federal register

Wednesday
September 24, 1997

Part IV

Environmental Protection Agency

40 CFR Part 9 et al.

Control of Emissions of Air Pollution from Nonroad Diesel Engines; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 9, 86, and 89

[AMS–FRL–5888–4]

RIN 2060–AF76

Control of Emissions of Air Pollution From Nonroad Diesel Engines

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking.

SUMMARY: In this action, EPA is proposing new emission standards for nonroad diesel engines. The affected engines are used in most land-based nonroad equipment and some marine applications. If these standards are implemented as proposed, the resulting emission reductions would translate into significant, long-term improvements in air quality in many areas of the U.S. For engines in this large category of pollution sources, the standards for oxides of nitrogen and particulate matter emissions would be reduced by up to two-thirds from current standards. Overall, the proposed program would provide much-needed assistance to states facing ozone and particulate air quality problems that are causing a range of adverse health effects for their citizens, especially in terms of respiratory impairment and related illnesses.

DATES: EPA will hold a hearing on the proposed rulemaking on October 8, 1997. EPA requests comments on the proposed rulemaking by November 24, 1997. More information about commenting on this action and on the public hearing and meeting may be found under Public Participation in **SUPPLEMENTARY INFORMATION**, below.

ADDRESSES: Materials relevant to this proposal, including the Draft Regulatory Impact Analysis are contained in Public Docket A–96–40, located at room M–1500, Waterside Mall (ground floor), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460. The docket may be inspected from 8:00 a.m. until 5:30 p.m., Monday through Friday. A reasonable fee may be charged by EPA for copying docket materials.

Comments on this proposal should be sent to Public Docket A–96–40 at the above address. EPA requests that a copy of comments also be sent to Alan Stout, U.S. EPA, Engine Programs and Compliance Division, 2565 Plymouth Road, Ann Arbor, MI 48105.

The public hearing will be held at Ramada Hotel O'Hare, 6600 North Mannheim Road, Rosemont, IL 60018, phone number (847) 827–5131. The public hearing will begin at 9 a.m. and will continue until all testimony has been presented. A transcript of the hearing will be placed in the docket. Copies may also be obtained by arrangement with the court reporter on the day of the hearing.

For further information on electronic availability of this proposal, see **SUPPLEMENTARY INFORMATION** below.

FOR FURTHER INFORMATION CONTACT: Alan Stout, U.S. EPA, Engine Programs and Compliance Division, (313) 741–7805; stout.alan@epamail.epa.gov.

SUPPLEMENTARY INFORMATION:

Regulated Entities

Entities potentially regulated by this action are those that manufacture or introduce into commerce new compression-ignition nonroad engines, vehicles, or equipment, and entities that rebuild or remanufacture nonroad compression-ignition engines. Regulated categories and entities include:

Category	Examples of regulated entities
Industry	Manufacturers of new nonroad diesel engines and equipment.
Industry	Rebuilders and remanufacturers of nonroad diesel engines.

This list is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. To determine whether particular activities may be regulated by this action, the reader should carefully examine the proposed regulations, especially the applicability criteria in § 89.1, and the existing regulatory language in 40 CFR part 89. Questions regarding the applicability of this action to a particular entity may be directed to the person listed in **FOR FURTHER INFORMATION CONTACT.**

Obtaining Electronic Copies of the Regulatory Documents

The preamble, regulatory language and Draft Regulatory Impact Analysis (Draft RIA) are also available electronically from the EPA Internet Web site. This service is free of charge, except for any cost already incurred for internet connectivity. The electronic version of this proposed rule is made available on the day of publication on the primary Web site listed below. The EPA Office of Mobile Sources also publishes **Federal Register** notices and related documents on the secondary Web site listed below.

1. http://www.epa.gov/docs/fedrgstr/EPA–AIR/ (either select desired date or use Search feature)
2. http://www.epa.gov/OMSWWW/ (look in What's New or under the specific rulemaking topic)

Please note that due to differences between the software used to develop the document and the software into which the document may be downloaded, changes in format, page length, etc., may occur.

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I. Introduction

Air pollution continues to represent a serious threat to the health and well-being of millions of Americans and a large burden to the U.S. economy. This threat exists despite the fact that over the past two decades great progress has been made at the local, state, and national levels in controlling emissions from many sources of air pollution. As a result of this progress, many individual emission sources, both stationary and mobile, pollute at only a fraction of their precontrol rates. However, continued industrial growth and expansion of motor vehicle usage threaten to reverse these past achievements. Today, many states are finding it difficult to meet the current ozone and particulate matter National Ambient Air Quality Standards (NAAQS) by the deadlines established in the Act.[1] Furthermore, other states that are approaching or have reached attainment of the current ozone and PM NAAQSs will likely see those gains lost if current trends persist.

In recent years, significant efforts have been made on both a national and state level to reduce air quality problems associated with ground-level ozone, with a focus on its main precursors, oxides of nitrogen (NO_X) and volatile organic compounds (VOCs).[2] In addition, airborne particulate matter (PM) has been a major air quality concern in many regions. As discussed below, ozone and PM have been linked to a range of serious respiratory health problems and a variety of adverse environmental effects.

The states have jurisdiction to implement a variety of stationary source emission controls. In most regions of the country, states are implementing significant stationary source NO_X controls (as well as stationary source VOC controls) for controlling acid rain, ozone, or both. In many areas, however, these controls will not be sufficient to reach and maintain the current ozone standard without significant additional NO_X reductions from mobile sources. Generally, the Clean Air Act specifies that emission standards for controlling NO_X, HC, and PM emissions from new mobile sources must be established at the federal level.[3] Thus, the states look to the national mobile source emission control program as a complement to their efforts to meet air quality goals. The concept of common emission standards for mobile sources across the nation is strongly supported by manufacturers, which often face serious production inefficiencies when different requirements apply to engines or vehicles sold in different states or areas.

Mobile source emission control programs have a history of technological success that, in the past, has largely offset the pressure from constantly growing numbers of vehicles and miles traveled in the U.S. The per-vehicle rate of emissions from new passenger cars and light trucks has been reduced to very low levels. Similarly, manufacturers of heavy-duty engines for highway use have developed new technological approaches over the past two decades that have significantly reduced emissions from these engines; new standards scheduled to take effect in 1998 will result in significant further emission reductions from trucks and buses (58 FR 15781, March 24, 1993). As a result, increasing attention is now focused on the engines used in a wide range of nonroad equipment.

Manufacturers of engines for nonroad applications have only recently become subject to emission regulations. The lessons learned from many years of reducing passenger car and heavy-duty truck emissions are being applied to nonroad engines; however, extensive new efforts are necessary to develop emission control techniques that address unique characteristics of nonroad applications (such as special engine cooling needs, dusty operating environments, marine use, etc.). The broad range of engine sizes (from a few kilowatts of power to many hundreds of kilowatts), the vast array of agricultural, construction, industrial, and electrical generation applications into which nonroad engines are installed, the large number of equipment manufacturers, and the newness of many in this industry to emission control requirements all combine to increase the challenge of reducing emissions from nonroad engines. A more detailed discussion of the history of nonroad engine emission control is included under Background (Section II.B.).

In addition, there are technological challenges inherent to nonroad diesel-cycle engine design that must be addressed.[4] While diesel engines provide advantages in terms of fuel efficiency, reliability, and durability, controlling NO_X emissions is generally considered a greater challenge for diesel engines than for otto-cycle engines. Similarly, control of PM emissions, which are very low for gasoline-fueled engines, represents a substantial challenge for diesel engines. Part of this challenge for diesel engines is that most traditional NO_X control approaches tend to increase PM emissions, and vice versa. A more complete discussion of technology issues is presented under Technological Feasibility (Section V).

This notice proposes a new set of emission standards for all nonroad diesel engines, except for locomotive engines, engines used in underground mining equipment, and marine engines rated over 37 kW.[5] EPA's Supplemental Advance Notice of Proposed Rulemaking (Supplemental ANPRM), published on January 2, 1997, and the comments received on that notice provide the framework for these new emission standards (62 FR 200, January 2, 1997).

II. Background

A. Air Quality Problems Addressed in the Proposed Rule

The emission standards proposed in this notice are intended to be a major step in reducing the human health and environmental impacts of ground-level ozone and particulate matter (PM). This section summarizes the air quality rationale for these new emission standards and their anticipated impact on nonroad diesel emissions.

1. Ozone

There is a large body of evidence showing that ground-level ozone, which is formed from photochemical reactions of NO_X and VOCs, causes harmful respiratory effects, including chest pain, coughing, and shortness of breath. Ozone most severely affects people with compromised respiratory systems and children. In addition, NO_X itself can directly harm human health. Beyond their effects on human health, other negative environmental effects are also associated with ozone and NO_X. Ozone has been shown to injure plants and materials; NO_X contributes to the secondary formation of PM (nitrates), acid deposition, and the overgrowth of algae in coastal estuaries. These environmental effects, as well as the health effects described above, are described in the Draft RIA. Additional information may be found in EPA's ''staff papers'' and ''air quality criteria''

[1] See U.S.C. 7401 *et seq.*

[2] VOCs consist mostly of hydrocarbons (HC), including nonmethane hydrocarbons (NMHC).

[3] The CAA limits the role states may play in regulating emissions from new motor vehicles and nonroad engines. California is permitted to establish emission standards for new motor vehicles and most new nonroad engines; other states may adopt California's programs (sections 209 and 177 of the Act).

[4] Diesel-cycle engines, referred to simply as ''diesel engines'' in this notice, may also be referred to as compression-ignition (or CI) engines. These engines typically operate on diesel fuel, but other fuels may be also be used. This contrasts with otto-cycle engines (also called spark-ignition or SI engines), which typically operate on gasoline.

[5] This proposal is based on metric units. With the exception of engine power ratings, English units are included parenthetically throughout the preamble. The conversion of engine power ratings is included in Table 1, but is not repeated in the rest of the document.

documents for ozone and nitrogen oxides.[6,7,8,9]

Today, many states are finding it difficult to show how they can meet or maintain compliance with the current National Ambient Air Quality Standard for ozone by the deadlines established in the Act.[10] There are 66 areas currently designated ''nonattainment'' for ozone.

Local, state and federal organizations charged with initiating programs to achieve cleaner air have mounted significant efforts in recent years to reduce air quality problems associated with ground-level ozone, and there are signs of partial success. The main precursors of ozone, NO_X, and VOCs appear to have been reduced, and average levels of ozone seem to have begun gradually decreasing. However, this progress is in jeopardy. EPA projects that reductions in ozone precursors that will result from the full implementation of current emission control programs will fall far short of what would be needed to offset the normal emission increases that accompany economic expansion. By the middle of the next decade, the Agency expects that the downward trends will have reversed, primarily due to increasing numbers of emission sources. As discussed below, EPA expects that NO_X levels will have returned to current levels by around 2020 in the absence of significant new reductions. To the extent that some areas are seeing a gradual decrease in ozone levels in recent years, EPA believes that the expected increase in NO_X will likely result in an increase in ozone problems in the future.

NO_X controls are an effective strategy for reducing ozone where its levels are relatively high over a large region (as in the Northeast and much of the Midwest, Southeast, and California). EPA and states see regional control of NO_X emissions, in addition to local-scale VOC and NO_X controls, as a key to improving regional-scale air quality in many parts of the country. Specifically, EPA believes that regional-scale reductions in NO_X emissions will be necessary for many areas to attain and maintain compliance with the current ozone NAAQS. For the regions listed above, the NO_X reductions needed are very large (greater than 50 percent from base 1990 emissions in many cases). New programs to control emissions from both stationary and mobile sources will be necessary in most of these areas, since it is unlikely that cost effective controls of this magnitude can be achieved with either source category alone. Although in some locations and circumstances moderate reductions in local NO_X emissions may be associated with localized increases in ozone, the Agency is convinced that the ultimate attainment goal of all nonattainment areas necessitates continued reduction of regional-scale NO_X emissions.

2. Particulate Matter

Particulate matter, like ozone, has been linked to a range of serious respiratory health problems. Particles are deposited deep in the lungs and result in effects including premature death, increased hospital admissions and emergency room visits, increased respiratory symptoms and disease, decreased lung function (particularly in children and individuals with asthma), and alterations in lung tissue and structure and in respiratory tract defense mechanisms. These effects are discussed further in the Draft RIA for this rule. (Additional information may be found in EPA's ''staff paper'' and ''air quality criteria document'' for particulate matter.[11 12])

Currently, there are 80 PM–10 nonattainment areas across the U.S. (PM–10 refers to particles smaller than 10 microns in diameter.) As is the case with NO_X, levels of PM caused by mobile sources are also expected to rise in the future. EPA believes that this projected increase will occur for two reasons: because of the expected continued increase in numbers of PM sources, including nonroad diesel engines; and because NO_X from diesel engines and other sources is transformed in the atmosphere into fine secondary nitrate particles.

Secondary nitrate particles account for a substantial fraction of the airborne particulate in some areas of the country, especially in the West. Measurements of ambient PM in some western U.S. urban areas that are having difficulty meeting the current NAAQS for PM–10 have indicated that secondary PM is a very important component of the problem. Secondary nitrate PM (consisting mostly of ammonium nitrate) is the major constituent of this secondary PM. For example, in Denver, on days when PM levels are high, about 25 percent of the measured PM–2.5 is ammonium nitrate. In the Provo/Salt Lake City area, secondary PM comprises about 40 percent of the measured PM–10. Similarly, in the Los Angeles Basin, secondary nitrate PM levels represent about 25 percent of measured PM–10.[13] Nitrate PM constitutes a smaller, but often important, fraction of PM in other areas of the country.

Because the atmospheric chemistry of secondary PM formation has common attributes to that of ozone, secondary PM also tends to be a regional, rather than a strictly local phenomenon. For this reason, EPA believes that regional-scale NO_X controls, including control of mobile NO_X sources, are very effective in reducing secondary PM over a significant area. For example, California's PM State Implementation Plans for serious areas conclude that secondary formation of nitrate particulate due to regional-scale NO_X emissions contributes to the particulate problem in the South Coast Air Basin, Coachella Area, and the San Joaquin Valley. EPA and the State of California believe that reduction of this fraction of the total PM will require additional regional-scale reductions in NO_X emissions.[14]

EPA believes that mobile sources, including nonroad diesel engines, contribute substantially to the fraction of ambient PM that is generally considered controllable. (The largest fraction of ambient PM is attributed to ''miscellaneous'' and ''natural'' sources, including wind erosion, wildfires, and fugitive dust, which are difficult or impossible to control.) As discussed in more detail in the next section, mobile sources make up more than a quarter of ''controllable'' sources (i.e., excluding

[6] 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 (found in Air Docket A–95–58).

[7] U.S. EPA, 1996, Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P–93/004aF (found in Air Docket A–95–58).

[8] U.S. EPA, 1995, Review of National Ambient Air Quality Standards for Nitrogen Dioxide, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–95–005 (found in Air Docket A–93–06).

[9] U.S. EPA, 1993, Air Quality Criteria for Oxides of Nitrogen, EPA/600/8–91/049aF (found in Air Docket A–93–06).

[10] See 42 U.S.C. 7401 *et seq.*

[11] U.S. EPA, 1996, Review of National Ambient Air Quality Standards for Partculate Matter, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–96–013 (found in Air Docket A–95–54).

[12] U.S. EPA, 1996, Air Quality Criteria for Particulate Matter, EPA/600/P–95/001aF (found in Air Docket A–95–54).

[13] Summary of Local-Scale Source

[11] U.S. EPA, 1996, Review of National Ambient Air Quality Standards for Partculate Matter, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–96–013 (found in Air Docket A–95–54).

[12] U.S. EPA, 1996, Air Quality Criteria for Particulate Matter, EPA/600/P–95/001aF (found in Air Docket A–95–54).

[13] Summary of Local-Scale Source Characterization Studies, EPA–230–S–95–002, July, 1994 (Air Docket A–96–40).

[14] Memorandum to the docket from Carol Bohnenkamp, EPA Region 9, regarding regional nature of secondary nitratee PM in California, July 30, 1997 (Docket A–96–40).

miscellaneous and natural sources), with nonroad diesel engines accounting for about 16 percent. In addition, secondary PM contributes significant additional PM in some western PM nonattainment areas.

3. Contribution of Nonroad Engines to Emissions

Figure 1 shows EPA's current estimates of the NO_X emissions from the categories of nonroad diesel engines affected by the proposed standards. For 1996, nonroad diesel engines are estimated to represent about 27 percent of mobile source NO_X and 13 percent of total NO_X emissions. In the future, EPA projects NO_X emissions from these engines to drop slightly due to the Tier 1 emission standards, but then begin to rise again as growth overtakes the Tier 1 improvements. The contributions of the engines covered by this proposal to mobile source NO_X and total NO_X are projected to remain about constant.

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Figure 1

NOx Emissions

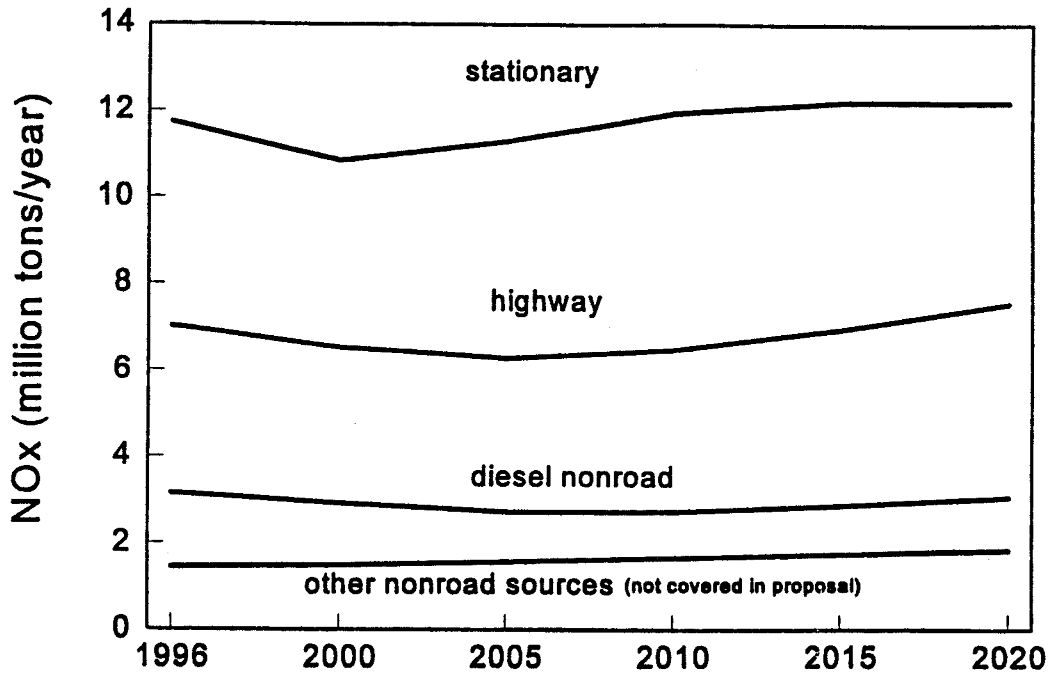
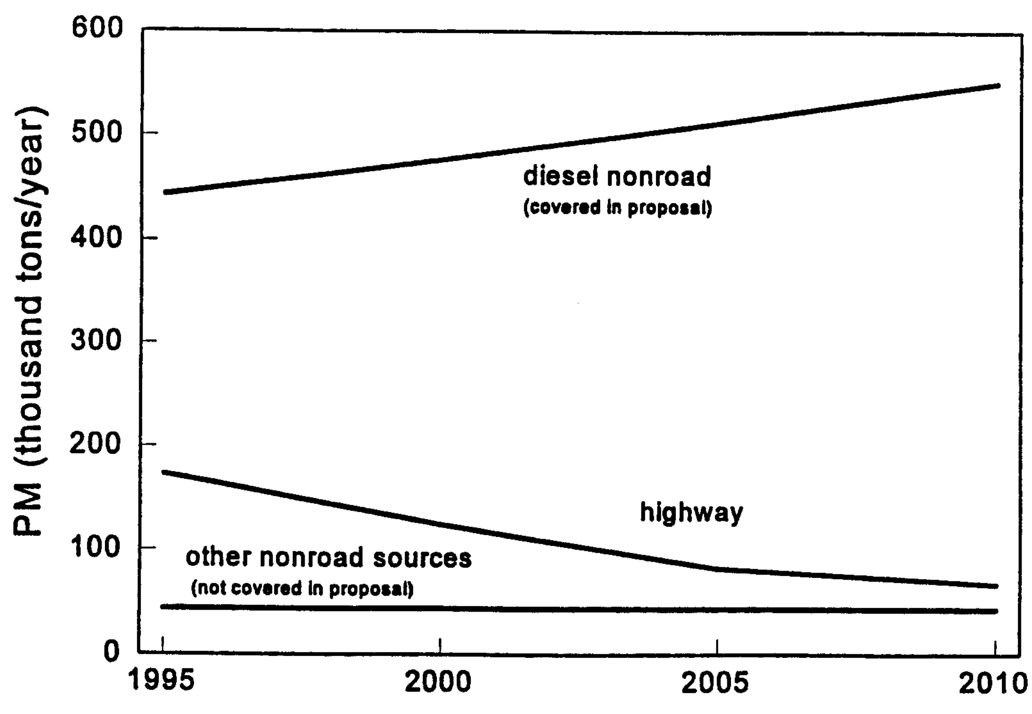


Figure 2

Diesel PM Emissions



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Similarly, Figure 2 presents the Agency's best current projections for diesel PM emissions. EPA estimates that nonroad diesel engines currently contribute about 440,000 tons, or 48 percent of the directly emitted PM from mobile sources and 16 percent of total controllable PM emissions. In the future, Figure 2 projects that nonroad diesel PM emissions will steadily rise in the absence of new emission standards. In addition to directly emitted PM, EPA estimates that, as a national average, nonroad diesel engines currently contribute approximately 130,000 tons of PM in the form of secondary nitrate particles, based on the estimated 3,100,000 tons of NO_X emitted by these engines. Since NO_X emissions from these engines is expected to decrease slightly and then begin to rise (see Figure 1), nitrate PM attributable to these engines can be expected to follow the same pattern.[15]

In this rule, EPA is for the first time proposing emission standards for NMHC + NO_X, PM, carbon monoxide (CO), and smoke from engines rated under 37 kW. Engines in this category contribute to emissions of each of these pollutants, including emissions in nonattainment areas. Chapter 5 of the Draft RIA presents the Agency's most recent estimates of emissions from all land-based nonroad diesel engines and marine diesel engines rated under 37 kW.[16]

B. Legislative and Regulatory History

1. U.S. Federal Action

Section 213(a)(1) of the Clean Air Act required that the Agency study the emissions from all categories of nonroad engines and equipment to determine, among other things, whether these emissions ''cause or significantly contribute to, air pollution which may reasonably be anticipated to endanger public health and welfare.'' Section 213(a)(2) further required EPA to determine whether the emissions of CO, VOC, and NO_X found in the above study significantly contributed to ozone or CO emissions in more than one nonattainment area. With a determination of significance, section 213(a)(3) requires the Agency to establish emission standards regulating CO, VOC, and NO_X emissions from new nonroad engines and vehicles. EPA may also promulgate emission standards under section 213(a)(4) regulating any other emissions from nonroad engines that EPA finds contribute significantly to air pollution.

On June 17, 1994, EPA made an affirmative determination under section 213(a)(2) that nonroad emissions are significant contributors to ozone or CO in more than one nonattainment area (59 FR 31306, June 17, 1994). In the same notice, EPA set a first phase of emission standards (''Tier 1 standards'') for nonroad diesel engines rated 37 kW and above. The Tier 1 standards did not include engines used in aircraft, underground mining equipment, locomotives, or marine vessels. EPA has initiated separate rulemakings to adopt regulations appropriate to different subgroups of nonroad engines, as described below.

EPA has taken several other actions under section 213, some of which provide important background for this proposal and are discussed here. The Agency recently published proposed emission standards for locomotive engines, which are addressed separately by the Act under section 213(a)(5) (62 FR 6366, February 11, 1997). Aircraft, which are regulated under sections 231 through 234 of the Act, must comply with emission standards finalized May 8, 1997 (62 FR 25356).

With regard to marine engines, EPA has finalized regulations for recreational marine engines, including personal watercraft and outboard engines (61 FR 52087, October 4, 1996).[17] That final rule sets no standards for diesel marine engines, though emission standards were proposed for those engines (59 FR 55929, November 9, 1994; 61 FR 4600, February 7, 1996). The large diesel marine rule is currently under development. However, as discussed in the Supplemental ANPRM, emission standards for marine diesel engines rated under 37 kW are included in the scope of this proposal.

EPA has also established a first phase of regulations for small SI engines, those rated under 19 kW (60 FR 34582, July 3, 1995). These engines are used in handheld and nonhandheld applications like chainsaws and lawnmowers. The Agency has also published an ANPRM for a second phase of control for these engines (62 FR 14740, March 27, 1997). SI engines rated over 19 kW remain unregulated, though EPA has begun work toward new emission standards for those engines.

2. State of California Action

The California Air Resources Board (California ARB) has the authority to regulate emissions from all nonroad engines, except for new engines used in locomotives and new engines used in farm and construction equipment rated under 130 kW. So far, the California ARB has adopted regulations for four groups of nonroad engines. First, emission standards have been promulgated for new small off-road engines rated under 19 kW, including both diesel and otto-cycle models. The California ARB, as a signatory to the Nonroad Statement of Principles, has indicated its intent to amend the regulations for small off-road engines to be consistent with the Statement of Principles for diesel engines rated under 19 kW in this notice. The California ARB has also set emission standards for new land-based nonroad diesel engines rated over 130 kW, which will be harmonized with the standards proposed in this notice. The California ARB has also adopted emission standards for nonroad recreational engines, including both compression-ignition and the more prevalent spark-ignition models. EPA intends to work cooperatively with the California ARB to develop new emission standards for nonroad SI engines rated over 19 kW (including new EPA emission standards applicable to engines for recreational vehicles). Finally, the California ARB has approved a voluntary registration and control program for existing portable equipment.

3. Development of This Proposal

In 1994 and 1995, states and environmental groups encouraged EPA to adopt more stringent emission standards for highway and nonroad diesel engines, in order to address the need for national pollution reduction measures to improve air quality in many urban areas. In response, EPA initiated discussions with engine manufacturers regarding future emission controls for these engines, gathering input from other interested parties as well. EPA, the California ARB, and engine manufacturers subsequently developed and agreed on a Statement of Principles supporting proposal of new emission standards for heavy-duty highway engines starting with the 2004 model year, which were published with an ANPRM on August 31, 1995 (60 FR 45580). These emission standards were formally proposed on June 27, 1996 (61 FR 33421), with signature on a final rule expected in 1997.

The Statement of Principles for highway engines included a

[15] ''Emission Inventories Used in the Nonroad Diesel Proposed Rule,'' EPA memorandum to Air Docket A–96–40 from Joe Somers, August 1997.

[16] See also, ''Nonroad Engine and Vehicle Emission Study—Report and Appendices,'' EPA–21A–201, November 1991 (available in Air Docket A–96–40).

[17] The final rule set no standards for sterndrive/inboards; refer to the preamble of that rule for a discussion of that decision.

commitment by the signatories to also pursue appropriate standards for nonroad engines, which was further discussed in the associated ANPRM. Subsequently, EPA, the California ARB, and engine manufacturers completed a similar Statement of Principles for nonroad diesel engines, which was then published with a Supplemental ANPRM, announcing the initiation of the rulemaking described in this document (62 FR 200, January 2, 1997). The Nonroad Statement of Principles and the comments received on the Supplemental ANPRM serve as a blueprint for the emission standards and other regulatory provisions proposed in this document.

In addition, in accordance with the Small Business Regulatory Enforcement Fairness Act of 1996, EPA conducted outreach to small businesses from various industry sectors to inform them of regulatory provisions of this proposed rule that may affect them and to seek early comment. As described below in Section VIII.B. (Regulatory Flexibility Act), EPA convened a federal government panel which collected comments and made recommendations about how the proposed program could reduce the impact on small entities. Several provisions to provide flexibility or relief for small businesses were recommended by small-entity commenters and the panel and have been incorporated into this proposal.

4. Harmonization

As EPA has pursued the emission reductions from nonroad engines needed to meet air quality goals, an important consideration has been harmonization with standards adopted and under consideration in California and Europe. The international nature of this industry, in which many manufacturers sell engines and equipment globally, makes harmonized standards and test procedures very important. Harmonized programs can avoid costly multiple design configurations to meet varying requirements, with associated cost savings to ultimate purchasers. In addition, with regard to international trade, harmonization reduces the cost of introducing a product into another country. For these reasons, EPA has pursued a policy of harmonizing with both California and the European Union (EU), to the extent this can be accomplished under the air quality improvement goals and process constraints of all of the parties, and to the extent it does not have a significant adverse impact on EPA's overarching mission of improving air quality in the United States.

To date, the goal of harmonization has been an important factor in the context of this rule and, in fact, harmonization was a major impetus behind the development of the Nonroad Statement of Principles. EPA and the California Air Resources Board agreed in that document to pursue harmonized standards and test procedures such that a nonroad diesel engine family tested and certified by EPA could be sold in California and, similarly, an engine family tested and certified in California could be sold in the rest of the country. Regarding international harmonization, the Statement of Principles signatories expressed an intent to work with the European Union, Japan, and other regulatory bodies in developing harmonized future standards, including provisions for implementation flexibility.

Subsequent to the completion of the Nonroad Statement of Principles, the responsible regulatory group in the EU issued a draft directive proposing a new round of standards that are aligned with the Tier 2 standards spelled out in this proposal.[18] This harmonization was a direct result of extensive discussions on potential standards that would be mutually acceptable.

Though harmonized to a great degree, the proposed EPA and EU standards are not identical. In particular, the proposed EU standards do not cover engines rated under 19 kW or above 560 kW and the EU proposal does not include Tier 3 standards. In addition, the EU proposed separate NO_X and HC standards (in contrast to EPA's proposed combined standards), and specified a somewhat different implementation schedule. Nevertheless, the goal of harmonization efforts, avoiding widespread duplicative design configurations, is being addressed at this stage of proposing new standards. Beyond standard levels and implementation dates, there are other differences between EPA and EU programs, including approaches to averaging, banking, and trading programs, flexibility provisions, and test procedure specifications. EPA plans to continue its harmonization work with governments in Europe and in other countries, in conjunction with the usual public rulemaking process, to build on the substantial successes to date. One major area in which a coordinated program will be pursued is the evaluation and possible modification of the certification test cycle discussed in Section III.B.

It should be noted that the small marine engines included in this proposal are not currently addressed in the EU program. Therefore, the ultimate success of international harmonization efforts with respect to these engines depends on further efforts by regulating agencies. It should also be noted that these engines are not covered by International Maritime Organization NO_X reduction efforts in the context of the International Convention for the Prevention of Pollution from Ships (MARPOL).

5. 2001 Feasibility Review

EPA proposes to conduct a special review, to be concluded in 2001, to reassess the appropriateness of the Tier 2 standards for engines rated under 37 kW and the Tier 3 standards for engines rated between 37 and 560 kW (including whether to propose the introduction of Tier 3 standards for PM). In addition to reviewing whether or not the proposed standards are technologically feasible and otherwise appropriate under the Clean Air Act, the Agency will examine the need for equipment redesign due to the proposed standards and will take appropriate action, such as proposing to relax or delay the standards, if significant adverse impacts on the nonroad equipment industry are identified.

Before making a final decision in this review, EPA intends to issue a proposal and offer an opportunity for public comment on whether the Tier 2 standards for engines rated under 37 kW and the Tier 3 standards for engines rated between 37 and 560 kW continue to be consistent with the Act and continue to be technologically feasible for implementation according to the proposed schedule. Any Tier 3 PM standards would also be proposed in such a notice. Following the close of the comment period, EPA intends to issue a final Agency decision under section 307 of the Act.

If by 2001 EPA finds the emission standards are not feasible according to the proposed schedule, or are otherwise not appropriate under the Act, EPA will propose changes to the program, possibly including adjustments to the levels of the standards. The adjusted standards may be more or less stringent than those already established, including the possibility of a new emission standard for particulate matter. Any change to the specified certification test procedure, including the possible adoption of a transient test cycle, will be

[18] Common Position (EC) No. /96, Adopted by the Council On ________ With a View to Adopting Directive 96/ /EC of the European Parliament and of the Council On the Approximation of the Laws of the Member States Relating To Measures Against the Emission of Gaseous and Particulate Pollutants From Internal Combustion Engines to Be Installed In Non-Road Mobile Machinery,'' draft dated November 12, 1996 (available in Docket A–96–40).

factored into the evaluation of the appropriateness of the numerical standards. The standards finalized in the rulemaking initiated by this proposal would stay in effect unless revised by subsequent rulemaking procedure. The Supplemental ANPRM provides additional discussion of the Agency's plans for the feasibility review.

Based on the information presented in the Draft RIA and in Section V of this notice, EPA believes the proposed standards are technologically feasible and otherwise appropriate under the Act. Nonetheless, it is clear that a significant amount of research and development will be needed to comply with the proposed standards. Over the next several years, EPA will be actively engaged in programs to evaluate technology developments and progress toward meeting the proposed standards. This process will involve in-house programs, coordination with the involved industries, and active interaction with other stakeholders.

III. Description of Proposed Standards and Related Provisions

This proposed rulemaking includes a comprehensive program to reduce emissions from nonroad diesel engines and equipment. The significant potential benefits of controlling emissions from these engines provides a major opportunity to address the nation's air quality problems. The proposed program consists of stringent new emission standards, requirements to ensure that engines maintain their level of emission performance as they age, provisions providing compliance flexibility to engine and equipment manufacturers, and a voluntary program to encourage the introduction of low-emitting engines.

A. Emission Standards

EPA is proposing emission standards covering all nonroad diesel engines except for locomotives, engines used in underground mining equipment, and large (rated over 37 kW) engines used in marine applications. Engines not included in this proposal are or will be addressed by other federal programs. EPA is proposing a set of emission standards that vary in level and implementation date, depending on the rated power of the engine and other factors. The Agency believes that the standards proposed in this notice are consistent with the Clean Air Act requirement that standards represent the ''greatest degree of emission reduction achievable'' given the criteria specified by the Act (see Section V below).

In general, emission standards for engines rated between 37 and 560 kW are proposed in two tiers, building on the phase-in schedule adopted in the Tier 1 rule (see Table 1). These standards approximate the degree of control anticipated from existing and proposed standards covering engines used in heavy-duty diesel highway vehicles, with appropriate consideration of differences in the operational characteristics of the engines and in the organization of the industries. Specifically, the first set of proposed standards (Tier 2) generally parallel the emission standards that apply beginning with 1998 model year highway engines (58 FR 15781, March 24, 1993). The second set of proposed standards (Tier 3) parallel standards EPA has proposed for 2004 model year diesel highway engines (61 FR 33421, June 27, 1996). The standards for engines rated over 37 kW would become effective in the 2001 to 2006 time frame for Tier 2 levels and 2006 to 2008 for Tier 3 levels.

TABLE 1.—EMISSION STANDARDS IN G/KW-HR (G/HP-HR)

Engine Power	Tier	Model year	NMHC + NO_X	CO	PM
kW<8 (hp<11)	Tier 1	2000	10.5 (7.8)	8.0 (6.0)	1.0 (0.75)
	Tier 2	2005	7.5 (5.6)	8.0 (6.0)	0.80 (0.60)
8≤kW<19 (11≤hp<25)	Tier 1	2000	9.5 (7.1)	6.6 (4.9)	0.80 (0.60)
	Tier 2	2005	7.5 (5.6)	6.6 (4.9)	0.80 (0.60)
19≤kW<37 (25≤hp<50)	Tier 1	1999	9.5 (7.1)	5.5 (4.1)	0.80 (0.60)
	Tier 2	2004	7.5 (5.6)	5.5 (4.1)	0.60 (0.45)
37≤kW<75 (50≤hp<100)	Tier 2	2004	7.5 (5.6)	5.0 (3.7)	0.40 (0.30)
	Tier 3	2008	4.7 (3.5)	5.0 (3.7)	....
75≤kW<130 (100≤hp<175)	Tier 2	2003	6.6 (4.9)	5.0 (3.7)	0.30 (0.22)
	Tier 3	2007	4.0 (3.0)	5.0 (3.7)	....
130≤kW<225 (175≤hp<300)	Tier 2	2003	6.6 (4.9)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	....
225≤kW<450 (300≤hp<600)	Tier 2	2001	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	....
450≤kW<560 (600≤hp<750)	Tier 2	2002	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	....
kW≥560 (hp≥750)	Tier 2	2006	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)

The standards proposed in this notice for engines rated under 37 kW would be the first EPA emission standards for these nonroad diesel engines. The proposed Tier 1 standards would be phased in by power category beginning in 1999, with Tier 2 standards phased in by power category beginning in 2004. Tier 3 standards are not proposed for these engines in this rule.

Table 1 lists the range of standards for the different power categories, including all the tiers of proposed standards with the affected model years. References throughout this notice to the engine power ratings listed in Table 1 will identify only the kilowatt rating. The reader may refer to the table for conversion between metric and English units.

EPA is at this time proposing Tier 3 standards only for nonroad diesel engines rated between 37 kW and 560 kW. For engines rated under 37 kW, the Agency believes it would be inappropriate to commit to Tier 3 standards at this time, since the industry is only now beginning to address emission control requirements for the first time. The uncertainties involved in proposing more than two tiers of standards seem too great at this early stage in the regulation of these engines.

In the case of engines rated over 560 kW, the longer lead time EPA believes is appropriate for these engines shifts the proposed implementation schedule for these engines later than any other engines for Tier 2 standards, starting with the 2006 model year. This lead time reflects the longer product redesign cycles typical of these large engines with very low sales volumes. The Agency's intent is to avoid imposing unnecessary costs associated with frequently changing standards. As is the case for engines rated under 37kW, the large uncertainties that would be involved in proposing a third tier of standards, in this case presumably for sometime after 2010, led to EPA's decision not to propose such Tier 3 standards for these engines at this time.

Where Tier 3 standards are proposed, the Agency is choosing not to include more stringent PM standards. The Agency recognizes that there is an inverse technological relationship between NO_X and PM emission control and believes that more stringent PM standards may threaten the feasibility of the proposed Tier 3 NO_X standards. In addition, as discussed in Section III.B. below, the Agency believes that investigation during the next few years may conclude that a different emission test cycle is more appropriate for nonroad engines, especially for PM emissions. For these reasons, EPA believes that Tier 3 PM standards will be more appropriately discussed in the context of the improved technical understanding that will exist by the time of the 2001 Feasibility Review (see Section II.B.5. above).

The standards proposed in this docket assume the use of EPA's existing steady-state (modal) test procedures. New steady-state test cycles are proposed for constant-speed engines, marine propulsion engines, and engines rated under 19 kW. The Agency and the industry are working to better understand the sensitivity of nonroad diesel engine emissions to the test cycle, as discussed in the next section.

EPA proposes to change from a measurement of total hydrocarbons to nonmethane hydrocarbons. There is, however, no standardized method for measuring methane in diesel engine exhaust. In the absence of such a procedure, EPA is proposing to allow any of three options: (1) Measure total hydrocarbons in place of nonmethane hydrocarbons, without adjusting numerical values, (2) manufacturers may develop and use their own procedure to analyze nonmethane hydrocarbons, with prior approval from EPA, or (3) measure total hydrocarbons but subtract 2% from the measured hydrocarbon mass to correct for methane. This assumed methane fraction is based on data from two heavy-duty diesel engines.[19]

EPA is aware of the flame ionization detector plus gas chromatography method of determining nonmethane hydrocarbons (SAE J1151) and requests comment on whether this procedure or any other would be appropriate to measure methane. If such a procedure is acceptable, EPA further requests comment on whether a uniform procedure is preferable to the proposed options.

Finally, EPA is proposing to maintain the current smoke standards for nonroad diesel engines rated over 37 kW. The Agency proposes to extend the applicability of these standards to nonroad diesel engines rated under 37 kW. This proposal is discussed in detail in Section III.G.

B. Test Procedures

1. Test Cycles

The test cycle used to measure emissions is intended to simulate some measure of actual operation in the field. Testing an engine for emissions consists of exercising it over a prescribed duty cycle of speeds and loads using an engine dynamometer. The nature of the test cycle used for determining compliance with emission standards during the certification process is critical in evaluating the likely emissions performance of engines designed to those standards. To the extent that in-use operation differs from the certification test, there is the possibility that a certified engine will have higher than expected emission rates in the field. EPA has addressed such concerns in the past; for example, the highway heavy-duty engine test cycles were changed to address transient operation (45 FR 4136, January 21, 1980) and, more recently, EPA has revised the test cycle for light-duty vehicles (61 FR 54852, October 22, 1996).

Because of the potential inadequacies in the ability of test cycles to ensure control in real-life conditions, EPA is very concerned that engines may be designed to control emissions well during a certification test only to emit at higher levels during field operation. EPA has observed at times that manufacturers may tailor the design of their engines to narrowly meet emission test requirements. Also, engine manufacturers have a degree of discretion in how they control engine operation across the whole range of engine operating modes to balance competing demands for power, fuel economy and emission control. The advent of electronic controls has greatly increased the level of sophistication in controlling the full range of engine operation. This advance also carries with it some uncertainty about whether proper control of emission-related engine parameters is maintained during engine operation that is not represented in the certification test cycle. The current nonroad test cycle, with a limited combination of steady-state speeds and loads, does not include some operating modes that are commonly experienced in the field.

Originally, certification testing of heavy-duty highway engines was conducted with steady-state test cycles (one cycle for diesel engines and one for otto-cycle engines), in which an engine is operated at several discrete modes of constant speed and load for measuring emissions. EPA subsequently revised the highway engine test instead to use transient cycles, which continuously vary speeds and loads. Current test requirements for nonroad diesel engines are based on an eight-mode steady-state test cycle similar to the original cycle for highway engines. This test cycle was developed by the International Organization for Standards (ISO) as part of Standard 8178 and is designated as the C1 cycle.

EPA still believes that the C1 cycle is the most appropriate cycle available at this time for ensuring that emissions are controlled in the field. The Agency therefore proposes to continue to rely on the C1 cycle as the principal method of testing nonroad diesel engines. NO_X emission rates depend significantly on the degree of engine loading (as a fraction of its rated capacity); i.e., higher relative engine load, or load factor, corresponds with a greater mass of NO_X emissions for each combustion event. Testing on a limited number of engines—with current technology—shows that total NO_X emissions from the C1 cycle are comparable to those generated on the transient highway test procedure.[20] Engine-to-engine variability is significant, but available data is insufficient to determine any directional difference in the average results. This testing does not provide for conclusions on the possibility of high in-use NO_X emissions from engines that are designed to control emissions only

[19] Springer, Karl J. (1979), "Characterization of Sulfates, Odor, Smoke, POM and Particulates from Light and Heavy-Duty Engines—Part IX," Ann Arbor, Michigan: U.S. Environmental Protection Agency, Office of Mobile Sources. Publication No. EPA–460/3–79–007.

[20] "Summary of Nonroad Compression Ignition Transient and Steady-State NO_X and PM Emissions Data," EPA memorandum from Cleophas Jackson to Docket A–96–40, May 21, 1997.

in modes represented by the certification test procedure. The same testing shows that HC emissions, while more sensitive to test cycle in percentage terms, are formed at much lower levels. The set of engines tested emitted on average about 0.7 g/kW-hr (0.5 g/hp-hr) of HC less on the C1 cycle than on the highway test procedure, which is much less than the variability observed for NO_X emissions. Tested CO emissions were significantly lower on the C1 cycle than on the highway test procedure, which is reflected in the lower numerical emission standards for nonroad engines.

Evaluating the ability of a test cycle to appropriately measure PM emissions, however, requires a review of different parameters than evaluation of comparability for NO_X emissions. Particulate emissions, like NO_X emissions, depend on engine load, but are most sensitive to the degree of transient engine operation. Most nonroad engines are used in applications that include substantial transient operation in use, especially those used to propel motive equipment. Equipment such as pumps and generators operate mostly or exclusively at constant engine speeds, but they may may also depart from steady-state operation due to variation in engine loads over time. EPA believes that the proposed PM emission standards, with a steady-state certification test, will result in a predictable improvement in PM emissions from those engines used in constant-speed applications. Engines experiencing a greater degree of transient operation will also likely have lower rates of PM emissions, though the degree of that reduction is harder to predict. The concern for ensuring an adequate level of control of PM emissions from all nonroad engines has been the principal motivation for EPA to look at the possibility of incorporating an element of transient operation in the certification test. While the proposal includes no testing with a transient cycle, EPA will continue to pursue development of a transient cycle that can be incorporated into certification testing, as described below.

The proposal includes additional cycles for specific engines. The same numerical standards apply to all test cycles. Any engines that are limited to operate only at a constant speed may, at the manufacturer's option, use the ISO D2 cycle for emission testing. This cycle, which omits idle and intermediate-speed modes from the C1 cycle, is representative of engines such as generators, which are designed never to run at these omitted speeds.[21] Because of the more limited range of engine operation in the D2 cycle, manufacturers must ensure that engines certified with data generated with the D2 cycle are used exclusively in constant-speed applications. Accordingly, these engines must include labeling information indicating this limited emission certification.

For engines rated under 19 kW, EPA proposes an additional test cycle, the ISO G2 cycle, though manufacturers may also use the C1 or, for constant-speed engines, the D2 cycle for these smaller engines. The ISO G2 cycle includes the same modes as the D2 cycle and adds a mode for operation at idle. This cycle was developed to represent the operation of small diesel engines used primarily at rated speed, such as in lawn and garden applications, generators, pumps, welders, and air compressors. EPA has investigated the representativeness of this cycle for engines rated under 19 kW and supports the use of this cycle at this time. By capturing operation at rated speed for a variety of engine loads and including operation at idle the G2 cycle seems appropriate for the principal applications of these engines. The Nonroad Statement of Principles specifies only the G2 cycle for engines rated under 19 kW. Since that time, further deliberation has led EPA to allow also the C1 cycle and, in the case of constant-speed engines, the D2 cycle for these engines. As described above, the D2 cycle is appropriate for those engines that are limited to operate only at rated speed. By including more operating modes, the C1 cycle can be considered more broadly representative of a wide range of engine applications, including those rated under 19 kW. While the D2 cycle clearly has a unique role in emission certification, the C1 and G2 cycles here present manufacturers with two optional procedures for all the engines rated under 19 kW that are not certified under the D2 cycle. EPA therefore requests comment on whether it is appropriate or desirable to allow use of both the C1 and G2 cycles for these engines.

EPA proposes that propulsion marine engines rated under 37 kW rely on the E3 cycle for emission testing. The E3 cycle, which consists of engine operation at four different engine speeds and four different loads, was developed by ISO to represent the operation of propulsion marine engines, and has been supported by an Agency investigation.[22] EPA nevertheless requests comment on whether a similar candidate cycle for propulsion marine engines, the ISO E5 cycle, would be equally or more appropriate. The E5 cycle differs from the E3 cycle by including engine operation at idle. In addition, EPA proposes an additional flexibility to marine engine manufacturers to allow marine engines to be included in land-based engine families. This flexibility would enable manufacturers to certify propulsion marine engines on the C1 test cycle, which would be appropriate for marine engines developed from land-based models. Finally, EPA proposes that auxiliary marine engines subject to this rule (i.e., engines installed on a marine vessel, but not used for propulsion) should be tested using the G2, C1, or D2 test cycles, with the constraints described above for the counterpart land-based nonroad engines.

Except for the C1 cycle and the D2 cycle for constant-speed engines, EPA has little data supporting the adequacy of the test cycles described above; however, there also seems to be no information indicating that these cycles are flawed. ISO committees developed the various test cycles intending to capture a representative portion of the in-use operation for particular groups of engines. EPA, supporting efforts to harmonize emission certification requirements with those of other countries, supports the use of ISO test cycles if EPA can find that they are adequate for measuring and controlling in-use emissions. As noted above, EPA has reviewed the E3 and G2 cycles and supports the use of these cycles at this time. Technologies and emission control strategies in the future may, however, become more sensitive to variations in engine operation; EPA will therefore continue to explore the potential benefits of a new or revised test cycle for certifying engines.

The Supplemental ANPRM describes the need to review the adequacy of the certification test procedure, especially as it relates to transient operation in the field. The signatories to the Nonroad Statement of Principles agreed to better characterize in-use engine operation and evaluate the effectiveness of the current test procedure. In the event that the current test procedure would be found inadequate to address air quality concerns, EPA has committed to pursuing a revised test procedure to address the problem. In so doing, the

[21] For a description of the development of the D2 cycle, see ''Exhaust Emission Testing of Diesel Engines for Industrial Applications,'' (Docket A–96–40, item II–D–26).

[22] Selection of Duty Cycle for High-Speed CI Marine Engines,'' EPA memorandum to Docket A–96–40 from Mike Samulski, February 19, 1997.

Agency recognizes several constraints, including the need for a very extensive effort to develop revised test cycles, the importance of the objective of maintaining harmonization of international standards, and the need to re-evaluate the numerical standards with any change in the test procedure. Also, because of the time required to develop revised test cycles and the additional time for engine manufacturers to redesign engines with a new procedure, any change in the test cycle would likely not apply before the implementation of Tier 3 standards.

EPA requests comment on appropriate test cycles for nonroad diesel engines.

2. Test Fuel

In the 1994 final rule, EPA allowed manufacturers to test for certification of PM emission levels using the low-sulfur test fuel specified by the California ARB for nonroad diesel engines. EPA's objective was to minimize any difference from the protocol previously established for California, because EPA finalized PM standards for engines rated over 130 kW only in response to industry's request to adopt California's PM standard, which was not considered technology-forcing. Under current regulations, testing with federal test fuel involves an optional adjustment of measured PM levels to account for the higher PM emissions associated with the higher fuel sulfur content.

EPA is now proposing PM standards that are expected to provide meaningful reductions from all sizes of engines used nationwide. The Clean Air Act accordingly requires EPA to ensure that the test procedure, including fuel specifications, adequately represent in-use operation. Typical nonroad diesel fuel sulfur levels outside of California are about 0.33 weight percent, though nonroad equipment to some degree utilizes highway fuels, which have a maximum allowable sulfur level of 0.05 weight percent.[23] California extends the 0.05 weight percent limit to include both highway and nonroad diesel fuel. Using the calculated adjustment to PM emission levels for fuel sulfur finalized in 1994, the difference between 0.33 and 0.05 weight percent would correlate with a difference of 0.06 g/kW-hr (0.05 g/hp-hr) in PM emission levels. To the extent that in-use emissions are higher with high-sulfur fuel, regulated engines could be operating at levels that significantly exceed certification standards. This raises concerns regarding whether the test fuel is representative of in-use fuels. EPA therefore proposes to require that, beginning with Tier 2 emission standards (Tier 1 standards for engines rated under 37 kW), testing with fuel based on federal specifications be conducted without use of any adjustment to measured PM levels. Testing for NO_X, HC, CO, and smoke is not affected, since the 1994 final rule already specified that federal test fuel was appropriate without adjustment for measuring emissions of those pollutants.

Manufacturers' likely continued interest in using California's test fuel is consistent with EPA's goal of harmonizing certification requirements where possible. EPA will therefore continue this practice as an option for manufacturers. The Agency requests comment on whether there should be an upward adjustment to measured PM levels when engines are tested with low-sulfur fuel. EPA also requests comment on the appropriate form of such a PM adjustment. The current equation for adjusting PM measurements depends on the relationship of PM emission levels to fuel sulfur content and could therefore be modified to adjust PM measurements from testing with low-sulfur fuel. Such a calculation would require selection of a representative in-use fuel sulfur level.

One possible resolution would be to adopt the sulfur specification used for European testing. European test fuel specifications include a fuel sulfur level between 0.1 and 0.2 weight percent sulfur. Testing with fuel sulfur levels between 0.05 and 0.1 weight percent are allowed, but are adjusted upward using the same adjustment equation specified by EPA, referenced to a test fuel with 0.15 weight percent sulfur.

EPA currently specifies test fuel with a range in fuel sulfur levels from 0.05 to 0.5 weight percent. EPA solicits information related to sulfur levels found in in-use fuels, including the degree to which nonroad equipment utilizes highway-grade diesel fuel. EPA will accordingly consider changes to the test fuel specifications to ensure that the test fuel is representative of that used in the field.

Whether or not the manufacturers utilize low-sulfur test fuels and any associated adjustment, EPA would intend to conduct confirmatory testing with federal test fuels, which would not involve any adjustment to measured PM levels.

C. Durability

To achieve the full benefit of the emissions standards, programs are necessary to encourage manufacturers to design and build engines with durable emission controls and encourage the proper maintenance and repair of engines throughout their lifetime. The goal is for engines to maintain good emission performance throughout their in-use operation.

When the Tier 1 standards for engines rated over 37 kW were developed, deterioration was not expected to be a problem for two reasons. First, the Tier 1 standards were not considered by EPA to be technology forcing. Second, the focus was on NO_X control and NO_X emissions were thought not to deteriorate from these engines. As a result, there are few requirements in the current regulations that address deterioration concerns for nonroad diesel engines. As tighter standards are put into place, EPA believes that it becomes necessary to adopt measures to address concerns about possible in-use emission performance degradation.

EPA is proposing to make some changes to the existing durability program, as the new standards are phased in, to help ensure that engines are still meeting applicable standards in use. The specific areas of the durability program that are being focused on here are useful life, warranty period, deterioration factors, allowable maintenance intervals, and rebuilding requirements.

a. Useful Life

Currently, nonroad diesel engines rated over 37 kW are defined, for emission control purposes, to have a useful life of 8,000 hours or 10 years, whichever occurs first. The in-use testing liability period is currently 6,000 hours or 7 years, whichever occurs first. Based on a study performed for EPA, this is representative of the average time until first rebuild for the majority of nonroad diesel engines.[24] EPA is proposing no changes to these requirements.

EPA proposes a shorter useful life and liability period for engines rated under 37 kW. Based on EPA's current understanding, the smaller engines have a shorter life expectancy than larger engines. This is supported by data supplied to EPA on two small engines.[25] According to comments received from some manufacturers, engines rated under 37 kW that operate at higher rated

[23] "Estimates for In-use Nonroad Diesel Sulfur Levels," EPA memorandum from David Korotney to Docket A–96–40, July 1, 1997.

[24] ICF Incorporated, "Industry Characterization: Nonroad Heavy Duty Diesel Engine Rebuilders," prepared for U.S. Environmental Protection Agency, Contract 68–C5–0010, WAN 102, January 3, 1997, (Docket A–96–40, item II–A–02).

[25] Letter from Norman Weir, Yanmar Diesel America Corp., to Don Kopinski, Environmental Protection Agency, March 10, 1997 (Docket A–96–40, II–D–27).

speeds (<3000 rpm) have a shorter life expectancy than engines rated under 37 kW that operate at lower speeds.[26] EPA believes that these comments are reasonable. Table 2 presents the proposed useful lives and in-use testing liability periods. EPA requests comment on the appropriateness of the proposed useful lives for engines rated under 37 kW (land-based and marine). EPA is also interested in any durability data on nonroad diesel engines, especially those rated under 37 kW.

TABLE 2.—PROPOSED USEFUL LIFE AND RECALL TESTING PERIODS

Power rating	Rated engine speed	Useful life		Recall testing period	
		Hours	Years	Hours	Years
< 19 kW	All	3000	5	2250	4
19–37kW	Constant speed engines 3000 rpm	3000	5	2250	4
	All others	5000	7	3750	5

Liability periods were proposed based on the ratio of useful life and liability periods established for engines rated over 37 kW. The purpose of the shorter liability periods is to ensure that engines used in recall testing are not statistical outliers with poor emissions durability. If a recall were ordered, all engines in that family would be subject to the recall regardless of their age.

EPA also requests comment on the appropriateness of basing the useful life on the typical time until first rebuild. The ICF report cited above reports that the average time until retirement for nonroad diesel engines is between 12,000 and 14,000 hours. According to this information, no one would be liable for the emission performance of these engines for a large percentage of their overall operation. EPA understands, however, that an appropriate useful life is needed to protect manufacturers from recall testing being based on engines that continue to perform beyond the emission control design life and are not representative of typical use.

b. Warranty Period

Tied to the useful life is the minimum warranty period imposed by the Clean Air Act. Currently, the minimum warranty period for nonroad diesel engines rated over 37 kW is 3,000 hours or 5 years of use, whichever occurs first. EPA proposes to extend this minimum warranty period to engines rated between 19 and 37 kW; however, for engines rated under 19 kW, EPA proposes a warranty period of 1,500 hours or 3 years, whichever occurs first. A shorter warranty for engines rated under 19 kW is proposed due to the shorter useful lives, and the three year warranty period for small engines is consistent with current warranty practice. EPA requests comment on the appropriateness of the proposed warranty period.

c. Deterioration Factors

In the Tier 1 nonroad engine rule, EPA did not require manufacturers to accumulate operating time on durability data engines or to generate deterioration factors for engine certification because that rule focused almost entirely on modest reductions in NO_X emissions. Analysis of highway engine data at that time led EPA to conclude that heavy-duty diesel engines do not generally produce more NO_X emissions as they get older. EPA believes that this stability of emission control can be attributed to the fact that diesel engine manufacturers have met emission standards through internal improvements to the engine and fuel systems, rather than relying on aftertreatment and other devices that would be more susceptible to in-use degradation. In fact, engine deterioration in current technology nonroad diesel engines could result in lower NO_X emission levels due to a loss in cylinder compression.

As NO_X, HC, and PM standards are reduced and nonroad diesel engine manufacturers introduce new technologies solely for emission control purposes, such as aftertreatment, sophisticated fuel delivery controls, and exhaust gas recirculation (EGR), long-term emissions performance becomes a greater concern. In addition, emission deterioration characteristics are not well known for aftertreatment, EGR, and other more sophisticated emission-control strategies.

EPA proposes to require the application of a deterioration factor (DF) to all engines covered by this rule. The DF is a factor applied to the certification emission test data to represent emissions at the end of the useful life of the engine. Currently, DFs are required for highway heavy-duty engines but are only required for nonroad diesel engines rated over 37 kW if engines use aftertreatment technologies. Deterioration factors would be determined by the engine manufacturers in accordance with good engineering practices. EPA is not proposing a specified procedure. The deterioration factors would, however, be subject to EPA approval. EPA requests comment on the need for and application of DFs.

It is not EPA's intent to force a great deal of data gathering on engines using established technology for which the manufacturers have the experience to develop appropriate DFs. New DF testing may not be needed where sufficient data already exists. EPA's main interest is that technologies with unproven durability in nonroad applications, such as EGR, are demonstrated to meet the proposed emission requirements throughout their useful lives. However, because this rule creates a program that will introduce new standards and new technologies over many years, the DF requirement is being proposed for all engines so that EPA can be sure that reasonable methods are being used to ascertain the capability of engines to meet standards throughout their useful lives. This proposed DF program would allow EPA to act in the traditional role of establishing emission performance standards, rather than putting EPA in a position where it would appear to be prejudging the durability of specific technologies and designs.

Similar to the provisions for highway engines, EPA proposes to allow the nonroad engine manufacturers the flexibility of using carryover and carryacross of durability emission data from a similar engine that has either been certified to the same standard or for which all of the data applicable for certification has been submitted. In addition, EPA proposes to extend this flexibility to allow deterioration data from highway engines to be used for similar nonroad engine families.

EPA is especially concerned that an unnecessarily burdensome durability

[26] Letter from Dr. Hartmut Mayer, Euromot, to Donald Kopinski, Environmental Protection Agency, January 16, 1997 (Docket A–96–40, II–D–32).

demonstration not be required for engines using established technology for which the manufacturers have the experience to determine appropriate deterioration factors. In these cases, EPA proposes to allow nonroad engine manufacturers to perform an analysis, based on good engineering practices, in place of actual service accumulation. For instance, in the case where no durability data exists for a certain engine but both smaller and larger engines using similar technology have been shown not to deteriorate for NO_X in use, it would be possible to build a case showing no NO_X deterioration for that engine.

EPA proposes that engines using established technology, for the purposes of this program, are engines that do not meet the proposed Tier 3 NMHC+NO_X and PM emission standards. However, EPA specifically proposes to exclude engines using exhaust gas recirculation or aftertreatment from being considered as using established technology. In the case where a manufacturer believes that a given engine is using established technology even though it meets the Tier 3 NMHC+NO_X and PM levels, EPA proposes that, prior to applying for certification, the manufacturer would be able to petition the Administrator to consider the given engine as using established technology.

In the past, in on-highway engine certification, durability data have been used for many years through carryover and carryacross of data. One concern is that, with repeated incremental changes in a nonroad engine design, the data would become unrepresentative for the engine applying for certification. EPA requests comment on how to ensure that carryover and carryacross data is appropriate (for example, by including limit on how long data could be used). EPA also requests comment on alternatives to the durability program described here which would result in better, and more cost-effective, confirmation of in-use emissions performance.

d. Allowable Maintenance Intervals

Manufacturers are currently required to furnish the ultimate purchaser of each new nonroad engine with written instructions for the maintenance needed to ensure proper functioning of the emission control system. Generally, manufacturers require the owners to perform this maintenance as a condition of their emission warranties. If such required maintenance is more than the engine owner is likely to perform due to cost or inconvenience, then in-use emissions deterioration can result. For highway diesel engines, EPA imposes limits on the frequency of maintenance that can be required of the engine owners for emission-related items; these limits also apply to the engine manufacturer during engine certification and durability testing. Further, the performance of maintenance would be considered during any in-use recall testing conducted by the Agency.

Currently, EPA specifies no minimum allowable maintenance intervals for nonroad diesel engines. EPA believes, however, that allowable maintenance intervals for nonroad engines are necessary to ensure that the technology is practical in use. Because the actual maintenance intervals for nonroad engines are likely to be similar to highway engines, EPA believes that maintenance requirements should parallel those for highway engines (40 CFR 86.094–25). EPA therefore proposes the following minimum intervals for adjustment, cleaning, repair, or replacement of various components.

At 1,500 hours and 1,500 hour intervals thereafter:

1. EGR related filters and coolers.
2. Positive crankcase ventilation valve.
3. Fuel injector tips (cleaning only).

At 3,000 hours and 3,000-hour intervals thereafter for engines rated under 130 kW, 4,500-hour intervals thereafter for engines rated over 130 kW:

1. Fuel injectors.
2. Turbocharger.
3. Electronic engine control unit and its associated sensors and actuators.
4. PM trap or trap-oxidizer system.
5. EGR system (including all related control valves and tubing).
6. Catalytic convertor.
7. Any other add-on emissions-related component.

Add-on emission-related components are those whose sole or primary purpose is to reduce emissions or whose failure will significantly degrade emission control, yet not significantly affect the performance of the engine.

Consistent with the definition for highway engine maintenance requirements, EPA proposes to define the following components as critical emission-related components:

1. Catalytic convertor.
2. Electronic engine control unit and its associated sensors and actuators.
3. EGR system (including all related filters, coolers, control valves and tubing).
4. PM trap or trap-oxidizer system.
5. Any other add-on emissions-related component.

If maintenance is scheduled on critical emission-related components in-use, EPA proposes that the manufacturer be required to show the reasonable likelihood that the maintenance will be performed in-use. In the proposed regulations, EPA lists the same manufacturer options for showing that maintenance is likely to be performed in-use as are currently included in the highway program. This list includes showing that performance would degrade without maintenance, survey data showing that the maintenance is performed, using a visible signal system, free maintenance provided by the manufacturer, and other methods approved by the Administrator.

EPA requests comment on the need for allowable maintenance intervals and the appropriateness of the intervals proposed here. EPA also requests comment on the appropriateness and need for the proposed critical emission-related scheduled maintenance requirements.

e. Rebuilding Requirements

EPA has two concerns regarding the rebuilding of nonroad diesel engines, both related to new emission-related components that may be added to the engine to meet the new standards. First, EPA is concerned that during engine rebuilding, there may not be an incentive to check and repair emission controls that do not affect engine performance. Second, EPA is concerned that there may be an incentive to rebuild engines to an older configuration due to real or perceived performance penalties associated with technologies that would be used to meet the standards proposed in this notice. Such practices would likely result in a loss in emission control.

Under the current program, there are no specific rebuilding requirements for nonroad diesel engines. However, there is a tampering provision that states ‘‘the manufacturer or rebuilder of the part may certify according to 40 CFR 85.2112 that use of the part will not result in a failure of the engine to comply with emission standards.’’ [27] For highway engines, engine rebuilding practices are currently addressed in general terms under EPA policies established under Clean Air Act section 203(a)(3) regarding tampering. Under a separate action for highway heavy-duty engines, EPA has proposed to add the highway policies to the regulations as they apply to tampering and has also proposed new measures.[28] EPA's intent is to propose the same rebuilding requirements for nonroad diesel engines as those

[27] 40 CFR 89.1007.

[28] Environmental Protection Agency, ‘‘Control of Emissions of Air Pollution from Highway Heavy-Duty Engines; Notice of Proposed Rulemaking,’’ 61 FR 33421, June 27, 1996.

proposed to be put into place for heavy-duty highway engines starting with the 2004 model year.

EPA proposes that parties involved in the process of rebuilding or remanufacturing engines (which may include the removal of the engine, rebuilding, assembly, reinstallation and other acts associated with engine rebuilding) must follow the provisions listed below to avoid tampering with the engine and emission controls. The applicability for these provisions is proposed to be based on the build date of the engine. The rebuild requirements apply to any engine built on or after the date that new standards, proposed in this rule, go into effect for a specific engine category, regardless of the emission levels that the engine is designed to achieve.

(1) EPA proposes that, during engine rebuilding, parties involved must have a reasonable technical basis for knowing that the rebuilt engine is equivalent, from an emissions standpoint, to a certified configuration (i.e., tolerances, calibrations, and specifications).

(2) When an engine is being rebuilt and remains installed or is reinstalled in the same piece of equipment, it must be rebuilt to a configuration of the same or later model year as the original engine. When an engine is being replaced, the replacement engine must be an engine of (or rebuilt to) a configuration of the same or later model year as the original engine.

(3) At the time of rebuild, emission-related codes or signals from on-board monitoring systems may not be erased or reset without diagnosing and responding appropriately to the diagnostic codes. Diagnostic systems must be free of all such codes when the rebuilt engines are returned to service. Further, such signals may not be rendered inoperative during the rebuilding process.

(4) When conducting an in-frame rebuild or the installation of a rebuilt engine, all emission-related components not otherwise addressed by the above provisions must be checked and cleaned, repaired, or replaced where necessary, following manufacturer recommended practices.

Under this proposal, any person or entity engaged in the process, in whole or part, of rebuilding engines who fails to comply with the above provisions may be liable for tampering. Parties would be responsible for the activities over which they have control and as such there may be more than one responsible party for a single engine in cases where different parties perform different tasks during the engine rebuilding process (e.g., engine rebuild, full engine assembly, installation). EPA is not proposing any certification or in-use emissions requirements for the rebuilder or engine owner. EPA requests comment on the appropriateness of applying this rebuild program to nonroad engines.

EPA is proposing to adopt modest record keeping requirements that EPA believes are in line with customary business practices. The records would be kept by persons involved in the process of nonroad engine rebuilding or remanufacturing and shall include the hours at time of rebuild and a list of the work performed on the engine and related emission control systems, including a list of replacement parts used, engine parameter adjustments, design element changes, and work performed as described in item (4) of the rebuild provisions above. EPA proposes that such records be kept for two years after the engine is rebuilt.

Under this proposal, parties would be required to keep the information for two years but would be allowed to use whatever format or system they choose, provided that the information can be readily understood by an EPA enforcement officer. EPA proposes that parties would not be required to keep information that they do not have access to as part of normal business practice. In cases where it is customary practice to keep records for engine families rather than specific engines, where the engines within that family are being rebuilt or remanufactured to an identical configuration, such record keeping practices are proposed to be satisfactory. Rebuilders would be able to use records such as build lists, parts lists, and engineering parameters that they keep of the engine families being rebuilt rather than on individual engines, provided that each engine is rebuilt in the same way to those specifications. EPA requests comments on the appropriateness of the proposed record keeping requirements including whether the records should be kept for a longer period of time such as for five years.

D. Averaging, Banking, and Trading

With this notice, EPA is proposing to replace the existing nonroad engine averaging, banking, and trading (ABT) program with a comprehensive new program. The proposed program is intended to enhance the flexibility offered to engine manufacturers that will be needed in meeting the stringent NMHC + NO_X standards and the PM standards being proposed. The proposed changes to the ABT program have been made in tandem with the proposed emission standards. This allows EPA to propose the most stringent emission standards that should apply with the proposed ABT program, while providing the flexibility and cost benefits to manufacturers who have to meet the technical challenges of the lower standards. It should be noted that as part of the 2001 feasibility review described earlier, the Agency plans to reassess the appropriateness of the averaging, banking, and trading provisions applicable to nonroad diesel engines and modify the provisions if deemed necessary.

The proposed changes come in the context of the existing ABT program for nonroad engines, which was adopted in 1994 (see 59 FR 31306, June 17, 1994). The existing program covers diesel engines rated over 37 kW and is available for NO_X emissions only. The three aspects of the ABT program (averaging, banking, and trading) are described in the following paragraphs.

Averaging means the exchange of emission credits among engine families within a given engine manufacturer's product line. 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 certified below the same emission standard, such that the average emissions from all the manufacturer's families (weighted by engine power and production volume) are at or below the level of the emission standard. 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 used to determine compliance during assembly line testing and in-use compliance testing.

Banking means the retention of emission credits by the engine manufacturer generating the credits for use in future model year averaging or trading. Under the existing program, banked credits have a three year life. EPA believes banking improves the feasibility of meeting standards, including the development and early introduction of advanced emission control technology, which allows certain engine families to act as trail blazers for new technology. This can help provide valuable information to manufacturers on the technology prior to manufacturers needing to apply the technology throughout their product line. It can also provide valuable information for use in other regulatory programs. An incentive for early introduction arises because the banked credits can subsequently be used by the manufacturer to ease the compliance burden of new, more stringent standards.

Trading means the exchange of emission credits between engine manufacturers which can then be used for averaging purposes, banked for future use, or traded to another engine manufacturer. Trading can be advantageous to smaller manufacturers who might have limited opportunity to optimize their costs through the use of averaging. Trading can also be advantageous to larger manufacturers because extending the effective averaging set through trading can allow for overall optimization of costs across manufacturers.

As described later in this section, EPA is proposing significant changes to the existing ABT program for nonroad diesel engines. Behind these changes is the recognition that the proposed standards represent a major technological challenge to the industry. ABT provisions can ease the need to bring all engines into compliance during the exact year the proposed new standards would take effect by allowing credits to be used, for example, to temporarily offset emissions from some particularly difficult to control engine line. While the existing ABT provisions were designed with these same general goals in mind, EPA believes that the nature of the challenge presented by standards proposed in this notice justifies efforts to increase the flexibility of the ABT program. The Agency wishes to maximize the flexibility and incentives for early introduction of technology which ABT offers without limiting the air quality benefits of the proposed standards. This will help ensure that the proposed new standards will, in fact, be attainable for the manufacturers, will be met at the lowest cost, and will still achieve the expected emissions benefit from the proposed standards.

The ABT program contained in this proposal would apply to all nonroad diesel engines covered by this notice. The following discussion of the proposed ABT provisions is divided into two sections. The first section describes the proposed provisions for engines rated over 37 kW. The second section describes the proposed provisions for those engines rated under 37 kW, including land-based and marine engines, both of which are currently unregulated by EPA. Readers are encouraged to review the draft regulations for a fuller understanding of how the proposed ABT program would operate. In addition to those areas specifically highlighted, the Agency solicits comments on all aspects of the proposed ABT changes, including comments on the benefit of these changes to manufacturers in meeting the proposed emission standards and any potential air quality impacts which might be associated with them.

1. Proposed Program for Engines Rated Greater Than or Equal to 37 kW

EPA is proposing to implement several new provisions upon finalization of the proposed standards. The following section is divided into two subsections and describes the proposed changes to the ABT program for engines greater than or equal to 37 kW. The first subsection describes the general provisions applicable to all engines. The second subsection describes several provisions specific to engines certified to the existing Tier 1 standards for engines greater than or equal to 37 kW.

i. General Provisions: Beginning with the proposed Tier 2 standards, the form of the standard changes from separate HC and NO_X standards to a combined NMHC + NO_X standard. Therefore, once the proposed Tier 2 standards take effect, credits will be based on combined NMHC + NO_X values. In the Tier 2 time frame, NMHC + NO_X credits will be generated against the proposed Tier 2 standards, which vary from 6.4 to 7.5 g/kW-hr (4.8 to 5.6 g/hp-hr), depending on the power rating of the engine. In the Tier 3 time frame, NMHC + NO_X credits will be generated against the proposed Tier 3 standards, which vary from 4.0 to 4.7 g/kW-hr (3.0 to 3.5 g/hp-hr), depending on the power rating of the engine.

The existing Tier 1 ABT program for nonroad engines does not cover PM emissions. Based on the certification levels of Tier 1 engines, the Tier 2 PM standards contained in the proposal will require manufacturers to reduce the PM levels of their engines. In addition, the proposed NMHC + NO_X standards will affect the manufacturer's ability to comply with the proposed PM standards due to the tradeoff between NO_X emissions and PM emissions which exists for diesel engines. Therefore, beginning with the introduction of Tier 2 engines, EPA is proposing to include PM emissions in the ABT program in order to provide manufacturers with greater flexibility in complying with the proposed PM standards. (As described later, EPA is proposing to allow the early banking of PM credits from Tier 1 engines under certain conditions.) All PM credits will be generated against the proposed Tier 2 standards until EPA adopts subsequent PM standards. Because EPA is proposing to include both NMHC + NO_X and PM in the ABT program, EPA is also proposing to prohibit manufacturers from generating credits on one pollutant while using credits on another pollutant all on the same engine family. EPA believes such a provision is important given the tradeoff between NO_X and PM emissions which exists for diesel engines.

As discussed earlier, EPA is planning to assess the adequacy of the current steady-state test procedure in an effort to determine if the expected emission benefits are being realized in use. EPA is concerned that PM reductions required on the current steady-state certification test will not result in similar reductions in use and could possibly, under some situations, even result in an increase in in-use emissions. Given the lack of sufficient information to confirm these concerns, EPA still believes it is appropriate to include PM emissions in the ABT program at this time. However, should EPA determine that the current test procedure is inadequate and the expected in-use emission benefits are indeed not being fully realized, it would, of course, be inappropriate to allow the unconsidered use of credits generated under the current test procedure to demonstrate compliance under a future, more appropriate test procedure. EPA would therefore need to reassess the appropriateness of the PM provisions for any Tier 3 standards, taking into consideration the amount of credits generated up to that point or taking the expected credit balances into account in setting the Tier 3 PM standard levels.

EPA is also proposing FEL upper limits that go with these new proposed standards. EPA believes the proposed FEL upper limits provide the manufacturers adequate compliance flexibility while protecting against the introduction of unnecessarily high-emitting engines. EPA requests comment on the appropriateness of the proposed upper limits. EPA is proposing a NMHC + NO_X FEL upper limit of 10.5 g/kW-hr (7.9 g/HP-hr) for engines greater than or equal to 130 kW certified in the Tier 2 time frame. The proposed NMHC + NO_X FEL upper limit is based on the existing Tier 1 NO_X and HC standards of 9.2 and 1.3 g/kW-hr (6.9 and 1.0 g/HP-hr), respectively.

Engines between 37 and 130 kW do not currently have to show compliance with an HC standard. However, data from those engines currently certified with EPA show that these engines are below the 1.3 g/kW-hr (1.0 g/HP-hr) HC level. Therefore, EPA is proposing the same NMHC + NO_X FEL upper limit of 10.5 g/kW-hr for Tier 2 engines greater than or equal to 37 kW and less than 130 kW. For Tier 3 engine families, EPA proposes that the NMHC + NO_X FEL upper limit be the Tier 2 NMHC + NO_X standards for the same power category of engines.

For PM, EPA is proposing a PM FEL upper limit of 0.54 g/kW-hr (0.40 g/HP-hr) for engines greater than or equal to 130 kW certified in the Tier 2 time frame. The proposed PM FEL upper limit is based on the existing Tier 1 PM standard. Engines between 37 and 130 kW do not currently have to show compliance with a PM standard. Therefore, EPA is proposing a PM FEL upper limit of 1.2 g/kW-hr for Tier 2 engines greater than or equal to 37 kW and less than 130 kW. This level represents a typical PM level for uncontrolled engines based on an EPA report.[29] (EPA is not proposing a PM FEL upper limit beyond Tier 2 because EPA is not proposing Tier 3 PM standards at this time.)

Upon finalization of the new standards, EPA is proposing to replace the three year credit life provision of the existing ABT program with no limit on credit life. EPA believes that unlimited life is warranted given the stringency of the proposed standards. An unlimited credit life will promote the feasibility of the proposed standards because it increases the value of the credit to the manufacturer by providing greater flexibility. It is consistent with the emission reduction goal of ABT, not only because of the increased manufacturer incentive but also because it eliminates the ‘‘use or lose’’ aspect of the existing program’s limit on credit life which creates the perverse incentive for manufacturers to use credits as quickly as possible. As a result, unused credits, which are extra emission reductions beyond what the EPA regulations require, may remain off the market longer. EPA also believes that removing credit life limits for the cleaner engines will provide maximum incentive for the development and introduction of clean engines with emission levels approaching the research objectives of the Nonroad Statement of Principles which are 2.0 g/kW-hr (1.5 g/hp-hr) NO_X and 0.07 g/kW-hr (0.05 g/hp-hr) PM.

EPA is proposing to eliminate the ‘‘buy high/sell low’’ power conversion factor provision of the existing ABT regulations and to replace it with the sales-weighted average power value beginning in Tier 2. Currently, when a manufacturer generates credits, the credits are based on the minimum power configuration in a family. When a manufacturer goes to use credits, the credits are based on the maximum power configuration in the family. In other words, credit generation is calculated based on the configuration which generates the least benefit within the family while credit use is based on the configuration which requires the most credits to comply. In some cases this can result in a sizeable offset. Based on experience with the ABT program for highway heavy-duty engines, EPA does not believe such an offset is necessary. This provision tends to introduce a penalty for credit generating engines, thus reducing the benefits of the ABT program for manufacturers. Therefore, EPA proposes to base both credit generation calculations and credit usage calculations on the sales-weighted average power values within each engine family. EPA has already proposed to incorporate this same change into the highway heavy-duty diesel engine ABT program (61 FR 33421, June 27, 1996) and requests comment on the appropriateness of such a change for the nonroad ABT program.

EPA is proposing to include an adjustment in the calculation of credits for the useful life of the engine. The existing ABT program does not include any adjustment for useful life to the credit calculations. All engines covered under the Tier 1 standards were assumed to have the same useful life of 8,000 hours. Therefore, in light of the fact that manufacturers are allowed to use credits across all power categories under the existing Tier 1 program, it was not necessary to adjust the value of the credits for different engine lifetimes. However, as discussed earlier, EPA is proposing to adopt useful life periods for engines below 37 kW that vary from 3,000 hours to 5,000 hours. In addition, as discussed later, EPA is also proposing to allow ABT credits to be used across some of the power categories where useful life will vary. Therefore, in order to appropriately determine the relative value of credits generated and the relative amount of credits used by different engines over their regulatory lifetime, EPA is proposing to include useful life in the equations used to calculate credits generated or credits used under the ABT program.

Another factor applied in the highway heavy-duty engine program that EPA is not proposing to include in the credit calculation for the nonroad program is related to engine load factor. Load factor refers to the percentage of maximum power at which an engine operates. An engine class that operates at a higher load would burn more fuel, and therefore, generate more emissions during an hour of operation. Including the load factor in the equation would lead to a more accurate estimation of in-use emissions and would be necessary if EPA were proposing to allow credits from the nonroad ABT program to be transferred to other emission trading programs, such as the Open Market Trading Program. No adjustment to the credit calculations for load factor is proposed under this rule because there do not appear to be distinct and varied load factors for different types of engines regulated under this rule.[30] As an indicator, the D2 and G2 test cycles have load factors of about 47% and the C1 test cycle has a load factor that is generally around 50±5%. However, the decision not to propose the inclusion of a load factor term to the credit calculations should not be interpreted to mean that this factor would not be appropriate for any future efforts. For example, marine engines have two very distinct engine applications: recreational and commercial. Commercial marine engines often have useful lives ten times longer and load factors two times greater than recreational marine engines. As noted below, EPA’s diesel marine rule is currently under development and may need to address these differences as part of that proposal.

As discussed later in more detail in the equipment manufacturer flexibility section, EPA is proposing that engine manufacturers be given the option to trade the NMHC + NO_X and PM credits generated by their engines to equipment manufacturers. Equipment manufacturers could use these credits to increase their options under the equipment manufacturer flexibility provisions.

There are two remaining areas on which EPA is requesting comment. First, EPA requests comment on the inclusion of engines certified to meet the State of California’s standards in the

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[29] ‘‘Nonroad Engine and Vehicle Emission Study’’ (NEVES), U.S. EPA, EPA Report Number 21A–2001, November 1991 (available in Air Docket A–96–40).

[30] There are a wide range of load factors for in-use nonroad diesel engines which are a result of the wide variation of nonroad equipment applications. However, EPA believes that any attempt to track these load factors for the purposes of credit calculations would be overly burdensome and would have no real emissions benefit since the credits are only allowed to be used in within the nonroad ABT program.

proposed ABT program. Currently, manufacturers may not include engines certified for California in the ABT program. Although the California ARB is expected to adopt the same standards that EPA is proposing today, they have not yet proposed such changes to their diesel nonroad program. Therefore, EPA does not believe that it can propose to include such engines in the revised ABT program at this time without knowing the full details of California's program.

Second, EPA is requesting comment on whether there should be restrictions on trading PM credits across the different power categories for which EPA is proposing standards. Based on the emission levels of Tier 1 engines certified with EPA, the PM levels of engines between 75 and 130 kW appear to be similar to those of engines between 130 and 560 kW. (At this point, EPA has very little PM emissions data on engines between 37 and 75 kW that are required to be certified by January 1998.) Under the proposal, the Tier 2 PM standards for engines less than 130 kW will be higher than the Tier 2 PM standards for engines greater than 130 kW. Based on the limited certification information, EPA has concerns that engines in one power category could generate PM credits against higher standards and then use those credits for showing compliance with another power category of engines with a lower standard. For this reason, EPA is requesting comment on limiting the use of PM credits to the power category in which the credits were generated.

ii. Special Provisions for Tier 1 Engines: As described above, EPA is proposing to replace the existing ABT program with a comprehensive new program. Based on EPA's experience with Tier 1 certification and because of implementation differences between the existing Tier 1 provisions and the proposed Tier 2 and later provisions, EPA is proposing two changes that will specifically affect engines certified to the existing Tier 1 standards. First, EPA is proposing a methodology for calculating NO_X credits earned with Tier 1 engines that can be used for showing compliance with the proposed Tier 2 NMHC + NO_X standards. Second, EPA is proposing to allow engine manufacturers to bank early PM credits that can be used once the proposed Tier 2 standards take effect. Both of these proposed changes are described in more detail below. The proposed changes in the general provisions, described above, including the unlimited life, use of average power for credit calculations, and useful life adjustment, will also apply to engines certified to the existing Tier 1 engines. EPA believes these changes are warranted for Tier 1 engines given the stringency of the proposed standards. Also these proposed changes are consistent with the feasibility of the proposed standards because they increase the value of the credits to the manufacturer by providing greater flexibility.

With regard to the generation of NO_X credits from engines certified to the existing Tier 1 standards, EPA is proposing to continue to allow manufacturers to earn NO_X credits, but not NMHC + NO_X credits. The NO_X credits earned on engines certified to the existing Tier 1 standards could be used to show compliance with the proposed Tier 2 NMHC + NO_X standards. Under the existing Tier 1 regulations, manufacturers are required to meet separate HC and NO_X standards. However, as noted earlier, beginning with the proposed Tier 2 standards, the form of the standard changes to a combined NMHC + NO_X standard. Based on EPA certification information for engines between 130 and 560 kW, the sales-weighted average HC levels of Tier 1 engines are 0.5 g/kW-hr, well below the 1.3 g/kW-hr standard. EPA believes the Tier 1 HC standard did not require manufacturers to reduce HC emissions, and therefore, allowing manufacturers to earn NMHC + NO_X credits against the combined Tier 1 HC and NO_X standards would provide manufacturers with false HC credits. For this reason, EPA is proposing to allow manufacturers to earn NO_X credits, and not NMHC + NO_X credits, on Tier 1 engines.

With regard to the calculation of NO_X credits from Tier 1 engines that are to be banked or traded, EPA is proposing that an adjustment be made in the calculation unless the engine on which the credits were earned is below the applicable standards by a specified amount. EPA believes an adjustment to the NO_X credits from certain Tier 1 engines is necessary to prevent the possibility of a significant delay in the introduction of engines meeting the proposed Tier 2 NMHC + NO_X standards. Based on certification information for current Tier 1 nonroad engines, if EPA allowed engine manufacturers to generate NO_X credits against the Tier 1 standard from all engines, they could potentially generate a large number of NO_X credits, and thereby significantly delay compliance with the proposed Tier 2 standards. Furthermore, the smaller incremental reductions from those engines only slightly below the standard are less likely to represent the cleaner, pull-ahead technologies which ABT is designed to encourage. However, these smaller credits do represent early reductions and do have some value given the stringency of the Tier 2 standards.

EPA is proposing to implement a trigger as a mechanism to distinguish between Tier 1 engine families which are eligible for no adjustment and those families which must be adjusted. For engine families certified with a NO_X FEL at or below 8.0 g/kW-hr NO_X, no adjustment would be applied to any NO_X credits. EPA has set 8.0 g/kW-hr NO_X to be a reasonable discriminator for pull-ahead technology based on the certification levels and technologies used to comply with the existing Tier 1 standards. For engine families certified at a NO_X FEL above the 8.0 g/kW-hr trigger in the Tier 1 time frame, an adjustment that reduces the value of the credits by 35 percent would be applied to the NO_X credits. EPA requests comment on the proposed level to be used for adjusting the converted Tier 1 NO_X credits. The proposed level was selected based on a combination of factors. If the rate is set too high, EPA would create a significant disincentive for the introduction of progressively improved technology. There may also be some incentive for manufacturers to marginally recalibrate engines at higher NO_X levels for improved operating characteristics such as fuel economy. Conversely, if EPA set the rate too low (or proposed no adjustment at all), there would be little incentive to develop and implement truly cleaner technology than currently exists. EPA believes an adjustment of 35 percent for credits generated at NO_X FELs above 8.0 g/kW-hr, strikes a balance between these dynamics.

With regard to PM, EPA is proposing to allow early banking of PM credits from Tier 1 engines, under certain conditions, as soon as the proposed standards are finalized. Under the proposal, an engine will be eligible to generate PM credits as long as the engine meets the Tier 1 NO_X standard of 9.2 g/kW-hr. For those eligible engines, the number of PM credits generated will be calculated against the proposed Tier 2 standards and may only be used to show compliance once the Tier 2 PM standards take effect. EPA is not proposing to apply the trigger or credit adjustment concept to PM credits because the proposed provisions for PM credits already require credits generated in the Tier 1 time frame to be calculated against the significantly more stringent proposed Tier 2 standards. Based on certification information for current Tier 1 nonroad engines, if EPA allowed manufacturers to bank credits against the relatively loose Tier 1 PM standard, manufacturers could potentially generate a large number of PM credits, and thereby significantly delay compliance with the proposed Tier 2 standards. EPA's main objective in ABT is to increase the feasibility of the proposed standards by allowing manufacturers to meet more stringent standards for certain engine families, allowing manufacturers more flexibility and lead time in bringing emissions for more problematic families down to the level of the standards. It is not designed to allow manufacturers to delay compliance with new standards for a long period of time for large numbers of engines. EPA requests comment on the appropriateness of the 9.2 g/kW-hr NO_X level as a limiting factor for whether PM credits can be generated by an engine family.

EPA requests comment on two additional changes for Tier 1 engines that EPA is considering adopting upon finalization of the proposed standards. First, EPA is considering adopting a safety net approach regarding the use of the NO_X credits generated from Tier 1 engines used in the Tier 2 time frame. As noted earlier, manufacturers have the potential to earn a large number of credits from current Tier 1 engines that could be used to significantly delay the introduction of engines meeting the Tier 2 standards. Although EPA doesn't expect this situation will occur, EPA is considering adopting a provision that would apply an additional 10 percent surcharge to the NO_X credits used by a manufacturer if they use credits to certify more than 20 percent of their fleet in the first or second year a Tier 2 standard applies in a given power category. EPA believes such a provision would provide manufacturers with sufficient compliance flexibility while, at the same time, encouraging them to reasonably limit the number of engines certified through ABT as the proposed standards take effect. EPA requests comment on the level of both the surcharge and the level at which the surcharge would apply.

Second, EPA is requesting comment on limiting the number of years for which early PM credits would be available. Assuming EPA finalizes the proposed standards prior to the beginning of the 1999 model year, manufacturers would have the potential to bank early PM credits for between two to seven years. This increases the chances that manufacturers could potentially generate a large number of PM credits, and thereby delay compliance with the proposed Tier 2 standards for many engines. Therefore, EPA is requesting comment on limiting the availability of early PM credits to the three years prior to when the applicable Tier 2 standards take effect.

2. Proposed Program for Engines Rated Under 37 kW

As noted earlier, EPA is proposing standards for engines rated under 37 kW, which are currently unregulated by EPA. Therefore, the existing ABT program does not apply to such engines. EPA is proposing provisions to include both land-based and marine engines rated under 37 kW in the ABT program. A number of provisions are being addressed for these engines, including credit generation, credit life, credit calculation, trading across power categories, credit exchange between land-based and marine applications, and a special multi-year averaging and banking program.

With regard to credit generation, EPA is proposing to make credits available for both NMHC + NO_X emissions and for PM emissions as soon as the standards are finalized. However, because of the kinds of technologies typically used by these engines, it is necessary to put some restrictions on how they are generated. Specifically, EPA is proposing that all credits generated from engines rated under 19 kW be calculated against the proposed Tier 2 standards, even prior to the Tier 2 time frame. This will apply for both NMHC + NO_X credits and PM credits. In other words, prior to the date when the proposed Tier 2 standards become effective, manufacturers who want to generate credits can generate credits only against the proposed Tier 2 standards, not the proposed Tier 1 standards. EPA believes this strategy for generating emission credits from engines rated under 19 kW is appropriate because the majority of engines in that power category use indirect fuel injection designs, which tend to have significantly lower NO_X levels compared to direct injection engines and, in most cases, NMHC + NO_X levels significantly lower than the proposed Tier 1 standards. For engines rated between 19 and 37 kW, where direct injection engines are more common, EPA is proposing that all engines generate credits against the applicable proposed standards, but, as discussed below, EPA is requesting comment on whether credits for engines between 19 kW and 37 kW should be generated against the proposed Tier 2 standards even during the Tier 1 time frame.

Because engines rated under 37 kW are currently unregulated at the Federal level, EPA cannot base the Tier 1 FEL upper limits on the previously applicable standards. However, the California ARB currently regulates nonroad diesel engines rated under 19 kW. Based on existing California ARB standards for nonroad diesel engines rated under 19 kW, EPA is proposing Tier 1 FEL upper limits for engines rated under 37 kW of 16.0 g/kW-hr (12.0 g/hp-hr) for NMHC + NO_X and 1.2 g/kW-hr (0.9 g/hp-hr) for PM. The proposed FEL upper limits for the Tier 2 standards are the proposed Tier 1 standards.

With regard to credit life, EPA is proposing to adopt the unlimited life provisions for engines rated under 37 kW, as described earlier for engines rated over 37 kW, with one exception. Because of concerns over the amount of credits manufacturers could earn on indirect injection engines under the proposed Tier 1 standards and the potential for significant delay in implementation of the Tier 2 standards, EPA is proposing that all credits generated prior to the Tier 2 time frame on engines rated under 19 kW expire at the end of 2007. With respect to credit generation and usage calculations, EPA is proposing that manufacturers use the sales-weighted average power for engines rated under 37 kW, as described earlier for engines rated over 37 kW. The inclusion of useful life in the calculation of credits, as described earlier, will also apply to the proposed ABT program for engines rated under 37 kW.

With respect to trading across power categories, EPA is proposing two restrictions on such trading because of the concerns noted above regarding the relatively low emissions from indirect injection engines. First, EPA is proposing that manufacturers not be allowed to use credits generated on engines rated under 19 kW to demonstrate compliance for engines rated over 19 kW. Second, EPA is proposing to prohibit manufacturers from trading credits earned on indirect injection engines rated over 19 kW to other manufacturers. Under this second proposed restriction, a manufacturer would still be allowed to use such credits for averaging or banking purposes with other engines it produces rated over 19 kW. EPA believes these trading restrictions are important to alleviate concerns that indirect injection engines could generate significant NMHC + NO_X credits against the proposed standards, which could then be traded to other manufacturers to delay compliance in the higher power categories. As an alternative to the proposed prohibition on trading credits from indirect injection engines to other manufacturers, EPA requests comment on applying the same limitation on credit generation for engines greater than or equal to 19 kW and less than 37 kW as are being proposed for engines below 19 kW. This alternative would require that all credits, including credits generated on Tier 1 engines, be generated against the proposed Tier 2 standards.

With respect to the exchange of credits across applications, EPA is proposing that manufacturers not be allowed to use credits generated on land-based engines to demonstrate compliance for marine engines. EPA believes that trading from land-based nonroad engines to marine engines is inappropriate for three reasons. First, allowing land-based credits to offset marine emissions could neutralize the marine program. There are many more land-based nonroad engines than there are marine engines, and allowing these trades would allow manufacturers to effectively trade out of the marine emission control requirements. Second, such a program would penalize small marinizers whose business consists of buying engines or engine blocks and modifying them for marine applications, or other manufacturers of only marine engines. These small marinizers would not have the same access to land-based credits as large engine manufacturers who also marinize their own engines. Allowing cross-application trading would give large manufacturers an unfair competitive advantage, since large manufacturers could effectively trade themselves out of the marine program whereas smaller marinizers would have to make the investments necessary to reduce emissions from their marine engines. Third, allowing land-based nonroad engine credits to offset marine emissions raises concerns regarding the geographic distribution of emission reductions. Specifically, the emissions from diesel marine engines are concentrated only in port areas while the emission from land-based nonroad are arguably spread out more evenly across the country. This creates a level of uncertainty as to whether the engines that generated the credits will be used in the same nonattainment area as the marine engines whose emissions are offset by the credits. While this problem is present to a certain degree in all nonroad programs, it is also the case that marine engines can be used in only one kind of area, and thus the ability to offset potentially higher marine emissions with lower-emitting land-based engines is limited.

While EPA is proposing not to allow manufacturers to use credits generated on land-based engines to demonstrate compliance for marine engines, EPA is proposing to allow manufacturers to use credits generated on marine engines to demonstrate compliance for land-based applications. This will benefit those engine manufacturers that only manufacture marine engines, who otherwise would be limited to trading emission credits among themselves or not trading at all. In addition, EPA expects to propose that small diesel marine engines be included in future diesel marine ABT program. This would create additional trading opportunities for these engine manufacturers.

Last of all, EPA is proposing a special four-year averaging and banking program for engines rated under 37 kW that would allow manufacturers to create a negative balance of credits for the first two years after the proposed Tier 1 standards are effective. This negative balance would have to be eliminated by the end of the fourth year of the Tier 1 standards. Based on discussions with engine manufacturers, it appears the proposed Tier 1 dates for engines rated under 37 kW will be challenging, especially for air-cooled direct injection engines. Even though a number of the small engine manufacturers have signed the Nonroad Statement of Principles that included the proposed Tier 1 standards, there may be some engine models that will not be ready by the proposed implementation dates. Therefore, EPA believes the two year allowance is important to ensure the feasibility of the proposed standards given the short lead time that is expected between the time the rule is expected to be finalized and the proposed implementation dates of the Tier 1 standards. Under the proposed program, manufacturers would be allowed to certify engines with FELs above the proposed Tier 1 standards and generate ''negative credits'' for the first two years after the proposed Tier 1 standards take effect. By the end of the fourth year after the proposed Tier 1 standards take effect, the manufacturer would be required to have certified enough engines with FELs below the proposed Tier 1 standards such that they have generated enough credits in order to pay back the negative credits, along with a ten percent penalty for any negative balance of credits carried over from one year to the next. Because of the penalty applied to negative credit balances, EPA believes the multi-year averaging and banking program will provide a small benefit to the environment in the long run. Under this special program, manufacturers would not be allowed to use emission credits obtained through trading with other engine manufacturers to offset their negative credit balances. In accordance with the above described provisions, separate programs would apply for engines rated under 19 kW and for engines between 19 and 37 kW.

As noted earlier, EPA solicits comments on all aspects of the proposed ABT changes, including comments on the benefit of these changes to manufacturers in meeting the proposed emission standards and any potential air quality impacts which might be associated with them.

E. Flexibility for Equipment Manufacturers

1. Overview of Approach to Providing Flexibility

EPA has often set engine emission standards that take full effect at a set point in time, concurrently precluding the installation of engines not certified to the new standards in vehicles or equipment. In meeting with manufacturers of nonroad engines and equipment to develop the Statement of Principles, EPA determined that a different approach to implementing new standards might be needed to avoid unnecessary hardship for equipment manufacturers (sometimes referred to as original equipment manufacturers or OEMs), while achieving the desired environmental benefits.

Some equipment manufacturers that do not make their own engines have complained that the Tier 1 rule resulted in disruptions because their engine suppliers did not always provide adequate lead time for the equipment redesigns needed to accommodate engine design changes such as mounting locations and heat rejection loads. The averaging, banking, and trading program is of little help to them, because they, as equipment manufacturers, have no control over which engines earn or use credits. For some, even timely information on the new engine designs has not solved the problem because of the sheer volume of redesign work needed to change diverse product offerings with limited engineering staffs. The manufacturers expressed a belief that the same problem would accompany the transition to the proposed Tier 2 standards. By addressing this problem in the design of the Nonroad Statement of Principles, the signatories were able to consider more stringent standards earlier than would otherwise be feasible.

In response to these concerns, the Agency is proposing an OEM transition program to provide equipment manufacturers with some control of the transition process to new standards. This proposed program is based on the provisions contained in the

Supplemental ANPRM, with modifications suggested in written comments, in subsequent discussions with equipment manufacturers, and in the report of the panel convened for this rule under the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).[31] The program consists of six major elements, each directed at a specific need. Although they involve certain planning and recordkeeping responsibilities if taken advantage of, all of these elements are voluntary. An OEM has the option to continue to do business as under the current regulations, subject to the prohibited acts provisions of 40 CFR Part 89, Subpart K. The elements of the program are: (1) A percent-of-production allowance for general applications, (2) a larger percent-of-production allowance for agricultural equipment, (3) a small-volume allowance, (4) continuance of the Tier 1 allowance to use up existing inventories of engines, (5) access to averaging, banking, and trading program credits, and (6) availability of hardship relief. Each of these is discussed in detail below.

2. Elements of Proposed OEM Transition Program

a. Percent-of-Production Allowance for General Applications: This proposed element allows each equipment manufacturer to install engines not certified to new emission standards in a certain percentage of its annual production for the U.S. market. For equipment with engines over 37 kW, in each year that a new Tier 2 standard first applies, an OEM will be allowed up to 15 percent of its equipment produced for sale or use in the U.S. to contain engines certified to Tier 1 standards. This allowance drops to 5 percent in each of the next 6 years. These allowances can provide substantial relief by allowing an OEM to prioritize redesign work onto high volume models. Many manufacturers have a substantial number of lower volume models with combined sales within these percentages. The several years in which exemptions are allowed accounts for the very limited engineering staffs available in many companies for the needed redesign work. EPA believes that allowing this latitude in the initial years of the standards is consistent with the Clean Air Act and that, were it not available, many OEMs would likely be unable to meet the redesign requirements necessitated by the standards. This flexibility allows the vast majority of the equipment population to be in compliance with these stringent standards more quickly than would otherwise be possible.

As presented in the Supplemental ANPRM, this provision would apply to equipment with engines under 37 kW as well, except that the 5 percent allowance would extend for 3 years instead of 6, and the exempted equipment could use uncontrolled engines beginning in the Tier 1 time frame. Manufacturers of equipment with engines rated under 37 kW objected to the shorter flexibility program duration proposed for their equipment. They argued that the 1999 and 2000 Tier 1 implementation dates that apply to them make it even more imperative that they receive flexibility allowances at least as large as those applied to manufacturers of large equipment. This concept was also put forward for consideration by the Small Business Advocacy Review Panel as potentially beneficial in addressing small business concerns. EPA believes that this concern has merit and also believes that the effect of such an extension on the environmental benefit would be small. Therefore the Agency is proposing, as a regulatory alternative, that the provisions of the general percent-of-production allowance that apply to manufacturers of large equipment be applied to manufacturers of equipment using small engines as well. Comment is requested on which of these regulatory alternatives is preferred. This alternative would also apply to the special agricultural equipment allowance and the small volume allowance (both discussed below) as well, so that no distinction would be made between equipment above and below 37 kW.

Commenters on the Supplemental ANPRM also requested a somewhat modified proposal from that outlined above. Under this modified approach, OEMs could respread the fixed percentage allowances across the years covered by the program. For example, instead of 15 percent of its production in the first year and 5 percent in each of the next 6 years, an OEM could exempt 45 percent in the first year and none thereafter, or save and spread its exemptions at 15 percent in each of years five, six, and seven to accommodate Tier 3 product introductions. EPA expects that this approach would not result in a significant degradation of the environmental benefit, due to the low percentages involved after the first year in the fixed percentage approach and the likelihood that some OEMs would group exemptions earlier and some later. The Agency believes that this added flexibility would provide substantial benefit to the industry by allowing each OEM to make its own determinations regarding which equipment is most in need of the flexibility provisions. EPA is therefore proposing it as a regulatory alternative to the fixed-percentage proposal. This concept was also put forward for consideration by the Small Business Advocacy Review Panel as potentially beneficial in addressing small business concerns (see Section VIII.B.).

To simplify the program, EPA proposes that the allowance under this alternative be framed as a 45 percent cumulative allowance over seven years (30 percent over 4 years for engines rated under 37 kW if the shorter duration alternative for these engines is adopted). The percent of production of exempted equipment in the first year would be subtracted from this starting allowance to determine the remaining allowance, and so on. EPA requests comment on the percent-of-production allowance and on which regulatory alternative is preferred.

Because actual production figures are not available when product planning decisions must be made, OEM's will have to base these decisions on projected production volumes. As a result, EPA will expect manufacturers to factor actual production data into annual redeterminations of remaining allowances and to adjust their product plans accordingly, so that all compliance determinations are ultimately based on actual production.

Another modification suggested by commenters is a provision to allow transfer of exemptions between power categories, with appropriate weightings to account for the differing environmental impacts of different engines. The Agency believes that this flexibility could provide substantial implementation benefits to some manufacturers, but is concerned that substantial losses in environmental benefits could result unless conservative correction factors could be devised. Many parameters affect an engine's impact on the environment, including size, life expectancy, average load factors, annual usage, and location of use, making the determination of correction factors extremely difficult. Of even more concern is the possible abuse of transferred exemptions to disadvantage a smaller competitor. A large manufacturer with a diverse product offering could stack exemptions into a market niche it competes in, possibly allowing it to sell machines with cheaper noncomplying engines for many years. EPA requests comment on

[31] ''Final Report of the SBREFA Small Business Advocacy Review Panel for Control of Emissions of Air Pollution from Nonroad Diesel Engines'', May 23, 1997 (available in Air Docket A–96–40).

the transfer of exemptions, including possible ways of addressing these concerns. EPA is especially interested in comments on the possible allowance of exemption transfers limited to the two power categories under 19 kW in Tier 1, because of the special challenges involved in designing these small engines to control emissions by the implementation date, and the relatively narrow power range for these two categories, which may somewhat ease concerns about proper weighting and exemption stacking.

b. Percent-of-Production Allowance for Agricultural Equipment: In preparing the proposal, EPA was made aware of some special concerns in the implementation of new emission controls on agricultural equipment. First, because the prices of farm products are strongly influenced by economic factors other than the cost of production, individual farmers are often not able to pass cost increases for new machinery on to consumers. Second, although many agricultural operations are quite large, there remains a sizeable segment of this equipment user community for which the rapid introduction of new technologies may be problematic. This segment is characterized (to varying degrees) by: (1) Small operations, often limited to family members, (2) remoteness from dealer or factory repair facilities, (3) traditional reliance on user maintenance, and (4) reticence to buy machines with unfamiliar technologies such as electronic controls. Third, there are numerous agricultural equipment models that service niche applications, for which only a handful of machines are sold each year. Fourth, although the international harmonization of standards is one of the goals of this program, farm tractors have not yet been included in the proposed regulations in the EU, and so control of emissions from these machines in Europe may therefore lag that of other applications. Finally, there are special challenges in redesigning some agricultural equipment for modified engine designs, such as the potential for heat exchanger plugging by airborne crop debris and the need for tractor hood profiles that allow a clear view of crop rows. Although certain of these or similar issues may apply individually to other equipment market segments as well as the agricultural market, they combine in the agricultural segment to warrant particular concern about a rapid transition to new standards.

After considering these issues, the Agency is proposing to grant more lead time for this equipment through a somewhat expanded OEM transition provision. Specifically, in each year that a new Tier 2 standard (Tier 1 for engines rated under 37 kW) applies, an OEM will be allowed up to 30 percent of its farm equipment produced for sale or use in the U.S. to contain engines certified to Tier 1 standards (uncertified for engines rated under 37 kW). This allowance drops to 15 percent in each of the next seven years (3 years for engines rated under 37 kW if the shorter duration alternative for these engines is adopted). A company that makes some farm equipment and some equipment used in other applications, wishing to take advantage of both the general and the special allowances, would make separate percent-of-production determinations in each category. EPA is also proposing that the provisions discussed above for exemption spreading apply to this special allowance as well. This would in effect provide a 135 percent cumulative allowance over eight years (75 percent over 4 years for engines rated under 37 kW if the shorter duration alternative for these engines is adopted).

EPA is aware that some ambiguity exists in the term ''farm'' equipment. The Agency desires that this expanded allowance be reserved for equipment models that are clearly targeted for the agricultural markets, but also recognizes that machines are sometimes put to diverse uses. EPA believes that the current definition for ''farm equipment or vehicle'' in 40 CFR 85.1602 is adequate for the purposes of this program. This definition covers equipment primarily used in commercial farm and logging activities. No routine record keeping or other evidence would be required of OEMs to make such an a priori determination. However, should EPA gather clear evidence of a misapplication of this designation, a recalculation of exemptions under the general application allowance would be required. Comment on this approach and alternative suggestions are solicited.

It should be noted that, although this provision may have some negative air quality implications, the impact of this expanded allowance on air quality is mitigated somewhat by the typical locations of this type of equipment. Much of this equipment is used in rural areas of the country that are remote from urban nonattainment areas. This is perhaps especially true of the small volume applications most likely to be exempted in the transition program. Although the regional transport of emitted pollutants over large distances is of concern, as explained in Section II, it is reasonable to expect some falloff of airborne concentrations of these pollutants over these distances.

Commenters on the Supplemental ANPRM suggested that companies that make both agricultural equipment and other equipment be allowed to transfer exemptions between these broad categories to further enhance implementation flexibility. Though supporting the goal of increased flexibility, EPA is concerned that substantial transfers of the large special exemption allowance could slow the introduction of complying construction, industrial, and utility machines, which is not justified by the analysis above. The Agency is also concerned that this added flexibility could provide an unfair competitive advantage to large companies with diverse product lines, a concern reflected in the comments as well. These concerns could be addressed by discounting transferred exemptions to reflect environmental or business impact differentials. However, at this time, EPA has no basis by which to determine the appropriate discount levels and so is not proposing this flexibility. Other commenters requested that the special allowance provision be dropped entirely and the resulting exemption pool be respread into the general allowance. However, the Agency believes that this would not address the above-discussed concerns. EPA requests comment on the special allowance proposal and on the suggestions made in the Supplemental ANPRM comments.

c. Small Volume Allowance: The percent-of-production approach outlined above may provide little benefit to small businesses focused on a small number of equipment models. To respond to these concerns, EPA is proposing that equipment manufacturers be allowed to exceed the percent-of-production allowances described above during the same years affected by the allowance program for general applications, provided they limit the installation of Tier 1 engines (uncertified engines for ratings under 37 kW) in each power category to a single equipment model with an annual production level (for U.S. sales) of 100 pieces or less. Though intended to ensure that the flexibility program does not disadvantage small businesses, this provision would be available to all equipment manufacturers. A manufacturer's use of this provision would not affect the availability of the other elements of the OEM transition program, although it would not be additive to the percent-of-production allowances: an OEM could base its exemption count on the percent-of-production allowance or the small volume allowance in any power category in any year.

EPA proposes that the exemption spreading provisions for the percent-of-production allowances discussed above, if adopted for these allowances, apply to the small volume allowance as well. That is, a manufacturer of a piece of equipment with an engine rated over 37 kW may use Tier 1 engines in a total of 700 of these units produced over the first seven years after the Tier 2 standard takes effect. Similarly, a manufacturer of a piece of equipment with an engine rated under 37 kW may use uncontrolled engines in a total of 400 of these units produced over the first four years after the Tier 1 standard takes effect, if the shorter duration allowance alternative is adopted for these engines.

EPA is aware of two concerns that must be addressed with this program element. First, a manufacturer may need to curtail sales of a product that, though initially selling below 100 units annually, experiences unanticipated sales growth marginally beyond this level; there would be no time to redesign the product for the new tier of standards. The Agency believes that the flexibility provided by the exemption spreading measure discussed above would sufficiently address this concern. A manufacturer with better than expected sales orders for the exempted model would use up the total exemption allowance earlier than expected, but, except in the last year that exemptions are available when conservative planning may be called for, an annual adjustment of the following year's exemptions would cover any reasonable underestimate of sales.

The second concern regards the vagueness of the term ''model.'' Some OEMs may wish to take greater advantage of the small volume allowance by grouping several small volume products under a single model designation, possibly using ''submodel'' designations to distinguish products. One method of addressing this would be to adopt a regulatory definition of the term ''model'' for the purposes of this program, such as requiring that products cannot be considered to be of the same model designation unless they have exactly the same model number, with no distinguishing lower level designations.

Another approach would be to simplify the program by not requiring that the small volume exemption be limited to a single model. This has the advantage of providing more flexibility to the OEMs by allowing any number of models to be exempted, provided the combined annual exemptions from all of these models does not exceed the allowed maximum in any one power category. Some manufacturers have advocated this approach. However, it has the disadvantages of increasing the number of exemptions likely to be taken (thus possibly foregoing some environmental benefit), and of moving away from the intent of the small volume allowance, which is to help small OEMs with very limited product offerings. EPA believes that these disadvantages are not serious, and so is proposing this approach as an alternative to the single model requirement. This concept was also put forward for consideration by the Small Business Advocacy Review Panel as potentially beneficial in addressing small business concerns. EPA requests comment on the small volume allowance and on which of the proposed regulatory alternatives is preferred.

d. Continuance of the Existing Inventory Allowance: Paragraph (b)(4) of 40 CFR 89.1003 states in part: ''Nonroad vehicles and equipment manufacturers may continue to use uncertified nonroad engines built prior to the effective date until uncertified engine inventories are depleted; however, stockpiling of uncertified nonroad engines will be considered a violation of this section.'' EPA proposes to extend this provision to the Tier 1-to-Tier 2 and Tier 2-to-Tier 3 transitions as well. A machine using such an engine would be considered under the tier of emission standards to which the engine is subject, and would therefore be treated as though it were produced in the previous year for such purposes as calculating percent-of-production and small volume allowances. It should also be noted that engines for which a manufacturer uses averaging, banking, and trading program credits to demonstrate compliance with EPA requirements will be treated in the OEM transition program as though they fully meet the applicable emission standards.

e. Access to Averaging, Banking, and Trading Program Credits: Though not discussed in the Supplemental ANPRM, commenters suggested that OEMs be provided additional flexibility by allowing them to purchase credits generated by engine manufacturers in the nonroad averaging, banking, and trading program. These credits would then be retired in exchange for further allowances to build equipment containing noncomplying engines. Although no guarantee could be made that credits would be available at a reasonable price, this provision would provide one more alternative in a range of options for OEMs to consider in planning for the new engines. This concept was also put forward for consideration by the Small Business Advocacy Review Panel as potentially beneficial in addressing small business concerns.

The Agency is favorable to concepts such as this that provide flexibility while tending to preserve the environmental benefit of the program, and so is proposing this additional flexibility. EPA believes this concept may actually benefit the environment by providing an incentive for engine manufacturers to pull ahead clean technologies in order to sell their credits at a profit. However, the Agency requests comment on whether there may be, on the other hand, the potential for a loss in environmental benefit through the creation of a market for credits that would otherwise have gone unused, and on the advisability of discounting credits used by OEMs to mitigate such losses. Comment is also sought on the advisability of restricting this provision to those applying for hardship relief, as discussed below.

The Agency is also soliciting comment on means of structuring the program to minimize its complexity and to preclude double-counting of credits. EPA is proposing that the credit amounts needed for each additional allowance be simply determined by multiplying the difference between the applicable standards times the midpoint of the applicable power range. For example, an allowance for a machine using a 200 kW (268 hp) Tier 1 engine in the Tier 2 time frame would require NMHC + NO_X credits totaling:

$$(1.3 + 9.2 - 6.6) \text{ g/kW-hr} \times 177.5 \text{ kW} \times 8{,}000 \text{ hr} = 5.538 \text{ Mg},$$

because 1.3, 9.2, and 6.6 g/kW-hr (1.0, 6.9, and 4.9 g/hp-hr) are the Tier 1 hydrocarbon, Tier 1 NO_X, and Tier 2 NMHC + NO_X standards, respectively; 177.5 kW (237.9 hp) is the midpoint of the 130 to 225 kW range, and 8,000 hours is the useful life for this range. For the sake of simplification, EPA would assume that Tier 1 hydrocarbon standards equate to NMHC levels, and that the 1.3 g/kW-hr (1.0 g/hp-hr) hydrocarbon level applies to Tier 1 power categories below 130 kW, for which there are no Tier 1 hydrocarbon standards. For OEMs seeking to use credits for additional allowances to install uncontrolled engines rated under 37 kW during Tier 1, EPA is proposing that the credit calculation assume uncontrolled NMHC + NO_X and PM levels of 16.0 and 1.2 g/kW-hr (11.9 and 0.9 g/hp-hr), respectively, based on a review of test data generated in the California small engine program.

Finally, the Agency is proposing that OEMs wishing to use ABT program credits would submit the same type of annual reports currently required of engine manufacturers participating in the ABT program, to allow the Agency to adequately track credits. Other credit use requirements and restrictions of the ABT program that apply to engine manufacturers would apply to equipment manufacturers as well.

f. Hardship Relief Provision: Commenters requested adoption of a hardship appeal process by which an OEM, especially a small business, could obtain relief by providing evidence that, despite its best efforts, it cannot meet the implementation dates, even with the OEM transition program provisions outlined above. Such a situation might occur if an engine supplier without a major business interest in the OEM were to change or drop an engine model very late in the implementation process. This concept was also put forward for consideration by the Small Business Advocacy Review Panel as potentially beneficial in addressing small business concerns. Based on outreach the Agency has done in formulating this proposal, especially to the small OEM community, EPA agrees that the concern of small businesses about the uncertainty of timely supply may be valid, and seeks to mitigate the possibility of business failures by providing fair, objective criteria for hardship appeal that minimize the potential loss in environmental benefit, minimize the Agency's involvement in a business' financial affairs, and avoid straining Agency resources.

The Agency is proposing a hardship relief provision under which appeals must be made in writing, be submitted before the earliest date of noncompliance, be limited to firms that fit the small business criteria established by the Small Business Administration,[32] include evidence that failure to comply was not the fault of the OEM (such as a supply contract broken by the engine supplier), and include evidence that the inability to sell the subject equipment will have a major impact on the company's solvency. The Agency would work with the applicant to ensure that all other remedies available under the flexibility provisions are exhausted before granting additional relief, and would limit the period of relief to no more than one year. Furthermore, the Agency proposes that applications for hardship relief only be accepted during the first year after the effective date of an applicable new emission standard. Comment is solicited on all aspects of this proposal and on whether the Agency should require those who receive relief to recover some of the lost environmental benefit, such as by purchasing Blue Sky Series engines described elsewhere in this proposal.

3. Availability of Engines

EPA is proposing that engine manufacturers be allowed to continue to build and sell the engines needed to meet the market demand created by the OEM transition program described above. Commenters on the Supplemental ANPRM expressed concern that the program will have minimal value because engine suppliers may decide not to continue making the older generation engines. Based on observation of current practice in which older engine configurations are routinely built to support replacement engine needs, EPA believes that engines will be made available to make the transition program workable. Further comment is solicited on this issue. Concerns that integrated manufacturers (who build engines for installation in their own OEM products and for sale to competitors) may purposely manipulate the production or prices of these engines to disadvantage their competitors appear to the Agency to be without merit, as this opportunity exists apart from EPA programs. However, to provide additional assurances, the engine manufacturers that signed the Nonroad Statement of Principles have agreed that, if they decide to continue the production of such engines, they will make them available for sale at reasonable prices to all interested buyers. EPA does not believe that regulation codifying this commitment is necessary or appropriate.

EPA is proposing that equipment manufacturers procuring engines for use under the OEM transition program provide written assurance to the supplying engine manufacturer that such engines are being procured for this purpose. EPA requests comment on the need for a requirement that engine manufacturers maintain or annually provide records on the engines manufactured in support of the OEM transition program, in order to help EPA prevent abuse of the program.

4. Enforcement and Record Keeping Requirements

The Agency desires to minimize the administrative burden to all parties involved with the OEM transition program. OEMs choosing not to take advantage of the allowances would have no requirements beyond those already in place from the Tier 1 rule. For OEMs choosing to take advantage of the allowances, EPA believes that the following requirements will be sufficient to allow it to enforce the program. (1) OEMs must keep records of the production of all pieces of equipment with engines covered by this rule. These records must be kept until December 31 of the year after the last year in which any of the allowances are used by the company. (2) Such records must include serial and model numbers and dates of production of equipment and installed engines, rated power of each engine, and the calculations used to determine the percent of production allowances taken in each power category. (3) OEMs must make these records available to the Agency upon request.

The Agency intends to conduct only limited audits of these records, and expects that scrutiny by the OEMs of their competitors' products will help identify potential candidates for audits. However, to further aid this process and the early identification of affected OEMs who may not be aware of the program requirements, EPA is considering also requiring that each OEM submit a letter to the Agency after each year in which allowances are utilized, providing some summary information, such as the number of machines sold with and without engines certified to the new standards. Comment is requested on the appropriateness of such a requirement.

EPA is aware of two conflicting concerns about the OEM transition program expressed by equipment manufacturers. On the one hand, manufacturers seek the maximum control and flexibility possible in implementing new standards. On the other hand, some manufacturers have felt that the flexibility provisions contained in the Supplemental ANPRM are already too complicated and that the suggested enhancements make them more so. Unfortunately, the simpler approaches suggested to date have involved a substantial loss in environmental benefits, amounting to effectively delaying the standards. Therefore the Agency has chosen to propose the collection of voluntary provisions discussed above, recognizing that effort will be needed by both the Agency and the industry to help manufacturers make best use of their options.

5. Alternative Concepts

Commenters on the Supplemental ANPRM suggested an alternative approach for helping OEMs implement

[32] 750 employees for manufacturers of construction equipment and industrial trucks, 500 employees for manufacturers of other nonroad equipment.

the new standards, by which a period of one to three years would be provided between availability of complying engines and the required date for use of these engines in new equipment. EPA is not proposing this approach because it would require a regulatory enforcement mechanism to ensure that final production-ready prototype engines are available long before the start of engine production on the required implementation date for new standards. Without such a mechanism, engine manufacturers could continue making design changes, delaying the implementation of new standards indefinitely. EPA is unaware of any such mechanism that would not also cause major disruptions in the industry.

Others recommended that the Agency set standards on a cost-effectiveness basis, application by application. Regulations would only apply to engines in those applications with an overall environmental impact high enough, and a cost of compliance low enough, to satisfy some specified cost-effectiveness threshold. The Agency is not proposing this approach for several reasons. First, this approach, which makes cost-effectiveness the primary factor in determining applicable standards, appears to be at odds with the standard setting criteria of section 213 of the Clean Air Act, which is primarily technology-based, with added consideration of cost, noise, energy, and safety factors. Second, accurate determinations of application-specific cost-effectiveness would be extremely difficult to make. Applications would constantly move above and below the threshold as new information and new design innovations are brought forth, creating uncertainty in the industry. Third, many engine models are used in multiple applications, possibly leading to multiple versions and higher costs. Fourth, evaluation outcomes would depend arbitrarily on how applications are defined. Many niche markets may have environmental impacts that are low individually, but quite large in the aggregate. Fifth, setting the threshold for cost-effectiveness would have inherent problems of arbitrariness, and would likely be met with vastly differing views in the public regarding the appropriateness of any threshold. Finally, the exempted equipment would still have some air quality impact, resulting in either a lower benefit of the program or more stringent standards for the regulated engines.

F. Flexibility for Post-Manufacture Marinizers

EPA believes that post-manufacture marinizers affected by the proposed standards may need some additional flexibility, beyond that available in the ABT program, to meet the challenges of new standards. By EPA's definition, a post-manufacture marinizer is someone who produces marine diesel engines by substantially modifying a complete or partially complete diesel engine, and who is not controlled by the manufacturer of the base engines or by an entity that controls both of them. For the purpose of this definition, ''substantially modify'' means changing an engine in a way that could change engine emission characteristics.

In some ways the challenge of any new standards for these marinizers would mirror that of nonroad equipment manufacturers, in that changes made by the original engine manufacturers might require changes in the parts and process involved in marinization. Because marinizers would experience similar impacts from the proposed standards as equipment manufacturers, EPA is requesting comment on extending some or all of the equipment manufacturer flexibility provisions described in Section III.E. to post-manufacture marinizers affected by this proposal. EPA sees the hardship relief provision for small businesses as perhaps especially appropriate for the post-manufacture marinizers, many of which are small businesses, and so is proposing their inclusion under this provision.

Unlike equipment manufacturers, however, marinizers generally complete the final stages of engine production and thus would typically be responsible for obtaining an EPA Certificate of Conformity with standards, and would bear liability for the emissions of these engines in use. One marinizer stated in EPA's outreach effort to small businesses (see Section VIII.B.) that the impact on small marinizers could be reduced if the proposed regulations allowed a post-manufacture marinizer to rely on the original engine maker's certificate of conformity, provided that the marinizer also demonstrates that it has not altered the engine's performance or combustion parameters. EPA is interested in pursuing certification streamlining options for marinizers, but has concerns that the original engine manufacturers may challenge their presumed liability in EPA enforcement actions directed at these engines. Also, a simple demonstration of equivalent emissions performance on pre- and post-marinized engines would not be sufficient to address the Agency's primary concern, which is the possibility of degradation of in-use emissions performance over time. EPA solicits suggestions on how the post-manufacture marinizer certification process might be streamlined while providing assurance of ongoing responsibility and durable emissions control design.

G. Control of Crankcase Emissions

Crankcase emissions are those exhaust gases that, upon leaving the combustion chamber, do not pass through the exhaust valve. Instead, the gases discharge (blowby) into the crankcase via the clearance between the piston and the cylinder wall. On certain engines (those engines with open crankcases), these gases may eventually escape from the crankcase to the atmosphere and are therefore named crankcase emissions. Some manufacturers produce engines that route crankcase vapors to the air intake system of the equipment; such a design is called a closed crankcase. This method, also called positive crankcase ventilation, recirculates blowby gases through a valve back to the intake manifold to be burned in the combustion chamber.[33]

Since 1985, closed crankcases have been required in naturally aspirated (nonturbocharged) highway diesel engines (45 FR 4136, January 21, 1980). Currently, turbocharged highway diesel engines are not required to have crankcase emission controls due to special difficulties in designing for closed crankcase. The problem with recirculating blowby gases in turbocharged engines is that the durability and effectiveness of turbocharger and aftercooler components can be affected by recycling gases containing particulate matter and corrosive gases.

There is limited data on crankcase emissions from nonroad diesel engines. In fact, EPA is not aware of any studies that explicitly investigate crankcase emissions from nonroad diesel engines. There are, however, studies relating to highway crankcase emissions.[34] Crankcase emission data from a 1977 study, in which three diesel engines (two naturally aspirated engines and one turbocharged engine) were tested. HC crankcase emissions ranged from 0.007 to 0.017 g/kW-hr (0.005 to 0.013 g/hp-hr), which represents 0.2 to 4.1 percent of corresponding exhaust emissions. PM crankcase emissions ranged from 0.9 to 2.9 percent of corresponding exhaust emissions. NO_X crankcase emissions represented only 0.01 to 0.1 percent of corresponding

[33] U.S. Environmental Protection Agency, Office of Mobile Sources, NEVES, Appendix I, Chapter 4, November 1991 (available in Air Docket A–96–40).

[34] ibid.

exhaust emissions. A more recent study performed by Southwest Research Institute in 1993 provided similar crankcase emissions from one turbocharged heavy-duty diesel engine, with HC, PM, and NO_X all at 0.01 g/kW-hr (0.01 g/hp-hr). None of the reported highway engines had more than 500,000 miles of use, an important consideration because of the expected increase in blowby gases as engines experience wear.[35]

EPA proposes to extend the closed crankcase requirement to nonroad engines, including the exemption for turbocharged diesel engines. Many naturally aspirated nonroad engines are already equipped with this technology; for those nonroad engine models still manufactured with open crankcases, EPA expects that closed-crankcase technology will be readily transferable. EPA has included the cost of closing crankcases in the analysis of the costs of complying with the proposed standards.

The proposed closed crankcase requirement applies to engines rated over 37 kW concurrent with the Tier 2 standards. Manufacturers of nonroad diesel engines rated under 37 kW are likely to have serious difficulties fully complying with closed crankcase provisions on the schedule proposed for Tier 1 emission standards, since this requirement would first apply to these manufacturers starting in 1999. Thus, for nonroad diesel engines rated under 37 kW, EPA proposes to delay the requirement for closed crankcases until 2001, providing more lead time for manufacturers of these engines. This delay will not have a major environmental impact because it is short, directed at a small segment of the engine market, and confined to a minor emission source relative to exhaust emissions. EPA requests comment on the proposal to control crankcase emissions and on the appropriateness of delaying the requirement for closed crankcases for these small engines.

H. Control of Smoke

1. Proposed Numerical Standards and Procedures

In 1994, EPA finalized smoke standards for nonroad diesel engines rated over 37 kW. The specified measurement method and calculations are from 40 CFR 86, subpart I, which was developed for highway engines. EPA concluded that the highway smoke test procedure would adequately test non-road engines and thus control smoke. The standards for nonroad engines are for engine smoke not to exceed averaged values of 20 percent on acceleration mode or 15 percent on lug mode and not to exceed peak opacity levels of 50 percent on either the acceleration or lug mode. EPA is proposing no changes to the smoke emission standards and procedures currently in place.

EPA proposes to extend the smoke standards to multiple-cylinder diesel engines rated under 37 kW, bringing these engines under the same regulatory framework as the larger engines. While these new standards may lead to lower smoke levels from some engines, the principal intent of setting standards is to prevent increased levels of smoke as engines are redesigned to comply with Tier 2 and Tier 3 standards for gaseous and particulate emissions. The same numerical standards would apply to the small engines. With minor exceptions, the same procedure, equipment, and calculation methods would also be used for these engines.

Extending smoke standards to the smaller engines raises some important issues. First, two-cylinder engines operating on the specified test procedure may produce puffs of smoke that may make the smoke measurement erratic. EPA proposes to permit the option of testing these engines with a preconditioned muffler of the type used in the field. Such an engine configuration is the same as that found in use, and thus represents meaningful control of in-use smoke; however, the smoke measurement response may be flattened out somewhat, resulting in potentially reduced levels of measured smoke. Engines with more than two cylinders will continue to be tested without a muffler, which is a ''worst case'' condition.

Second, specifying the correct exhaust pipe diameter requires extrapolation of specifications found in 40 CFR 86, subpart I. The current procedure calls for a 2 inch (5 cm) inside diameter exhaust pipe for testing engines rated under 101 horsepower maximum (75 kW). Yet, for constant visibility as a function of measured opacity (which is, in turn, a function of pipe diameter), this test pipe diameter should be smaller for engines with lower rated power. The same is true for the larger engines, where the procedure specifies the use of a 5 inch (13 cm) inside diameter exhaust pipe for the testing engines with a maximum rated power of 301 hp (225 kW) or greater. Consequently, the Agency is proposing that engines rated between 50 and 100 horsepower (37 and 75 kW) be tested with a 2 inch (5 cm) inside diameter exhaust pipe, while engines rated under 50 horsepower (37 kW) should be tested with an exhaust pipe of 1.5 inches (3.8 cm). Engines rated between 100 and 200 horsepower (75 and 150 kW) should be tested with the established 3 inch (7.6 cm) pipe diameter. Similarly, engines rated between 200 and 300 horsepower (150 and 220 kW) should be tested with the established 4 inch (10.2 cm) pipe diameter. For engines rated between 300 and 500 hp (225 and 373 kW), testing should be performed with the 5 inch (13 cm) inside diameter exhaust pipe, while engines rated over 500 horsepower (373 kW) should be tested with an exhaust pipe of 6 inches (15.2 cm). Perspectives and data on all issues related to testing these engines for smoke are solicited.

In applying the smoke standards and procedures to engines rated under 37 kW, EPA proposes to exempt one-cylinder engines. EPA believes that operation and testing of these engines is unique in ways that would need to be addressed before applying smoke standards. For example, it is not known if the smoke puffs emitted after each combustion stroke can be accommodated by the test procedure and if so, what the procedure features should be. The same is true of the dynamometer control specification elements of the procedure. Also, since there is no certainty as to the appropriate test procedure, there is no basis for selecting numerical standards. EPA is therefore proposing to postpone the regulation of smoke from these one-cylinder engines until a later rulemaking. The Agency believes there will be minimal air quality impact in the interim, since the large majority of one-cylinder diesel engines are used in generator sets and other steady-state applications; these engines therefore rarely experience acceleration modes, which are the the principal focus of smoke standards. EPA requests comment on the appropriate treatment of smoke requirements for one-cylinder engines.

In addition, EPA proposes to omit the smoke requirements for propulsion marine diesel engines rated under 37 kW. Manufacturers of these engines have stated that this is reasonable for at least the following two reasons. First, they state that smoke is not a problem with propulsion marine diesel engines. Most marine engine manufacturers already supply reduced-smoke engines because consumers demand low smoke levels for their own personal comfort. Second, they state that there is no reliable smoke test for propulsion marine engines, as the smoke test designed for land-based nonroad engines does not exercise the engine

[35] ''Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines,'' U.S. EPA, June 6, 1996 (Docket A–95–27).

over the typical marine engine operating cycle, which is governed by the propeller. EPA solicits comments on this issue.

2. Consideration of ISO Procedure

Since promulgation of the Tier 1 rule, an International Standards Organization committee (ISO TC70/SC8/WG1) has been developing a smoke test procedure specifically for nonroad engines. The EPA and regulated industry recognize the value of harmonized test procedures and standards limits. The Statement of Principles therefore states:

> The Signatories support the completion and worldwide adoption of the new smoke test being developed by the International Standards Organization (ISO 8178–9). EPA intends to propose to replace its current smoke test with the ISO test procedure for the sake of harmonization and improved control of smoke, provided that it provides for a level of smoke control at least as adequate as the current test.

However, this ISO procedure has not been finalized and thus it is not being proposed in this rulemaking. In anticipation of EPA's eventual consideration of the ISO 8178–9 test procedure, the Agency welcomes comments (including test data) addressing issues related to this procedure.

The draft ISO 8178–9 test procedure has several important features that distinguish it from the smoke test procedure developed for highway engines. First, the duty cycle over which the engine is to be operated is very similar to the procedure for highway engines, except that it deletes the 200 rpm initial speed increase and first-shift feature of the engine duty cycle. These types of operation are seldom, if ever, found in nonroad equipment.

A second important difference is the use of a Bessel filter algorithm to compute the peak, acceleration, and lug data from the instantaneous smoke values given by the smoke meter. The Bessel algorithm specified in the ISO procedure emulates a low-pass second-order filter and uses iterative calculations to determine coefficients that are a function of the smoke meter's physical and electrical response times and the sampling rate. This Bessel filter method of calculating results contrasts with the method specified in 40 CFR 86 subpart I, which calls for simple mathematical averages of one-half second data. The ISO Bessel filter calculation procedure selects the highest calculated value for each reported mode (acceleration, lug and peak), using Bessel averaging times that are less than or equal to those of the highway-based test procedure. The ISO procedure will likely result in values that are greater than those generated from the same data by the averaging procedure specified in 40 CFR 86 subpart I. Information, addressing this question, including test data if possible, is solicited.

Another issue is the form used for expressing the level of the standards. The current form is units of opacity—20 percent acceleration, 15 percent lug, and 50 percent peak. Opacity measurements are, however, a function of the effective optical path length, which is determined by the exit diameter of the exhaust pipe upon which the smoke meter is mounted. The diameter of the exhaust pipe specified in the current procedure is a function of engine power, as described above. However, this creates a step-wise relationship in the level of stringency as a function of engine power, which, at a minimum, creates different levels of stringency for engines close to the horsepower cut points. One solution is to express the measurements in units of light absorption coefficient, k (inverse meters), which is the form that the ISO committee has stated is the most technically correct. The numerical level of the standards would be expressed in terms such as the standard level, k, being a function (to some degree) of a parameter such as displacement, engine power, or other basic engine descriptor, and some constant. The EPA solicits data and comments on these issues.

3. In-Use Smoke Testing

Some state governments have expressed a desire for a smoke regulatory program that would enable them to test in-use nonroad engines in a manner that would permit action against gross emitters of smoke. The main elements of such a program would be a certification smoke requirement for new engines, EPA guidance for state in-use smoke control programs (including an in-use smoke test procedure and accompanying limit values), and a means by which the data from the two programs can be related. The current smoke test procedure from part 86, subpart I, does not provide data comparable to the most practical in-use smoke test procedure (a snap acceleration with measured opacity). Based on the current draft ISO 8178–9 certification smoke test procedure, EPA believes this test will provide the desired linkage. The Agency requests comment on the advisability of establishing such a smoke control program and on any interim steps that should be pursued while the ISO test is under development. Any such program would need to meet the requirements of section 209 of the Act regarding preemption of certain state programs.

I. Voluntary Low-Emitting Engine Program

a. Background

The Nonroad Statement of Principles includes a commitment to work towards a goal of achieving emission levels in the future that are even lower than those proposed in this notice. Specifically, the signatories agreed to strive to develop engines capable of controlling NO_X emissions to 2.0 g/kW-hr (1.5 g/hp-hr) and PM emissions to 0.07 g/kW-hr (0.05 g/hp-hr), while maintaining performance, reliability, durability, safety, efficiency, and compatibility with nonroad equipment.

Some technologies that will be pursued in the context of the research agreement have already undergone significant development. Officials representing certain cities, states, or regions in the U.S. have expressed interest in developing incentive programs to encourage the use of engines that go beyond federal emission standards. EPA also would like to encourage manufacturers to initiate demonstration projects to prove out these technologies in areas where there is a particular need for superior emission controls. EPA is therefore proposing a set of voluntary standards that may be used to earn a designation as a low-emitting engine. The program, if successful, will lead to the introduction and more widespread use of these low-emission technologies.

Ongoing research has led to much improved prospects for a variety of low-emitting diesel engine technologies. Some particulate traps are now designed for regeneration without an active control system, sometimes using fuel-based catalyst materials to reduce regeneration temperature requirements. Selective catalytic reduction, long used very effectively in stationary source applications, is now in several demonstration heavy-duty vehicles. Plasma and thermoelectric techniques are also under consideration for large particulate and NO_X reductions. EPA is very interested in seeing a demonstration of the emission-control potential for these engines in nonroad applications, especially related to the capability of maintaining low emission levels over extended field operation.

Alternative fuels also have the potential to reduce emissions from internal combustion engines. Alternative-fuel engines have made significant inroads into some segments of the nonroad market. Forklifts running on propane and generators fueled by natural gas are the most visible examples of nonroad applications with established roles for alternative fuels. Table 3 includes data derived from the PSR PartsLink database for these and other applications in which equipment with alternative-fueled engines was sold in 1995. This information is approximate and does not reflect the use of battery-powered equipment or any engine retrofits for fuel conversion.

TABLE 3.—APPROXIMATE SALES OF ALTERNATIVE FUEL APPLICATIONS MARKETED IN 1995

Application	1995 Sales			
	Natural gas	LPG	Diesel	Gasoline
Forklift	0	43,000	12,000	17,000
Generator	4,500	1,500	53,000	13,000
Gas Compressor	2,400	0	0	0
Oil Field Equip.	370	0	1,300	15
Terminal Tractor	0	230	3,700	750
Scrubber/Sweeper	10	170	6,200	3,400
Irrigation Set	150	0	4,700	1,600
Refrigeration, A/C	90	0	48,000	0
Pump	40	0	10,000	6,600

In addition to these existing uses of alternative fuels, ground service equipment at airports provides a case study of the potential to increase reliance on alternative fuels in the nonroad arena. A concern for reducing emissions to improve local air quality and limit worker exposures has led some airlines to see alternative fuels as a cost-effective alternative for their existing diesel-fueled equipment. Greater use of alternative fuels at airports has been limited by the availability of engines. A challenge for the engine manufacturers is to develop a nonroad alternative fuel engine without needing to charge a large premium (to recoup R&D) that makes the engines unaffordable. EPA's intent in pursuing a program of voluntary standards for low-emitting engines is to help justify development of these nonroad engines.

EPA believes that nonroad equipment is in some cases much better suited to alternative fuels than are highway vehicles. Nonroad equipment, when operated within a well-defined local area, often has the advantage of central fueling. Also, several high-power engines running consistently over long periods can consume great amounts of fuel and generate correspondingly high emissions. Alternative fuels have the potential to lower operating costs (for example, from less expensive fuel and longer oil-change intervals) in addition to reducing emissions.

b. Proposal for Blue Sky Series Engines

EPA proposes to adopt voluntary emission standards that manufacturers could use to earn a designation of ''Blue Sky Series'' engines. The range of possible incentives to produce these engines are described below.

Central to the purpose of the voluntary standards is the need to demonstrate superior control of particulate emissions. Because of the sensitivity of particulate emissions to test cycles, as described in Section III.B., testing on a transient cycle is an important element of the proposed program for Blue Sky Series engines. EPA has begun work toward developing transient test cycles for nonroad equipment, but there is not yet any established or proven nonroad transient cycle. The highway test cycle, while not developed for nonroad engine operation, would result in a significant degree of control for nonroad equipment. EPA therefore proposes to specify the highway transient test cycle to evaluate emission levels relative to the voluntary standards. A commenter on the Supplemental ANPRM recommended that engine manufacturers have the option of selecting alternative test cycles applicable to specific engines or applications. EPA requests further comment on alternative test cycles. If EPA adopts a transient test for certifying nonroad engines in the future, the Agency will accordingly re-evaluate the test cycle and standards for Blue Sky Series engines.

Manufacturers could certify to one of three levels to demonstrate emission control that goes beyond the Tier 2 certification requirements, as described in Table 4. The percentage reductions would apply to all power categories. EPA requests comment on whether simplifying the program to include only one or two emission levels to qualify for the Blue Sky Series program would make it more effective. Engines would need to meet all the requirements established to demonstrate durability of emission controls, including allowable maintenance, warranty, useful life, rebuild, and deterioration factor provisions. Manufacturers would demonstrate compliance with the CO standard by comparing the emission levels generated on the highway test cycle with the numerical value of the CO standard for the applicable tier of nonroad engines for that model year. Manufacturers would also need to demonstrate compliance with applicable smoke standards.

TABLE 4.—PROPOSED STANDARDS AND DESIGNATIONS FOR BLUE SKY SERIES ENGINES

Designation	Percent reduction relative to Tier 2 standards	
	$NMHC + NO_X$	PM
Blue Sky Series—Class A*	35	35
Blue Sky Series—Class AA	50	50
Blue Sky Series—Class AAA	65	65

*The Class A option would no longer be available beginning any year that the Tier 2 standards apply to a particular power range.

EPA recognizes that among the candidate engines for the Blue Sky Series program are those low-emitting engines that have already been designed and certified for highway use. EPA therefore requests comment on whether it would be more appropriate to set the optional emission standards based on established highway standards, defining, for example, an engine meeting the 2004 highway emission standards as a Blue Sky Series engine.

Repeating the certification process to develop and submit test data to make a highway engine available for nonroad use adds a significant hurdle to engines expected to sell in low volumes for nonroad applications. EPA therefore proposes for the Blue Sky Series engine program that manufacturers with highway-certified engines may waive the testing requirements for obtaining nonroad certification. This would include the need to comply with the provisions related to the durability of emission controls. EPA, however, would need to ensure that engine designs are not tailored to the transient cycle with much higher emissions on a steady-state cycle. To accommodate this, EPA would need to retain the ability to conduct in-use testing to verify that engines are operating in steady-state modes with substantially the same level of emission control. EPA therefore proposes that NO_X and PM emissions be no more than 20 percent higher on the appropriate nonroad steady-state test cycle compared with the highway test cycle. This is intended to provide relief for development testing needed to protect against in-use liability, while preventing any active strategies designed specifically for the transient test cycle at the expense of controlling emissions during steady-state operation. For evaluation of the performance of one of these engines in steady-state operation at any point in an engine's useful life, the Agency would conduct paired data generated on both the appropriate steady-state test cycle and the highway transient test cycle.

Engine manufacturers could generate credits under the averaging, banking, and trading program with Blue Sky Engines, provided that emission testing is also conducted on the appropriate steady-state test to facilitate calculation and exchange of credits. For this reason and for avoiding the uncertainty associated with surrogate test cycles, EPA would encourage manufacturers to conduct and submit steady-state test data with their application for certification even without a requirement to do so.

The Blue Sky Series program would begin immediately upon promulgation and would continue through the 2004 model year. EPA would evaluate the program to determine if it should be continued for 2005 and later engines, and if so, whether any changes are needed. This evaluation will be considered as part of the 2001 Feasibility Review. The experience gained with these engines and the Tier 3 resolution of certification test cycles and PM standards will factor into this evaluation.

c. Incentives for Producing Blue Sky Series Engines

Creating a program of voluntary standards for low-emitting engines, including testing and durability provisions to help ensure their in-use performance, will be a major step forward in advancing innovative emission control technologies, because EPA certification will provide protection against false claims of environmentally beneficial products. For the program to be most effective, however, incentives for the production of these engines must be created as well.

The Agency sees substantial potential for users and state and local governments to establish these incentive programs. For example, the increasing public concern about the effects of diesel engine emissions on health raises the possibility that some construction companies will purchase Blue Sky Series engines to protect its workers or the public from localized emissions, especially if benefits can also be gained in employee or public relations, such as with highly visible projects in polluted city centers. Similarly, a mining company could select these low-emitting engines for underground applications to minimize miners' exposure to exhaust pollutants. A state or local government may be able to add incentives for companies committing to rely on Blue Sky Series engines in contract bidding on publicly-funded construction projects in nonattainment areas. Some farmers may be willing to pay more for equipment with the cleaner engines to lower their field exposure to engine exhaust pollutants. In some of these applications, alternative fuels may be readily available, possibly even providing a cost savings compared to diesel fuel.

The Agency solicits ideas that could encourage the creation of these incentive programs by users and state and local governments. EPA also solicits comment on additional measures that that could be taken at a federal level to encourage these engines as well. One measure already suggested is adoption of a labeling program, by which EPA would regulate the form and display of prominent labels on equipment with Blue Sky Series engines. The Agency is not convinced at this point that such labels would provide sufficient incentive for users to purchase these engines to justify labeling requirements, but welcomes comment on this suggestion.

The Agency is concerned that incentive programs not lead to a net detriment to the environment through the double counting of benefits. For example, a manufacturer of a Blue Sky Series engine that claims credit under the averaging, banking, and trading program should not also be allowed to generate State Implementation Plan credit for emission reductions, such as under a state highway construction project program that encourages Blue Sky Series engines. The Agency intends to ensure that steps are taken to avoid such double counting of benefits.

IV. Technical Amendments

This proposed rule contains technical amendments to the procedures previously adopted for nonroad diesel engines (40 CFR part 89). These amendments result from the experience gained in conducting compliance programs for the recently implemented Tier 1 standards. Also, EPA's discussions with the industry on similar amendments related to testing highway engines have been translated into changes to nonroad test requirements where appropriate. This section describes proposed changes to the definition of rated speed and related terms and a variety of other modifications. A complete description of the technical amendments is detailed in a memorandum to the docket.[36]

A. Rated Speed Definition

EPA is proposing changes to the definitions of rated speed and intermediate speed. The current language allows the manufacturer to specify both of these speeds. Since these speeds are used to generate the test cycle, their definitions should permit only one rated and one intermediate speed for each engine. The proposed language links these speeds to speeds on the power and torque curves.

EPA is concerned that the current language allows a manufacturer to specify rated and intermediate speeds to any speeds. A manufacturer may specify these speeds to develop a less stringent test cycle. This test cycle would allow an otherwise failing engine to meet emission standards. Similarly, a manufacturer could take advantage of the current definitions by specifying speeds that maximize credits generated or minimize credits used in the Averaging, Banking, and Trading program.

Rated speed is proposed to be defined as the full load governed speed. The term full load is used to avoid confusion between the terms governed speed and high idle speed. High idle speed is the no-load governed speed. The maximum

[36] "Justification for Amendments to 40 CFR Part 89," EPA memorandum from Greg Orehowsky to Docket A–96–40, August 21, 1997.

full load speed is the highest speed with an advertised power greater than zero. EPA is linking full load governed speed to advertisements at this time since no adequate language has been developed that mathematically defines full load governed speed as a point on the torque or power curve. Power curves in manufacturer's advertisements typically end at the governed speed. EPA believes that manufacturers will continue to advertise the full range of power of its engine. Therefore, manufacturers will not set rated speed at less than full load governed speed. It is unlikely that manufacturers will advertise powers beyond the full load governed speed since a manufacturer cannot guarantee their customers power beyond this point.

The change in the definition of rated speed should not have any effect on manufacturers. EPA does not believe that any manufacturer will need to recertify their engines because of this new definition. By linking the definition to advertisements, EPA will not require manufacturers to perform an engine map for compliance testing. The advertised value will be the test value.

EPA plans to evaluate the appropriateness of the rated speed definition in a future test program. EPA would prefer to have a technical definition of full load governed speed, possibly in terms of rate of change of power. Given the large power range of engines covered by these regulations, an adequate definition using a singular rate could not be determined at this time. EPA will continue to evaluate this possibility.

Since the steady state test cycles test engines at a maximum of three engine speeds, it is important to test at speeds representative of in-use operation to control emissions during in-use operation. As the shapes of power and torque curves vary with future engine design, the emissions from engines will vary. Testing at the full load governor speed regulates emissions at this speed but may not effectively limit emissions from the engine. As part of the planned evaluation of the steady-state test procedure, EPA intends to evaluate whether another speed, such as the speed at maximum power, is more effective at controlling emissions.

EPA is proposing to amend the intermediate speed definition to be consistent with the definition of intermediate speed for the smoke test procedure. This definition will eliminate the possibility of a manufacturer specifying an intermediate speed to lower emissions from the engine. The proposed definition provides for testing at a median engine speed while still linking the definition to the torque curve of the engine and being a speed representative of in-use operation.

B. Other Technical Amendments

Additional amendments make a variety of clarifications and correct typographical errors and omissions from the original rule. The most significant of these are described in the following paragraphs.

The amendments change the criteria for test engine selection. The current language bases test engine selection on the maximum fuel per stroke at maximum power. However, EPA had intended in the original rule to make the test engine selection based primarily on the highest fuel per stroke at peak torque and secondarily on the highest fuel per stroke at rated speed.

The calibration requirements for the gaseous emission measurement analyzers are modified in various ways. The requirements for measurement accuracy below fifteen percent of full scale are revised to include a specific number of gas concentrations at the low end of the calibration curve. Also, calibration requirements are simplified to allow laboratories to calibrate only one analyzer range and still ensure accurate measurements. Additional changes to calibration requirements for other equipment are described in EPA's memorandum to the docket.

Other modifications relate to the test sequence and calculation of emission results. A ''mode'' is defined and the procedure for dealing with void modes is included. The equations used to calculate emissions during raw sampling are corrected. The amendments also correct errors in the currently listed equations and include new equations that were mistakenly omitted.

V. Technological Feasibility

The emission standards proposed above would apply to a broad range of diesel engines used in a wide variety of nonroad applications. Section 213(a)(3) of the Clean Air Act calls for EPA to establish standards that provide for the ''greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the engines or vehicles to which such standards apply, giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers and to noise, energy, and safety factors associated with the application of such technology.'' This section describes EPA's understanding of the range of technologies that will be available for manufacturers to comply with the proposed standards. The costs associated with these technologies are considered in Section VI.B. EPA has concluded, as described in the Draft RIA, that the proposed standards will have no significant negative effect on noise, energy, or safety.

EPA has considered the diversity of the nonroad engine and equipment industries and believes that the standards being proposed will require the most advanced technology that will be available for the various engines classes in this time frame. While meeting these standards will be challenging, EPA believes compliance with the standards will be feasible for manufacturers, as described in the following discussion. In the course of the 2001 Feasibility Review, EPA will verify the appropriateness of the Tier 2 standards for engines rated under 37 kW and the Tier 3 standards for engines rated between 37 and 560 kW, including consideration of the same factors described above. A more detailed description of the technologies and their potential for controlling emissions is contained in the Draft RIA.

In developing the various numerical standards and implementation dates proposed in this notice, EPA depended heavily on extending the analysis of technological feasibility for the preceding proposal for highway heavy-duty engines. While the proposed standards for highway engines applied equally to all sizes of engines starting in the same year, the standards proposed in this notice are a complex combination of numerical values and applicable model years. Varying numerical standards were considered necessary to account for the very wide range of engines represented in nonroad applications. Also, because of the range of engines offered by individual manufacturers, EPA agreed with manufacturers that new standards could be implemented most expeditiously by phasing the standards in at different times for different power ranges. EPA applied a similar phase-in for the first tier of nonroad emission standards promulgated in 1994.

A. Development of the Implementation Schedule

The timing of the new and revised standards was calculated to maximize the introduction of emission-reduction technologies. For engines rated under 37 kW, introducing new Tier 1 standards for 1999 and 2000 is very aggressive. EPA considered the five years of lead time between Tier 1 and Tier 2 standards for these engines to be necessary for manufacturers to recover their initial investment and prepare for the next round of changes.

For engines rated between 37 and 560 kW, the Tier 2 standards follow the introduction of comparable emission standards for highway engines. Within this range, engines rated between 225 and 450 kW were considered most susceptible to technologies transferred from highway engines and were therefore scheduled to be the first engines subject to the Tier 2 standards, starting in 2001. This provides three years following implementation of EPA's 1998 highway NO_X emission standard of 5.4 g/kW-hr (4.0 g/hp-hr) for manufacturers to incorporate highway-based technologies into nonroad engines to meet the Tier 2 standards, which are comparable to the 1998 highway standards. Other power ratings within this range follow over the next three years. Engines rated between 37 and 75 kW are the last ones in this group to be subject to Tier 2 standards; this additional lead time (until 2004) is due to the need for a greater effort to transfer technology from the larger highway engines to these engines, many of which are naturally aspirated. Proposed implementation of Tier 3 standards for these engines is scheduled between two and four years following the implementation of comparable emission standards for highway engines. Also, implementation of Tier 3 standards between 2006 and 2008 allows three to five years following implementation of the Tier 2 nonroad standards for different power ratings. EPA believes that implementing the proposed Tier 3 standards any sooner could either forego the potential of transferring highway technology or pose an unreasonably short period between the Tier 2 and Tier 3 standards for manufacturers to recoup their costs for complying with Tier 2 standards.

Engines rated over 560 kW are in a unique category. Because of the very low sales volumes of these engines, manufacturers need a longer period to recoup their development costs. For that reason, these engines and the associated equipment generally have much longer product development cycles. EPA has accordingly proposed only one additional tier of emission standard for these engines. Tier 2 standards would then apply beginning in 2006, six years after the Tier 1 standards take effect.

B. Development of Numerical Standards

The next paragraphs lay out the rationale for the numerical standards in this proposal (see Table 1 for emission standards). Individual technologies and the unique characteristics of various sizes of engines are considered in greater detail in the next section. Selecting the numerical standards involved a measure of extrapolation of information available for highway engines, with additional judgment to take into account the unique operating characteristics typical of nonroad applications of the various power ranges. For nonroad engines most similar to models available as highway heavy-duty engines, EPA made a relatively straightforward adjustment of the technological capabilities established for highway engines. Expectations for other engines, especially smaller models, were adjusted according to their size-related limitations, with the expectation that most of the control technologies were adaptable to any size diesel engine.

1. NMHC + NO_X

The targeted level of emission control for engines rated under 37 kW is based on engine designs utilizing direct injection, rather than the lower-emitting indirect injection designs. The direct injection engines have significantly better fuel economy; EPA therefore does not want to set emission standards that preclude the use of direct injection engines. The Tier 1 standards allow very little lead time, which limits the degree of control achievable from these engines. EPA chose a NMHC + NO_X standard of 9.5 g/kW-hr (7.1 g/hp-hr) for engines rated between 8 and 37 kW, expecting these engines to use similar technologies to those adopted for larger Tier 1 engines in response to EPA's 1994 rulemaking. Direct injection engines rated under 8 kW are expected to have a greater challenge reducing emissions in the near term, due to the design constraints related to the smaller cylinders and higher engine speeds, and would therefore be subject to a NMHC + NO_X standard of 10.5 g/kW-hr (7.8 g/hp-hr). The 1994 rulemaking set a NO_X standard of 9.2 g/kW-hr (6.9 g/hp-hr) for engines rated over 37 kW and an HC standard of 1.3 g/kW-hr (1.0 g/hp-hr) for engines rated over 130 kW. The technologies needed to meet this standard would generally involve combustion chamber optimization and timing retard, both of which are well established for diesel engines and should be readily adaptable to the smaller engine models.

The proposed Tier 2 and Tier 3 numerical standards for NMHC + NO_X emissions are derived most directly from highway engines. Engines rated over 75 kW were believed to have little difficulty in transferring technology developed for highway engines. Two principal factors were considered in selecting the numerical standard. First, though nonroad engines have much in common with their highway counterparts, some aspects of operation in nonroad applications differs significantly from that of highway engines. The main distinction in nonroad applications is the lack of high-speed air for cooling the engine and intake air (after being heated by a turbocharger). Less effective heat transfer in the aftercooler translates into higher combustion temperatures and higher levels of NO_X formation. Second, the different test cycles specified for certification testing prevent a direct translation of numerical standards; however, as described in Section III.B. above, test data shows that NO_X and HC levels are roughly comparable on the highway test cycle and the primary nonroad test cycle (C1). Taking these factors into consideration led EPA to choose numerical standards for NMHC + NO_X approximately 0.7 g/kW-hr (0.5 g/hp-hr) higher than the comparable highway standards for nonroad engines rated over 75 kW. The resulting NMHC + NO_X standards are either 6.4 or 6.6 g/kW-hr (4.8 or 4.9 g/hp-hr) for Tier 2 engines and 4.0 g/kW-hr (3.0 g/hp-hr) for Tier 3 engines.

Engines rated under 75 kW have additional distinctions relative to highway engines. These engines are typically naturally aspirated, in which case they do not have the benefit of a turbocharger and aftercooler for controlling intake air characteristics. These engines also have progressively smaller cylinder displacements and higher rotation speeds, which increase the challenge of controlling the combustion event. The proposed numerical standards for these engines are therefore set higher than those for larger engines. The proposed Tier 2 NMHC + NO_X standard for all engines rated under 75 kW is 7.5 g/kW-hr (5.6 g/hp-hr). Similarly, the proposed Tier 3 NMHC + NO_X standard for engines rated between 37 and 75 kW is 4.7 g/kW-hr (3.5 g/hp-hr)

2. PM

In 1994, EPA set a PM standard of 0.54 g/kW-hr (0.40 g/hp-hr), using the steady-state ISO C1 cycle, for engines rated over 130 kW. EPA is interested in the possibility of developing a nonroad transient test for greater assurance of reduced PM emissions in the field. Because there is still no such cycle established for nonroad engines, EPA is proposing to adopt PM standards that represent the greatest degree of control appropriate for testing on the current test cycles in the Tier 2 time frame, including engines of all power ratings.

More stringent PM standards for Tier 3 are not included in the proposal, with the hope that questions related to test cycles can be resolved in time for a subsequent action, if appropriate.

For engines rated over 130 kW, EPA proposes a Tier 2 PM standard of 0.20 g/kW-hr (0.15 g/hp-hr). For the same reasons described above for NMHC and NO_X emissions, EPA expects smaller engines to face a greater challenge in controlling PM emissions. The proposed Tier 2 PM standard for engines rated between 75 and 130 kW is therefore set at 0.30 g/kW-hr (0.22 g/hp-hr); the comparable standard for engines rated between 37 and 75 kW is 0.40 g/kW-hr (0.30 g/hp-hr). For engines rated under 37 kW, EPA is proposing new PM standards for both Tier 1 and Tier 2 engines. The near-term standards for Tier 1 engines are 1.0 and 0.80 g/kW-hr (0.75 and 0.60 g/hp-hr) for engines rated under 8 kW and engines rated between 8 and 37 kW, respectively. Proposed Tier 2 standards are set at 0.80 and 0.60 g/kW-hr (0.60 and 0.45 g/hp-hr) for engines rated under 19 kW and engines rated between 19 and 37 kW, respectively.

3. CO

Formation of CO in diesel combustion is inhibited by the presence of excess oxygen, resulting in relatively low CO emissions without any active control strategies. Setting numerical standards for CO emissions therefore serves largely to prevent unexpected problems. Where two tiers of standards are set forth in this proposal, the numerical CO standard is the same for both tiers. Again, the largest engines have the lowest numerical standard.

C. Technological Approaches

Because the proposed emission standards for nonroad diesel engines depend on the evaluation of technologies for complying with the standards for highway engines, the discussion of technological feasibility in that rulemaking is central to supporting the feasibility of the proposed standards for nonroad engines. This analysis of diesel engine technologies is contained in Chapter 4 of the Draft RIA for the highway rule.[37] This analysis is considered and applied to nonroad engines in Chapter 3 of the Draft RIA for this proposal, which is summarized in the following paragraphs.

By proposing multiple tiers of standards that extend well into the next decade, EPA is providing engine manufacturers with substantial lead time for developing, testing, and implementing emission control technologies. This lead time and the coordination of standards with those for highway engines allows time for a comprehensive R&D program to integrate the most effective emission control approaches into the manufacturers' overall design goals related to durability, reliability, and fuel consumption.

To meet the emission standards proposed above, manufacturers would need to move beyond the steps used to comply with the first phase of nonroad engine controls. Understanding the control technologies applied to engines complying with the Tier 1 standards is important in assessing the feasibility of meeting more stringent numerical standards. Engines rated between 75 and 560 kW have begun to comply with the first nonroad emission standards, providing a clearer picture of the starting point from which manufacturers of these engines will be working to reduce emissions for subsequent emission standards. In the case of manufacturers of engines rated under 37 kW, the standards proposed in this notice would represent the first emission requirements for these engines under EPA regulations; the starting point for improving emissions would therefore be focused on basic engine technology with new emission controls.

Highway heavy-duty engines will be subject to a 5.4 g/kW-hr (4.0 g/hp-hr) NO_X standard beginning in the 1998 model year. For those manufacturers that produce engines for both highway and nonroad service, variations on a single engine model are sometimes sold for both markets. Because these engines have similar emission levels on the eight-mode test, they could likely comply with the proposed Tier 2 NMHC + NO_X standards with relatively minor modifications to adapt the technology to nonroad applications. Similarly, Tier 3 standards are intended to follow the highway engine standards proposed for the 2004 model year, with the expectation that technology transfer will be a very important element of achieving compliance with the nonroad standards. Even where engines are dedicated to nonroad applications, the very similar engine design makes clear that much of the technological development that has led to lower-emitting highway engines can be transferred or adapted for use on nonroad engines. Specifically, much of the improvement in highway engines has come from ''internal'' engine changes such as variation in fuel injection variables (injection pressure, spray pattern, rate shaping), modified piston bowl geometry for better air-fuel mixing, and improvements intended to reduce oil consumption. Introduction and ongoing improvement of electronic controls have played a vital role in facilitating many of these improvements.

Other technological developments for highway heavy-duty engines require a greater degree of development before they can be applied to nonroad engines. Turbocharging is widely used now in nonroad applications, especially in larger engines, because it improves power and efficiency by compressing the intake air. Turbocharging can also decrease PM emissions; however, changing an engine from naturally aspirated to turbocharged may raise concerns about ''packaging,'' since with the added turbocharger the equipment may have to be adapted to accommodate a physically larger engine. The concern for packaging is especially sensitive for small, compact equipment designs. Space constraints, though, are generally a matter of cost rather than feasibility and are further addressed in the discussion of cost to equipment manufacturers. Turbochargers increase the power density of engines, but switching to a smaller engine with equivalent power may require substantial equipment redesign. EPA expects that, over the long term, equipment specifications will be updated to take advantage of the substantial growth in power density from all engines; however, the difficulty of making this transition prevents any straightforward analysis of addressing engine packaging concerns with more compact engines.

Aftercooling is a well established highway engine technology that has only recently been widely used in nonroad engines. The aftercooler chills the hot air coming from the turbocharger before it enters the cylinder, which decreases fuel consumption and helps prevent NO_X formation by reducing combustion temperatures. Air-to-water aftercoolers, which use the engine's coolant to provide partial cooling of the the intake air, can fit readily into most engine applications. In the long term, manufacturers are expected to move toward air-to-air aftercooling, which provides much better benefits for fuel economy and NO_X control. Because of the additional space required for air-to-air aftercoolers (for a separate heat exchanger and a bigger fan), these improved aftercoolers may in some cases be integrated when equipment manufacturers are ready to rework the overall designs for their equipment models.

[37] ''Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines,'' U.S. EPA, June 6, 1996 (Docket A–95–27).

In evaluating the feasibility of the proposed nonroad standards, it is helpful to separately consider three broad categories of engines. First, manufacturers of turbocharged nonroad diesel engines, most often rated over 75 kW, generally have the flexibility to incorporate more sophisticated technological innovations for performance, fuel economy, and emission control, including those derived from counterpart highway engines. Electronic controls offer great potential for improved control of engine operating parameters for better performance and lower emissions. Unit pumps or injectors would allow higher-pressure fuel injection with rate shaping to carefully time the delivery of the whole volume of injected fuel into the cylinder. Routing of the intake air and the shape of the combustion chamber can be redesigned for improved mixing of the air-fuel charge. Air-to-air aftercooling will likely gain widespread use in turbocharged engines, primarily for its fuel consumption and durability benefits, though it also lowers NO_X emissions. Manufacturers will be able to combine many of these technologies to comply with Tier 2 standards. Tier 3 standards will require deployment of additional technologies. Common rail injection systems provide greater overall control of the fuel injection strategy by maintaining a constant supply of high-pressure fuel at the injectors. Also, exhaust gas recirculation will likely be introduced in highway diesel engines over the next several years, providing valuable experience in developing those systems for nonroad engines. EPA believes these technologies will be important in achieving compliance with Tier 3 emission standards. A more detailed treatment of the feasibility of these engines meeting the proposed standards is included in the regulatory impact analyses, as described above. Because the long-term standards depend on significant progress in technology development, EPA will be reviewing requirements for Tier 3 engines by 2001 to confirm that developments are progressing as expected.

The second category is the set of water-cooled naturally aspirated engines, which are most often rated under 50 or 75 kW. The lack of turbocharging (and aftercooling) and the greater sensitivity to increased costs for these relatively inexpensive engines suggest that manufacturers will likely depend on basic technologies to control emissions to the necessary levels. Expected changes can be divided into two broad categories. First, combustion optimization includes changes to basic engine design for improved air-fuel mixing and management of the combustion process. These changes might include retarded injection timing, re-entrant piston bowl shapes, greater swirl of the intake air, and improved ring design for lower oil consumption. Second, fuel injection parameters provide many variables for the engine designer. Manufacturers might modify fuel pumps, injectors, or controls to achieve higher injection pressures, more rapid injection, better control of injection timing (including rate shaping), and reduced sac volume. In addition to exhaust emission control strategies, emissions from the crankcase of naturally aspirated engines can be eliminated by routing vapors from the crankcase directly to the air intake. These technological developments are well understood and should provide manufacturers with the tools needed to comply with Tier 1 and Tier 2 standards for engines rated under 37 kW. Similarly, engines rated between 37 and 75 kW should be able to comply with Tier 2 standards using these technologies; compliance with Tier 3 standards may in addition require use of exhaust gas recirculation. EPA believes these engines can meet the proposed emission standards without needing to incorporate turbocharging. EPA believes that increasing the numerical NMHC + NO_X standard by 0.9 g/kW-hr (0.7 g/hp-hr) relative to the larger engines appropriately compensates for the design constraints imposed by these engines.

Third, many of the air-cooled diesel engines rated under 8 kW face unique design challenges. The small cylinders and low cost of these engines limit the flexibility of designing or adapting technologies to control emissions. Tier 1 standards for these engines are therefore set at less stringent levels than larger engines. To reach these levels, manufacturers will need to rely on several of the strategies used for other engines. For example, increasing swirl and redesigning piston head geometries can be an effective way of improving fuel-air mixing in small engines, with the additional benefit of allowing higher injection pressures without increasing fuel wetting on the cylinder walls. The position and design of piston rings can be improved to reduce the contribution of engine oil to particulate emissions. Incorporating fuel injectors that provide mechanically controlled rate shaping would allow substantial control of NO_X emissions at a low cost. Using injectors with valve-closed-orifice nozzles would similarly control HC emissions. Engines that operate within a relatively narrow range of engine speeds can achieve a degree of charge-air compression with intake manifold designs that rely on pulse tuning. The unique characteristics of the smallest engines pose a challenge to the designer, but these and other technologies are available for complying with the Tier 1 and Tier 2 standards. Also, certification data from the California ARB shows that most direct injection diesel engines rated under 19 kW are currently emitting between 8 and 11 g/kW-hr (6 and 8 g/hp-hr) NMHC + NO_X; all these engines will need to improve, but the current best performers support the feasibility of the Tier 1 and Tier 2 standards for all these engines.

Finally, any engines relying on natural aspiration technology are also subject to the proposed requirement to eliminate crankcase emissions. This requirement has long been in place for naturally aspirated highway engines. EPA believes that the technology required to close the crankcase is well established and easily transferrable to any size of nonroad engine.

D. Conclusions Regarding Technological Feasibility

The standards set by this proposal are the most challenging that can be justified in this time frame. Engine manufacturers will need to use the available lead time to develop the necessary emission control technologies, including transfer of technology from highway engines. This development effort will require not only achieving the targeted emission levels, but also ensuring that each engine will meet all performance and emission requirements over its useful life. The proposed standards clearly represent major reductions compared with current emission levels.

Emission control technology for diesel engines is in a period of rapid development in response to the range of emission standards anticipated for the years ahead. This effort will need to continue to meet the requirements in this proposal. However, the emission targets are set in the framework of a long lead time, which provides manufacturers the time they will need to apply emission control technology developments to nonroad engines. Also, the experience gained in response to EPA's emission standards for highway engines will be invaluable in meeting the comparable requirements for nonroad engines. Because the technology development for highway engines will to a large extent constitute basic research of diesel engine combustion, this effort will also benefit manufacturers that produce no highway engines.

On the basis of information currently available, EPA believes that it is feasible for nonroad diesel engine manufacturers to meet the standards proposed in this notice within the the proposed time frame, using combinations of the technological approaches discussed above and in the Draft RIA. In addition, EPA believes that the flexibilities incorporated into this proposal will permit nonroad vehicle and equipment manufacturers to respond to engine changes in an orderly way. For both industries, EPA expects meeting these requirements will pose a significant challenge. As described above, EPA plans to assess, as part of the 2001 Feasibility Review, the appropriateness of the proposed Tier 3 standards and the proposed Tier 2 standards for engines rated under 37 kW.

VI. Projected Impacts

A. Environmental Impacts

To assess the environmental impact of the proposed standards, EPA has created a computer program for predicting emissions from the nonroad equipment covered by this proposal. A memorandum describing the computer program has been placed in the public docket for this rulemaking.[38] Chapter 5 of the Draft RIA also contains a thorough discussion of the methodology used to project the emission inventories and emission reductions from nonroad equipment covered by the proposed standards. The reader is directed to both of these documents for more information on the environmental impact of this proposal. EPA requests comment on all aspects of the computer program and the methodology for projecting the emissions impact of the proposed standards.

The amount of growth experienced in the nonroad market will have a significant impact on the emission inventories and emission reductions expected from the proposed standards. For this environmental impact analysis, EPA has examined the impact of the proposed standards under two different growth scenarios. (The growth rates used in the nonroad modeling are compounded growth rates.) The first scenario uses the growth rates developed by the Bureau of Economic Analysis (BEA). The BEA growth rates, which are based on a variety of economic indicators, vary by nonroad segment (i.e., agriculture, construction, etc.) and typically range from one to two percent per year. However, based on trends in nonroad equipment sales, trends in nonroad fuel usage, and the continuing strong performance of the U.S. economy, EPA believes that the BEA growth rates may underestimate the future growth of the nonroad market. Therefore, EPA has also modeled the impact of the proposed standards using a moderately higher growth rate of three percent for all nonroad segments. EPA believes the results from the two growth scenarios serve to bracket the expected environmental impact of the proposed standards. The following discussion of environmental impacts presents the results from both the BEA growth scenario and the three percent growth scenario. EPA requests comments on the appropriateness of the BEA growth rates and the three percent growth rate.

EPA modeled the impact of the proposed standards for NO_X, NMHC, and PM emissions. The modeling inputs conservatively assume that equipment manufacturers take full advantage of the flexibility provisions described earlier. EPA did not model the impacts of the proposed standards on CO because CO emissions from nonroad diesel equipment are a very small portion of the overall CO inventory and the proposed standards are not expected to have a significant impact on CO levels.

Because of the uncertainties about the degree to which the steady-state test procedure will control PM emissions in use, especially from the many nonroad engines that frequently operate in transient modes, EPA cannot be certain that any assessment of expected PM emission reductions made at this time will be completely accurate. Nevertheless, EPA has attempted to make a reasonable estimate of these reductions by assuming an in-use per-engine reduction equal to the difference between the Tier 1 and proposed standards. The baseline levels used in this analysis are consistent with the position taken in the Tier 1 rule that no PM benefits are claimed from the Tier 1 PM standard. EPA believes that this approach provides a reasonable estimate of PM benefits from the proposed standards but actual benefits could vary significantly from these levels.

Based on the results of the modeling, the expected emission benefits from the proposed standards are quite substantial. Tables 5, 6, and 7 contain the nationwide NO_X, NMHC, and PM inventories, respectively, under the baseline scenario, which assumes only the current Tier 1 standards are in effect, and under the control scenario, which assumes the proposed standards take effect. (The PM reductions contained in Table 7 are direct PM and do not include secondary PM benefits, which are described below.) By 2020, the emission reductions due to the proposed standards reach 50 percent for NO_X, 15 percent for NMHC, and 20 percent for PM. All percentages are calculated relative to the baseline inventories, which assumes only the current Tier 1 standards are in effect.

TABLE 5.—NO_X EMISSIONS INVENTORY FROM NONROAD DIESEL ENGINES

[Short tons]

Calendar year	BEA growth rates		3% growth rates	
	With the current standards	With the proposed standards	With the current standards	With the proposed standards
2000	2,920,000	2,890,000	3,150,000	3,120,000
2010	2,740,000	1,850,000	3,450,000	2,330,000
2020	3,070,000	1,460,000	4,520,000	2,150,000

[38] "Nonroad CI Nodeling Methodology and Request for Comment," EPA memorandum from Peter J. Caffrey to Docket A–96–40.

TABLE 6.—NMHC EMISSIONS INVENTORY FROM NONROAD DIESEL ENGINES

[Short tons]

Calendar year	BEA growth rates		3% growth rates	
	With the current standards	With the proposed standards	With the current standards	With the proposed standards
2000	503,000	497,000	543,000	536,000
2010	582,000	509,000	730,000	638,000
2020	673,000	541,000	980,000	789,000

TABLE 7.—PM EMISSIONS INVENTORY FROM NONROAD DIESEL ENGINES

[Short tons]

Calendar year	BEA growth rates		3% growth rates	
	With the current standards	With the proposed standards	With the current standards	With the proposed standards
2000	478,000	476,000	515,000	513,000
2010	553,000	483,000	693,000	606,000
2020	639,000	534,000	931,000	778,000

In addition to the effect of the proposed emission standards on direct PM emissions noted above, the proposed standards are expected to reduce the concentrations of secondary PM. Secondary PM is formed when NO_X reacts with ammonia in the atmosphere to yield ammonium nitrate particulate. SAI, under contract with EPA, recently evaluated the effect of the NO_X reductions on the formation of nitrate particulate.[39] The report concluded that, as a national average, each 100 tons of NO_X reduction will result in about 4 tons of secondary PM reduction. This conversion rate varies from region to region, and is greatest in the West. EPA estimates that the approximately 1.6 million tons per year of NO_X reduction projected in 2020 resulting from this proposal (assuming BEA growth rates) will result in a national average of about 64,000 tons per year reduction in secondary PM. This level of secondary PM reduction represents about 60 percent of the projected direct PM reductions presented in Table 7.

B. Economic Impacts

In assessing the economic impact of changing the emission standards, EPA has made a best estimate of the combination of technologies that an engine manufacturer might use to meet the new standards at an acceptable cost. While equipment manufacturers bear no responsibility for meeting emission standards, they will need to make changes in the design of their equipment models to accommodate the new engines. EPA's treatment of the impacts of the proposal therefore includes an analysis of costs for equipment manufacturers. Full details of EPA's cost and cost-effectiveness analyses can be found in Chapters 4 and 6 of the Draft RIA.

Estimated cost increases are broken into purchase price and total life-cycle operating costs. The incremental purchase price for new engines and equipment is comprised of variable costs (for hardware and assembly time) and fixed costs (for R&D, retooling, and certification). Total operating costs include any expected increases in maintenance or fuel consumption. Cost estimates based on these projected technology packages represent an expected incremental cost of engines as they begin to comply with new emission standards. Costs in subsequent years would be reduced by several factors, as described below. Separate projected costs were derived for engines and equipment used in six different ranges of rated power; costs were developed for engines near the middle of the listed ranges. All costs are presented in 1995 dollars. Life-cycle costs have been discounted to the year of sale. EPA requests comment on all aspects of the economic impact analysis.

1. Engine Technologies

The following discussion provides a brief description of those technologies EPA projects will be needed to comply with the new emission standards. In some cases it is difficult to make a distinction between technologies needed to reduce emissions for compliance with emission standards and those technologies that offer other benefits for improved fuel economy, power density, and other aspects of engine performance. EPA believes that without new emission standards, manufacturers would continue research on and eventually deploy many technological upgrades to improve engine performance or more cost-effectively control emissions. Turbocharging, aftercooling, and variable-valve timing are examples of technologies whose primary benefit is for improved performance. Modifications to fuel injection systems and the introduction of electronic controls will also continue, regardless of any change in emission standards, to improve engine performance. Some further development with a focus on NO_X, HC, and PM emissions will nevertheless play an important role in achieving emission reduction targets.

A variety of technological improvements are projected for complying with the multiple tiers of proposed emission standards. Selecting these technology packages requires extensive engineering analysis and judgment. The fact that manufacturers have nearly a full decade before implementation of the most challenging of the proposed standards ensures that technologies will develop significantly before reaching production. This ongoing development will lead to reduced costs in three ways. First, research will lead to enhanced effectiveness for individual technologies, allowing manufacturers to use simpler packages of emission

[39] "Benefits of Mobile Source NO_X Related Particulate Matter Reductions," Systems Applications International, EPA Contract No. 68–C5–0010, WAN 1–8, October 1996 (available in Air Docket A–96–40).

control technologies than we would predict given the current state of development. Similarly, the continuing effort to improve the emission control technologies will include innovations that allow lower-cost production. Finally, manufacturers will focus research efforts on any potential drawbacks, such as increased fuel consumption or maintenance costs, attempting to minimize or overcome any negative effects.

A combination of technology upgrades are anticipated as a result of the proposed emission standards. Modifications to basic engine design features, such as piston bowl shape and engine block and head geometry, can improve intake air characteristics and distribution during combustion. For this analysis, EPA anticipates that manufacturers will make these basic engine modifications for the first tier of proposed standards. These redesigned engines are then expected to serve as a platform for the other changes anticipated for the next tier of standards. This will be less true for engines rated under 37 kW, which have less time to incorporate design changes before Tier 1 standards become effective. Manufacturers are expected to introduce electronic controls on some engines. Advanced fuel-injection techniques and hardware will allow designers to modify various fuel injection parameters for higher pressure, further rate shaping, and some split injection. For Tier 3 standards, EPA expects that many engines will see further fuel injection improvements and will incorporate a moderate degree of cooled exhaust gas recirculation. Details of the mix of technologies included in the cost analysis can be found in Chapter 4 of the Draft RIA.

While the following analysis projects a relatively uniform emission control strategy for designing the different categories of engines, this should not suggest that EPA expects a single combination of technologies will be used by all manufacturers. In fact, depending on basic engine emission characteristics, EPA expects that control technology packages will gradually be fine-tuned to different applications. Furthermore, EPA expects manufacturers to use averaging, banking, and trading programs as a means to deploy varying degrees of emission control technologies on different engines. EPA nevertheless believes that the projections presented here provide a cost estimate representative of the different approaches manufacturers may ultimately take.

2. Engine Costs

The projected costs of these new technologies for meeting the proposed standards are itemized in the Draft RIA and summarized in Table 8. For the proposed Tier 1 standards for engines rated under 37 kW, estimated costs vary widely. Those engines that already operate with emissions low enough to meet the proposed Tier 1 standards would bear costs only for closing the crankcase and certifying the engine, or about $20 per engine. For the remaining one-third of engines expected to need reduced emissions, adding engine modifications leads to total costs of around $70. The anticipated increase in operating costs would similarly be focused on the minority of engines that need design improvements, totaling about $220 in net present value (npv) over the lifetime of those engines. The calculated sales-weighted composite increase in both the purchase price and the operating costs for all engines rated under 37 kW is $75 or less.

TABLE 8.—PROJECTED UNIT COSTS—ENGINES

Cost category	Year of production	Power (kW) 0–37	37–75	75–130	130–450	450–560	560+
Tier 1							
Incremental purchase price	1	$53					
Life-cycle Operating costs (npv)	all	73					
Tier 2							
Incremental purchase price	1	28	180	321	328	916	1214
Life-cycle Operating costs (npv)	all	0	0	0	0	0	0
Tier 3							
Incremental purchase price	1		322	424	436	1645	
	6		111	177	194	291	
Life-cycle Operating costs (npv)	all		89	103	125	180	

Tier 2 standards, which apply to to the full range of power ratings, involve higher estimated cost impacts. The set of technologies anticipated for Tier 2 engines, including engine modifications, improved fuel injection and some use of electronic controls, are not expected to cause any increase in operating costs, as described in the Draft RIA. The price of engines rated under 450 kW is expected to increase by up to $330, while engines rated over 450 kW may see price increases approaching or exceeding $1,000. The projected cost of compliance with Tier 3 standards entails increases from Tier 2 costs that follow a similar pattern to the increases for Tier 2 standards, though the proposed Tier 3 standards apply only to engines rated between 37 and 560 kW.

Characterizing these estimated costs in the context of their fraction of the total purchase price and life-cycle operating costs is helpful in gauging the economic impact of the proposed standards. ICF conducted a study to characterize the range of current engine costs.[40] Although the incremental cost projections in Table 8 increase dramatically with increasing power rating, they in fact represent a comparable price change relative to the total price of the engine. The estimated cost increases for all engines are between 2 and 10 percent of estimated engine prices (after typical discounts and rebates). Moreover, the cost savings

[40] ''Engine Price (On-Highway and Nonroad) & Life-cycle Cost Methodology,'' memorandum from Thomas Uden, ICF, Inc. to Alan Stout, U.S. EPA, March 21, 1997 (available in Air Docket A–96–40).

described below would further reduce the impact of the proposed emission standards; long-term cost increases are expected to be 4 percent of total engine price or less.

Another way of evaluating the variation of compliance costs with increasing power rating is to compare the ratio of projected cost to rated power (in kilowatts). For the Tier 2 standards, engines rated under 130 kW all have cost-per-kilowatt ratios near 3.5, while the ratios for larger engines is around 1.5. This shows again that the apparently high projected compliance costs for the largest engines, upon closer analysis, are consistent with their greater size and price.

For the long term, EPA has identified two principal factors that would cause the estimated incremental costs to decrease over time. First, since fixed costs are assumed to be recovered over a fixed period, these costs disappear from the analysis after they have been fully recovered. This has a most striking effect on the projected costs for engines rated over 450 kW, for which the much higher projected costs are dominated by fixed costs. Second, the analysis incorporates the expectation that manufacturers will apply ongoing research to making emission controls more effective and less costly over time. 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.[41] The analysis 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 and by reducing variable costs again by 20 percent starting with the sixth year of production. Table 8 lists the projected costs for each category of vehicle over time, including the set of numbers that illustrate the projected reduction in long-term costs for Tier 3 engines.

3. Equipment Costs

In addition to the costs directly associated with engines that are redesigned to meet new standards, costs may also result from the need to redesign the nonroad equipment in which these engines are used. Such redesigns, though not generally technologically challenging, could occur if the engine has a different shape or heat rejection rate, or is no longer made available in the configuration previously used. Based on their experience with the Tier 1 standards set in 1994, equipment manufacturers have told EPA that the main barrier to accommodating complying engines is the late delivery of such engines by engine manufacturers, which cuts into the lead time that equipment manufacturers need to properly redesign their equipment. Thus, attempts were made in the developing this proposal to provide stability and predictability in the setting of standards so engine and equipment manufacturers can more easily plan their product releases and can reasonably recoup the investment made to meet the standards.

In addition, the Tier 3 emission standards and implementation dates for engines rated over 37 kW and Tier 2 emission standards and implementation dates for engines rated under 37 kW are based on the premise that no significant equipment redesign beyond that required to accommodate engines meeting the previous tier of standards will be required to accommodate the new engines. Equipment manufacturers may, of course, choose to spread equipment redesigning over the time frame for both first and second tiers of standards. This analysis accounts for this flexibility by projecting one major redesign for each equipment model, spreading the costs of these redesigns over both tiers of standards. For each tier of standards, EPA projects that equipment manufacturers will have sufficient opportunity to accommodate complying engines and to market their product. EPA will consider the potential for multiple design changes to equipment models during the 2001 Feasibility Review.

In assessing the economic impact of the proposed emissions standards, EPA has made a best estimate of the modifications to equipment that relate to packaging (installing engines in equipment engine compartments), power train (torque curve), and heat rejection effects of the new complying engines. The incremental purchase price for new engines is comprised of fixed costs (for R&D and retooling) and variable costs (for hardware and assembly time for a small percentage of the equipment). In its analysis, EPA attributes all increases in operating costs (i.e., expected increases in maintenance or fuel consumption) to incremental engine costs, and thus, equipment costs do not include operating costs. As described in the engine cost section above, after a new standard takes effect, projected costs in subsequent years would be reduced by several factors. Separate projected costs were determined for equipment in the same ranges of power ratings used for engine costs. Full details of EPA's equipment cost analysis can be found in Chapter 4 of the Draft RIA.

a. Projected Equipment Changes: Key measures being taken by engine manufacturers to meet the Tier 1 standards set in 1994 are retarding the injection timing and adding air-to-water aftercooling. EPA projected in the Tier 1 rulemaking that, though the standards may lead to some additional heat rejection, it would not add enough heat rejection to require equipment changes such as increasing the cooling capacity and cooling fan speed (i.e., change the size of radiators or cooling fan blades).[42] However, equipment manufacturers claim that such changes are occurring due to Tier 1 standards. For the most part, this additional heat rejection occurred due to the retarded injection timing, and thus some equipment manufacturers needed to increase the size of their radiators to accommodate these Tier 1 engines. Some equipment manufacturers also increased the engine fan speed for additional airflow and cooling (increasing engine fan size can increase fan speed). In some cases, equipment manufacturers experienced a small increase in fuel consumption. In many cases equipment manufacturers needed to alter the engine compartment to accommodate these changes as well as making room for added turbochargers and aftercoolers.

A small percentage of equipment is projected to have modifications to the radiator and the engine fan to compensate for some additional heat rejection resulting from the proposed emission standards. Equipment with direct injection engines rated under 37 kW (about one third of the equipment in that size range) are expected to meet the proposed standards through retarded injection timing, which is expected to lead to some additional heat rejection. Some equipment/engines introducing or improving air-to-water aftercooling may still require more heat rejection and thus a somewhat larger radiator and fan, because the engine coolant would be routed (and thus heated up) through both the radiator and the aftercooler. Many equipment manufacturers are expected to install engines using air-to-

[41] ''Learning Curves in Manufacturing,'' Linda Argote and Dennis Epple, Science, February 23, 1990, Vol. 247, pp. 920–924 (available in Air Docket A–96–40).

[42] U.S. EPA, Final Regulatory Impact Analysis and Regulatory Support Document, ''Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts (50 Horsepower),'' May 27, 1994 (found in Air Docket A–91–24, item VI–B–1).

air aftercooling, which greatly reduces the heat load compared with current air-to-water aftercooling models. Also, no more retarding of the timing is expected for these engines as a result of the proposed emission standards. Therefore, no increase in heat rejection and thus in the size of the radiator and engine fan is expected for equipment with air-to-air aftercooling. However, even with air-to-air aftercooling, some equipment may need a larger engine fan (increase engine fan size or speed), because there may be some reduction in the airflow out of the engine compartment due to the aftercooler. In addition, exhaust gas recirculation may lead to some additional heat load in the Tier 3 time frame.

With sufficient lead time provided, engine and equipment manufacturers are expected to have an opportunity to integrate several changes not directly related to emission control (i.e., air-to-air aftercooling). Therefore, the equipment changes are projected to be needed only to compensate for some additional heat rejection. Thus, EPA estimated that a small percentage of the equipment would have an increase in the size of their radiators and cooling fans to accommodate the new complying engines. In addition, for engine compartment modifications (engine panels, brackets, etc.), EPA estimated that, for all power ranges, a large percentage of the equipment would need additional miscellaneous steel since it is expected that many nonroad equipment models would need some additional steel in accommodating complying engines.

b. Projected Equipment Costs: The costs of the projected equipment changes due to the proposed standards are itemized in the Draft RIA and summarized in Table 9. The effort for the R&D and tooling was estimated for modifying equipment in all the above power categories based on those changes needed to accommodate the engine technology modifications described earlier in this preamble. In addition, variable costs for engine compartment, radiator, and engine fan changes as described in the above section were added for all the equipment power categories. For all the power categories it was estimated that equipment manufacturers would expend significant effort to generally redesign the engine compartments of their equipment due to emissions control and its related effects.

TABLE 9.—PROJECTED UNIT COSTS

Tier	Power (kW)					
	0–37	37–75	75–130	130-450	450-560	560+
Tier 1:						
Equipment	$12					
Total Engine and Equipment	65					
Tier 2:						
Equipment	5	55	137	118	159	136
Total Engine and Equipment	33	235	458	446	1,075	1,350
Tier 3 short-term:						
Equipment		18	46	39	53	
Total Engine and Equipment		340	470	475	1,698	
Tier 3 long-term:						
Equipment		1	2	4	4	
Total Engine and Equipment		112	179	198	295	

For the proposed Tier 1 standards that apply to equipment with engines rated under 37 kW, the estimated composite cost increase is $12 per piece of equipment. As described in the Engine Cost section, this cost estimate is based on the determination that a large percentage of the engines for this range of equipment already operate with emissions low enough to meet the Tier 1 standards.

For Tier 2 standards, the low engine costs for equipment rated under 75 kW reflect the relatively high sales volume of this range even though most of the equipment would need relatively more effort for accommodating complying engines versus equipment with engines rated over 75 kW. The highest projected cost of $159 for equipment utilizing engines rated between 450 and 560 kW demonstrates that high per-equipment piece costs are due to amortizing large fixed costs over small sales volumes even though most of the equipment in this large power range would require relatively less effort in accommodating complying engines. Also, the higher projected cost of $137 for equipment with engines rated between 75 and 130 kW results from amortizing slightly lower fixed costs compared to ratings under 75 kW over a much smaller sales volume.

The projected incremental cost of complying with Tier 3 standards are lower than that for Tier 2 standards, because EPA expects most of the significant changes to equipment designs would occur for Tier 2 standards (the previous or first set of standards). For Tier 3 standards, equipment with engines rated between 37 and 560 kW are expected to have incremental costs ranging from $18 to $53. In addition, EPA estimated that, for equipment with engines rated under 37 kW, the incremental cost of Tier 2 standards is only $5.

As discussed in the Engine Cost section, characterizing both these estimated incremental equipment and engine costs in the context of their fraction of the total equipment purchase price is useful for evaluating the economic impact of the proposed standards. EPA collected quoted retail (list) prices on several equipment pieces to characterize the range of current equipment prices. The combined incremental costs estimated for equipment and engines together for all power ranges are mostly under 2 percent of list prices with the exception of a few low power rated equipment (e.g., a 3 kW centrifugal pump), which may have relatively low sales prices and thus estimated incremental costs that are up to 4 percent of list prices.

Furthermore, as described above in the Engine Cost section, the cost savings below would further reduce the projected cost of the proposed standards. For the long term, EPA has identified two principal factors that would cause the estimated incremental costs to decrease over time. First, since fixed costs are assumed to be recovered over a ten-year period, these costs disappear from the analysis after the first ten model years. Second, as described further in the Engine Cost section, the analysis incorporates the effects of a learning curve by projecting that the variable costs of making equipment changes to accommodate low-emitting engines decreases by 20 percent starting with the third year of production and by reducing variable costs again by 20 percent starting with the sixth year of production. Table 9 shows the schedule of projected equipment costs for each category of equipment over time, and it also presents the combined costs estimated for equipment and engines together. (The combined engine and equipment costs presented in Table 9 do not include increased operating costs.)

4. Aggregate Costs to Society

The above analysis develops unit cost estimates for each power category. With current data for equipment sales for each category and projections for the future, these costs can be translated into a total projected cost to the nation for the proposed emission standards in any year. Increased purchase prices and operating costs lead to aggregate costs of about $3 million in the first year, increasing to a peak of $320 million in 2008 as increasing numbers of engines become subject to the proposed standards. The following years show declining aggregate costs as the per-unit cost of compliance decreases, as described above, to a low point of about $190 million in 2014. After 2014, stable engine costs applied to a slowly growing market lead to slowly increasing aggregate costs.

Commenters on the Supplemental ANPRM suggested that new nonroad diesel engine standards would negatively impact other entities such as equipment distributors/dealers, ultimate purchasers (e.g., farmers, construction contractors, loggers), and suppliers of parts and services for engines and equipment. In the segment of the economy involving nonroad diesel engines and equipment, distributors/dealers and purchasers are downstream of engine and equipment manufacturers, and suppliers of parts and services are upstream. EPA recognizes that there may be some potential impact on these entities from the proposed rule. For example, as some commenters suggested, were a sudden large increase in equipment prices to occur, it might result in a slowing of purchases of new equipment, possibly causing upstream suppliers or downstream dealers to lose business. As described in Section IV.B.3., EPA estimates that the combined incremental costs for equipment and engines together for all power ranges would generally be under 2 percent of the list prices of equipment. Considering that price changes are already a common occurrence in this market, EPA believes the impacts will be minimal. Also, such small cost increments, together with the complexity of this market, make it extremely difficult to quantitatively analyze the impacts on entities upstream and downstream of engine and equipment makers. Therefore, EPA included in the cost analysis only those entities that are expected to be directly impacted by the proposed rule.

C. Cost-Effectiveness

EPA has estimated the cost-effectiveness (i.e., the cost per ton of emission reduction) of the proposed Tier 1, Tier 2 and Tier 3 standards for the same power categories of nonroad equipment highlighted earlier in this section. Chapter 6 of the Draft RIA contains a more detailed discussion of the cost-effectiveness analysis. EPA requests comments on all aspects of the cost-effectiveness analysis.

As described above in the Economic Impacts section, the projected cost of complying with the proposed standards will vary by power category and model year. Therefore, the cost-effectiveness will also vary from model year to model year. For comparison purposes, the discounted lifetime costs (including increased engine costs, equipment costs and operating costs), emission reductions (in short tons), and cost-effectiveness of the proposed NMHC + NO_X standards are shown in Table 10 for the same model years discussed above in the Economic Impacts section. EPA believes this is a conservative estimate because EPA assumed that all of the increased costs presented earlier were attributable to NMHC+NO_X control and none of the costs were attributed to PM control. NO_X reductions represent approximately 90 percent of the total NMHC+NO_X emission reductions expected from the proposed standards.

TABLE 10.—COST-EFFECTIVENESS OF THE PROPOSED NMHC+NO_X STANDARDS

Standard	Power (kW)	Year of production	Discounted lifetime cost	Discounted lifetime NMHC+NO_X reductions (tons)	Discounted lifetime cost-effectiveness (per ton)
Tier 1 ...	0–37	1	$138	0.32	$440
Tier 2 ...	0–37	1	33	0.04	790
	....	6	15	....	360
	37–75	1	235	0.59	400
	75–130	1	458	1.19	390
	130–450	1	446	2.11	210
	450–560	1	1,075	8.11	130
	560	1	1,350	11.44	120
	....	6	207	....	20
Tier 3 ...	37–75	1	430	0.62	700
		6	217	....	350
	75–130	1	573	0.94	610
		6	325	....	350
	130–450	1	601	1.71	350
		6	356	....	210
	450–560	1	1,878	6.08	310
		6	522	....	90

Weighting the projected cost and emission benefit numbers presented above by the populations of the individual power categories, EPA calculated the cost-effectiveness of the proposed NMHC + NO_X standards for the entire nonroad diesel engine fleet. Table 11 contains the resulting fleet-wide cost-effectiveness results for the Tier 2 and Tier 3 standards.

TABLE 11.—FLEET-WIDE COST-EFFECTIVENESS OF THE PROPOSED NONROAD NMHC + NO_X Standards

Standard	Discounted lifetime cost-effectiveness
Tier 2	$300/ton.
Tier 3—Short term	$400/ton.
Tier 3—Long term	$180/ton.

For comparison to other PM control strategies, EPA has also analyzed the cost-effectiveness of the proposed standards assuming half of the increased costs were attributable to PM control. Such a fleet-wide discounted lifetime cost-effectiveness represents the highest figure that could be expected for cost-effectiveness of the proposed standards and was calculated to provide an indication of the upper bound of PM cost-effectiveness. The resulting fleet-wide discounted lifetime cost-effectiveness of the proposed Tier 1 and Tier 2 PM standards was approximately $1,500 per ton.

In an effort to evaluate the cost-effectiveness of the proposed NMHC + NO_X controls for nonroad engines, EPA has summarized the cost-effectiveness results for three other recent EPA mobile source rulemakings that required reductions in NO_X (or NMHC + NO_X) emissions. The heavy-duty vehicle portion of the Clean Fuel Fleet Vehicle Program yielded a cost-effectiveness of approximately $1,500/ton of NO_X, Phase II of the Reformulated Gasoline Program yielded approximately $5,000/ton of NO_X, and the most recent NMHC + NO_X standards for highway heavy-duty diesel engines yielded a cost-effectiveness of $100–$600/ton of NMHC + NO_X. The cost-effectiveness of the proposed NMHC + NO_X standards for nonroad diesel engines presented above are more favorable than the cost-effectiveness of both the clean fuel fleet vehicle program and reformulated gasoline. The cost-effectiveness of the proposed NMHC + NO_X standards for nonroad diesel engines is comparable to the cost-effectiveness of the most recent NMHC + NO_X standards for heavy-duty highway diesel engines.

EPA has also summarized the cost-effectiveness results for two other recent EPA mobile source rulemakings that required reductions in PM emissions. The cost-effectiveness of the most recent urban bus engine PM standard was estimated to be $10,000–$16,000/ton and the cost-effectiveness of the urban bus retrofit/rebuild program was estimated to be approximately $25,000/ton. The PM cost-effectiveness of the proposed nonroad engine standards presented above are more favorable than either of the urban bus programs.

In addition to the benefits of reducing ozone within and transported into urban ozone nonattainment areas, the NO_X reductions from the proposed nonroad engine standards are expected to have beneficial impacts with respect to crop damage, secondary particulate, acid deposition, eutrophication, visibility, and forests, as described earlier. Because of the difficulty of quantifying the monetary value of these societal benefits, the cost-effectiveness values presented do not assign any numerical value to these additional benefits. However, based on an analysis of existing studies that have estimated the value of such benefits in the past, the Agency believes that the actual monetary value of the multiple environmental and public health benefits that would be produced by large NO_X reductions similar to those projected under this proposal will likely be greater than the estimated compliance costs. EPA requests comment on including these benefits in an estimate of the cost-effectiveness of the proposed standards.

VII. Public Participation

As mentioned above, EPA issued a Supplemental ANPRM releasing the Nonroad Statement of Principles and announcing EPA's intent to formally propose regulatory action relating to nonroad diesel emissions consistent with the Statement of Principles. By the time the comment period closed, the Agency had received more than 20 communications relating to this program and the Supplemental ANPRM. Additional comments have been received as a part of the Agency's special outreach to small entities (see Section VIII.B.). These comments have been very valuable in developing this proposal, and the Agency looks forward to additional comment as the formal rulemaking process now begins. All of these comments are available in the rulemaking docket and many of them are discussed in the context of various issues in this preamble. EPA has considered each of the comments and has attempted to address them in this proposal.

A. Comments and the Public Docket

Publication of this notice opens a formal comment period for this proposal. EPA will accept comments for the period indicated under ''**DATES**'' above. The Agency encourages all parties that have an interest in the program described in this notice to offer comment on all aspects of the action. Throughout this proposal are requests for specific comment on various topics.

The most useful comments are those supported by appropriate and detailed rationales, data, and analyses. The Agency also encourages commenters that disagree with the proposed program to suggest and analyze alternate approaches to meeting the air quality goals of this proposed program. All comments, with the exception of proprietary information, should be directed to the EPA Air Docket Section, Docket No. A–96–40 before the date specified above.

Commenters who wish to submit proprietary information for consideration should clearly separate such information from other comments by: (1) Labeling proprietary information ''Confidential Business Information'' and (2) sending proprietary information directly to the contact person listed (see **FOR FURTHER INFORMATION CONTACT**) and not to the public docket. This will help ensure that proprietary information is not inadvertently placed in the docket. If a commenter wants EPA to use a submission of confidential information as part of the basis for the final rule, then a nonconfidential version of the document that summarizes the key data or information should be sent to the docket.

Information covered by a claim of confidentiality will be disclosed by EPA only to the extent allowed and in accordance with the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, it will be made available to the public without further notice to the commenter.

B. Public Hearing

The Agency will hold a public hearing as noted in the **DATES** section above. Any person desiring to present testimony at the public hearing is asked to notify the contact person listed above at least five business days prior to the date of the hearing. This notification should include an estimate of the time required for the presentation of the testimony and any need for audio/visual equipment. EPA suggests that sufficient copies of the statement or material to be presented be available to the audience. In addition, it is helpful if the contact person receives a copy of the testimony or material prior to the hearing.

The hearing will be conducted informally, and technical rules of evidence will not apply. A sign-up sheet will be available at the hearing for scheduling the order of testimony. A written transcript of the hearing will be prepared. The official record of the hearing will be kept open for 30 days after the hearing to allow submittal of supplementary information.

VIII. Administrative Requirements

A. Administrative Designation and Regulatory Analysis

Under Executive Order 12866, the Agency must determine whether this regulatory action is ''significant'' and therefore subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order (58 FR 51735, Oct. 4, 1993). The order defines ''significant regulatory action'' as any regulatory action that is likely to result in a rule that may:

(1) 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;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or,

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, EPA has determined that this proposal is a ''significant regulatory action'' because the proposed standards and other regulatory provisions, if implemented, would have an annual effect on the economy in excess of $100 million. A Draft RIA has been prepared and is available in the docket associated with this rulemaking. This action was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12866. Any written comments from OMB and any EPA response to OMB comments are in the public docket for this proposal.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act was amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Public Law 104–121, to ensure that concerns regarding small entities are adequately considered during the development of new regulations that affect them. In response to the provisions of this statute, EPA has identified industries subject to this proposed rule and has provided information to and received comment from small entities and representatives of small entities in these industries. The Agency has also convened a panel under section 609(b) of the Regulatory Flexibility Act as added by SBREFA. The purpose of the Panel is to collect the advice and recommendations of representatives of small entities that will be affected by the rule and to report on those comments and the Panel's findings as to issues related to the key elements of an initial regulatory flexibility analysis under section 603 of the Regulatory Flexibility Act. Those elements of an initial regulatory flexibility analysis are:

- The number of small entities to which the proposed rule will apply.
- Projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including the classes of small entities which will be subject to the requirements and the type of professional skills necessary for preparation of the report or record.
- Other relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule.
- Any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the proposed rule on small entities.

Once completed, the Panel report is provided to the Agency issuing the proposed rule and included in the rulemaking record. In light of the Panel report, the Agency is to make changes to the proposed rule or the initial regulatory flexibility analysis for the proposed rule, where appropriate.

EPA has prepared an initial regulatory flexibility analysis to analyze the economic impacts of this proposed rule on small companies; the initial regulatory flexibility analysis is found in Chapter 4 of the Draft RIA. EPA's outreach to small entities and EPA's responses to the recommendations of the Panel are described in the initial regulatory flexibility analysis and summarized below. The Agency continues to be interested in the potential impacts of the proposed rule on small entities and welcomes additional comments during the rulemaking process on issues related to such impacts.

1. Applicable Small Businesses

The initial regulatory flexibility analysis analyzes four separate but related industries that will be subject to this proposed rule and that contain small businesses as defined by regulations of the Small Business Administration (SBA): nonroad diesel engine manufacturing, manufacturing of nonroad diesel equipment, post-manufacture marinizing of diesel engines, and the rebuilding or remanufacturing of diesel nonroad engines. According to SBA's regulations (13 CFR 121), businesses with no more than the following numbers of employees or dollars of annual receipts are considered ''small entities'' for purposes of a regulatory flexibility analysis:

- Manufacturers of engines (includes marinizers)—1000 employees.
- Equipment manufacturers
- Manufacturers of construction equipment—750 employees.
- Manufacturers of industrial trucks (forklifts)—750 employees.
- Manufacturers of other nonroad equipment—500 employees.
- Rebuilders/Remanufacturers of engines—$5 million.

2. Small Business Economic Impact Analysis

The initial regulatory flexibility analysis evaluates in detail the financial impacts of the proposed standards on small manufacturers of nonroad diesel equipment. Along with small manufacturers of equipment, the potential impacts on small manufacturers of diesel engines, small marinizers, and small engine rebuilders/remanufacturers were assessed as part of the SBREFA Panel process as discussed below; however, a detailed economic analysis was conducted only for equipment manufacturers, for the following reasons. There is only one small manufacturer of diesel engines affected by the proposed rule that meets the Small Business Administration's (SBA) small business criteria, and this small engine manufacturer would have impacts from the proposal that are similar to those impacts experienced by large nonroad engine manufacturers, which are described in Section VI.B. of this proposal. Marinizers are expected to experience impacts similar to those of nonroad equipment manufacturers since changes made by the original engine manufacturers might require changes in the parts and process involved in marinization. Engine rebuilders/remanufacturers would not be economically impacted by this proposed rule since as described in Section III.C. of this proposal, the proposed provisions for these entities would not require a change to their current practices.

As described in Section IV.B.4., commenters on the Supplemental ANPRM suggested that new nonroad diesel engine standards would negatively impact other small entities such as equipment distributors/dealers, ultimate purchasers, and suppliers of parts and services for engines and equipment. EPA recognizes that these downstream and upstream small entities may be adversely impacted by the proposed rule. However, for the reasons described in Section IV.B.4., EPA included in the cost analysis and the initial regulatory flexibility analysis only those entities that are expected to be directly impacted by the proposed rule. EPA asks for comments on the potential impacts of the proposed rule on any downstream and upstream small entities, with supporting data or methodologies to assist in analyzing these impacts whenever possible.

The initial regulatory flexibility analysis applies an economic measure known as the ''sales test'' to evaluate the economic impact of the proposed standards on small manufacturers of nonroad diesel equipment. The sales test involves calculation of annualized compliance costs as a function of sales revenue. According to the sales test results in the initial regulatory flexibility analysis, an estimated 9 percent of small equipment manufacturers would be economically impacted by greater than 1 percent by the proposed rule. Also, an estimated 5 percent of small equipment manufacturers would experience an impact greater than 3 percent.

As described in Section III.E. of this proposal, this proposed rule includes flexibility provisions for equipment manufacturers (both large and small manufacturers). As shown in the initial regulatory flexibility analysis, the flexibility provisions should reduce any economic impacts of the proposed regulations on small equipment manufacturers. However, the effects of the provisions are likely conservatively estimated because the hardship relief provisions described in Section III.E. were not included in the analysis. EPA considers the flexibility provisions to be a significant regulatory alternative since they meet the Agency's air quality objectives while minimizing significant economic impacts on small equipment manufacturers.

3. SBREFA Panel and Other Regulatory Alternatives

Consistent with SBREFA, EPA convened a Small Business Advocacy Review Panel on March 25, 1997 to collect the advice and recommendations of representatives of small entities that may be affected by the proposed rule and to report on those comments. The Panel, consisting of representatives of the Small Business Administration, the Office of Management and Budget, and EPA, issued a report on May 23, 1997.[43]

Accordingly, during the development of this proposal, EPA and the SBREFA Panel were in contact with representatives of small nonroad diesel equipment manufacturers, small nonroad diesel engine manufacturers, small nonroad engine rebuilders/remanufacturers, and small post-manufacture engine marinizers. In its final report, the SBREFA Panel encouraged EPA to continue to seek information and conduct analysis relating the number of small entities potentially affected by this proposed rule. The Panel also encouraged EPA to consider the potential overlap with Occupational Safety and Health Administration (OSHA) regulations related to ambient CO levels and to design the rule to minimize the need for record keeping and reporting. The Agency requests additional information, comments, and suggestions on the number of small entities and the potential overlap with OSHA CO limits in response to this proposal. Proposed measures to minimize record keeping and reporting are discussed in Section III.E. of this proposal.

In addition, the Panel believed that a set of five alternatives to the provisions outlined in the Supplemental ANPRM, considered as an integrated package, would provide significant flexibility and burden reduction for small entities subject to the proposed rule. The Panel believed that EPA should consider conducting further analysis on these five alternatives and proposing or soliciting comment on them in this proposal. It is important to note that the Panel's findings are based on the information available at the time the Panel report was drafted. The Panel makes its report at an early stage of the process of promulgating a rule and its report should be considered in that light.

EPA is proposing or soliciting comment in this proposal on the five regulatory alternatives, based on EPA's analysis and agreement with the Panel's findings (see Section III.E.). These alternatives meet the Agency's air quality objectives while maximizing the compliance flexibility for small manufacturers of nonroad equipment and small marinizers. A more detailed discussion on EPA's outreach and these significant regulatory alternatives is provided in the initial regulatory flexibility analysis (found in Chapter 4 of the Draft RIA) and in Section III.E. of this proposal.

[43] ''Final Report of the SBREFA Small Business Advocacy Review Panel for Control of Emissions of Air Pollution from Nonroad Diesel Engines'', May 23, 1997 (available in Air Docket A–96–40).

C. Paperwork Reduction Act

The information collection requirements in this proposed 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.* A copy of any of the submitted Information Collection Requests (ICR) documents may be obtained from Sandy Farmer, Regulatory Information Division, U.S. Environmental Protection Agency (2136); 401 M St., S.W.; Washington, DC 20460 or by calling (202) 260–2740. The following ICR documents have been prepared by EPA:

EPA ICR #	Title
0011.09	Selective Enforcement Auditing and recordkeeping requirements for on-highway HDE, nonroad compression ignition engines, and on-highway light-duty vehicles and light duty trucks.
0095.10	Pre-certification and testing exemption reporting and recordkeeping requirements.
0282.10	Emission Defect Information and Voluntary Emission recall reports.
1684.04	Compression ignition non-road engine certification application.
1695.03	Amendment to the Information Collection Request Emission Standards for New Nonroad Spark-Ignition Engines.
1826.01	Information Collection for Equipment Manufacturer Flexibility.

The Agency proposes to collect information related to certification results, durability, maintenance, and averaging, banking and trading. This information will be used to ensure compliance with and enforce the provisions in this rule. Section 208(a) of the Clean Air Act requires that manufacturers provide information the Administrator may reasonably require to determine compliance with the regulations; submission of the information is therefore mandatory. EPA will consider confidential all information meeting the requirements of § 208(c) of the Clean Air Act.

These collections of information have an estimated annual burden averaging 3100 hours annually for a typical engine manufacturer. The estimated likely respondents is 58 with annual operational and maintenance costs of $195,000. However, the hours and annual cost of information collection activities by a given manufacturer depends on manufacturer-specific variables, such as the number of engine families, production changes, emissions defects, and so forth. 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; and transmit or otherwise disclose the information.

An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR chapter 15.

Comments are requested on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques. Send comments on the ICR to the Director, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2136); 401 M St., S.W.; Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., N.W., Washington, DC 20503, marked ''Attention: Desk Officer for EPA.'' Include the ICR number in any correspondence. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after publication in the **Federal Register**, a comment to OMB is best assured of having its full effect if OMB receives it within 30 days after publication in the **Federal Register**. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

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 for 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 proposed rule contains no federal mandates (under the regulatory provisions of Title II of the UMRA) for state, local, or tribal governments. The rule imposes no enforceable duties on any of these governmental entities. Nothing in the proposed program would significantly or uniquely affect small governments. EPA has determined that this rule contains federal mandates that may result in expenditures of $100 million or more in any one year for the private sector. EPA believes that the proposed program represents the least costly, most cost-effective approach to achieving the air quality goals of the proposed rule. The cost-benefit analysis required by UMRA is contained in the RIA. The reader is directed to Section VIII.A. above, Administrative Designation and Regulatory Analysis, for further information regarding these analyses.

IX. Statutory Authority

In accordance with section 213(a) of the Clean Air Act, 42 U.S.C. 7547(a), EPA conducted a study of emissions from nonroad engines, vehicles, and equipment in 1991. Based on the results of that study, EPA determined that emissions of NO_X, VOCs (including HC), and CO from nonroad engines and equipment contribute significantly to ozone and CO concentrations in more than one nonattainment area (see 59 FR 31306, June 17, 1994). Given this determination, section 213(a)(3) of the Act requires EPA to promulgate (and from time to time revise) emissions standards for those classes or categories of new nonroad engines, vehicles, and equipment that in EPA's judgment cause or contribute to such air pollution. EPA has determined that the engines that would be regulated under this proposal ''cause or contribute'' to such air pollution. (See the June 1994 final rule and Section II.A.3. above).

Where EPA determines that other emissions from new nonroad engines, vehicles, or equipment significantly contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, section 213(a)(4) authorizes EPA to establish (and from time to time revise) emission standards from those classes or categories of new nonroad engines, vehicles, and equipment that EPA determines cause or contribute to such air pollution. In the June 1994 final rule, EPA made this determination for missions of PM and smoke from nonroad engines in general and for CI nonroad engines rated over 37 kW. With this document, EPA is making the same findings for nonroad diesel engines rated under 37 kW. (See Section II.A.3. above).

List of Subjects

40 CFR Part 9

Reporting and recordkeeping requirements.

40 CFR Part 86

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

40 CFR Part 89

Environmental protection, Administrative practice and procedure, Air pollution control, Diesel fuel, Motor vehicles, Motor vehicle pollution, Reporting and recordkeeping requirements, Research.

Dated: August 29, 1997.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40, chapter I, parts 9, 86, and 89 of the Code of Federal Regulations are proposed to be amended as set forth below.

PART 9—[AMENDED]

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

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

2. Section 9.1 is amended in the table by removing the center heading ''Control of Emissions From New and In-Use Nonroad Engines'' and the entries under that center heading and adding a new center heading and entries in numerical order to read as follows:

§ 9.1 OMB approvals under the Paperwork Reduction Act.

* * * * *

40 CFR citation	OMB control No.
* * * * *	
Control of Emissions From New and In-Use Compression-Ignition Nonroad Engines	
89.1	2060–0124
89.2	2060–0124
89.114–89.120	2060–0104
89.122–89.127	2060–0104
89.129	2060–0104
89.203–89.207	2060–0104
89.209—89.211	2060–0104
89.304–89.331	2060–0104
89.404–89.424	2060–0104
89.505–89.510	2060–0064
89.511–89.512	2060–0064
89.603–89.605	2060–0095
89.607–89.610	2060–0095
89.611	2060–0007 2060–0095
89.612	2060–0095
89.801–89.803	2060–0048
89.903	2060–0124
89.905–89.911	2060–0007
* * * * *	

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

3. The heading of part 86 is revised as set forth above.

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

Authority: 42 U.S.C. 7401–7671q.

5. Section 86.884–8 as amended at 62 FR 47122 effective January 5, 1998, is amended by revising the table in paragraph (c)(4) to read as follows:

§ 86.884–8 Dynamometer and engine equipment.

* * * * *

(c) * * *

(4) * * *

Maximum rated horsepower	Exhaust pipe diameter (inches)
HP≤50	1.5
50≤HP<100	2.0
100≤HP<200	3.0
200≤HP<300	4.0
300≤HP<500	5.0
HP≥500	6.0

* * * * *

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

6. The heading of part 89 is revised as set forth above.

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

Authority: Sections 202, 203, 204, 205, 206, 207, 208, 209, 213, 215, 216, and 301(a) of the Clean Air Act, as amended (42 U.S.C. 7521, 7522, 7523, 7524, 7525, 7541, 7542, 7543, 7547, 7549, 7550, and 7601(a)).

8. The following sections are redesignated as set forth in the following table:

Old designation	New designation
89.101–96	89.101
89.102–96	89.102
89.103–96	89.103
89.104–96	89.104
89.105–96	89.105
89.106–96	89.106
89.107–96	89.107
89.108–96	89.108
89.109–96	89.109
89.110–96	89.110
89.111–96	89.111
89.112–96	89.112
89.113–96	89.113
89.114–96	89.114
89.115–96	89.115
89.116–96	89.116
89.117–96	89.117
89.118–96	89.118
89.119–96	89.119
89.120–96	89.120
89.121–96	89.121
89.122–96	89.122
89.123–96	89.123
89.124–96	89.124
89.125–96	89.125
89.126–96	89.126
89.127–96	89.127
89.128–96	89.128
89.129–96	89.129
89.201–96	89.201
89.202–96	89.202
89.203–96	89.203
89.204–96	89.204
89.205–96	89.205
89.206–96	89.206
89.207–96	89.207
89.208–96	89.208
89.209–96	89.209
89.210–96	89.210
89.211–96	89.211
89.212–96	89.212
89.301–96	89.301
89.302–96	89.302
89.303–96	89.303
89.304–96	89.304
89.305–96	89.305
89.306–96	89.306
89.307–96	89.307
89.308–96	89.308
89.309–96	89.309
89.310–96	89.310
89.311–96	89.311
89.312–96	89.312
89.313–96	89.313
89.314–96	89.314
89.315–96	89.315
89.316–96	89.316
89.317–96	89.317
89.318–96	89.318
89.319–96	89.319
89.320–96	89.320
89.321–96	89.321
89.322–96	89.322
89.323–96	89.323
89.324–96	89.324
89.325–96	89.325
89.326–96	89.326
89.327–96	89.327
89.328–96	89.328
89.329–96	89.329
89.330–96	89.330
89.331–96	89.331
89.401–96	89.401
89.402–96	89.402
89.403–96	89.403
89.404–96	89.404
89.405–96	89.405
89.406–96	89.406
89.407–96	89.407
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89.411–96	89.411
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89.414–96	89.414
89.415–96	89.415
89.416–96	89.416
89.417–96	89.417
89.418–96	89.418
89.419–96	89.419
89.420–96	89.420
89.421–96	89.421
89.422–96	89.422
89.423–96	89.423
89.424–96	89.424
89.425–96	89.425
89.501–96	89.501
89.502–96	89.502
89.503–96	89.503
89.504–96	89.504
89.505–96	89.505
89.506–96	89.506
89.507–96	89.507
89.508–96	89.508
89.509–96	89.509
89.510–96	89.510
89.511–96	89.511
89.512–96	89.512

Old designation	New designation
89.513–96	89.513
89.514–96	89.514
89.515–96	89.515
89.516–96	89.516
89.601–96	89.601
89.602–96	89.602
89.603–96	89.603
89.604–96	89.604
89.605–96	89.605
89.606–96	89.606
89.607–96	89.607
89.608–96	89.608
89.609–96	89.609
89.610–96	89.610
89.611–96	89.611
89.612–96	89.612
89.613–96	89.613

9. In part 89, all internal section references are revised as indicated in the above redesignation table.

Subpart A—[Amended]

10. Section 89.1 is amended by revising paragraphs (a) and (b)(4) to read as follows:

§ 89.1 Applicability.

(a) This part applies to nonroad compression-ignition engines.

(b) * * *

(4) Engines used in marine vessels as defined in the General Provisions of the United States Code, 1 U.S.C. 3 , if those engines have a rated power at or above 37 kW.

11. Section 89.2 is amended by adding new definitions in alphabetical order to read as follows:

§ 89.2 Definitions.

* * * * *

Auxiliary marine diesel engine means a marine diesel engine that is not a propulsion marine diesel engine.

Blue Sky Series engine means a low-emitting nonroad engine meeting the requirements of § 89.112(f).

* * * * *

Compression-ignition engine means an engine with operating characteristics significantly similar to the theoretical Diesel combustion cycle. The non-use of a throttle during normal operation is indicative of a compression-ignition engine.

Constant-speed engine means an engine that is governed to operate only at rated speed.

Crankcase emissions means airborne substances emitted to the atmosphere from any portion of the engine crankcase ventilation or lubrication systems.

* * * * *

Farm equipment or vehicle has the meaning contained in 40 CFR part 85, subpart Q.

Full load governed speed is the maximum full load speed as specified by the manufacturer in the sales and service literature and certification application. This speed is the highest engine speed with an advertised power greater than zero.

* * * * *

Intermediate speed means peak torque speed if peak torque speed occurs from 60 to 75 percent of rated speed. If peak torque speed is less than 60 percent of rated speed, intermediate speed means 60 percent of rated speed. If peak torque speed is greater than 75 percent of rated speed, intermediate speed means 75 percent of rated speed.

* * * * *

Marine diesel engine means a compression-ignition engine that is intended to be installed on a vessel.

* * * * *

Post-manufacture marinizer means a person who produces a marine diesel engine by substantially modifying a certified or uncertified complete or partially complete engine; and is not controlled by the manufacturer of the base engine or by an entity that also controls the manufacturer of the base engine. For the purpose of this definition, ‘‘substantially modify’’ means changing an engine in a way that could change engine emission characteristics.

* * * * *

Propulsion marine diesel engine means a marine diesel engine that is intended to move a vessel through the water or direct the movement of a vessel.

Rated speed is the maximum full load governed speed for governed engines and the speed of maximum horsepower for ungoverned engines.

Specific emissions means emissions expressed on the basis of observed brake power, using units of g/kW-hr. Observed brake power measurement includes accessories on the engine if these accessories are required for running an emission test (except for the cooling fan). When it is not possible to test the engine in the gross conditions, for example, if the engine and transmission form a single integral unit, the engine may be tested in the net condition. Power corrections from net to gross conditions will be allowed with prior approval of the Administrator.

* * * * *

Tier 1 engine means an engine subject to the Tier 1 emission standards listed in § 89.112(a).

Tier 2 engine means an engine subject to the Tier 2 emission standards listed in § 89.112(a).

Tier 3 engine means an engine subject to the Tier 3 emission standards listed in § 89.112(a).

* * * * *

U.S.-directed production volume means the number of nonroad equipment or vehicles units produced by a manufacturer for which the manufacturer has reasonable assurance that sale was or will be made to ultimate purchasers in the United States.

* * * * *

Vessel has the meaning given to it in 1 U.S.C. 3.

12. Section 89.3 is amended by adding new acronyms in alphabetical order to read as follows:

§ 89.3 Acronyms and abbreviations.

* * * * *

EGR Exhaust gas recirculation

* * * * *

NMHC Nonmethane hydrocarbon

* * * * *

PM Particulate matter

* * * * *

§ 89.4 [Removed and reserved]

13. Remove and reserve § 89.4.

14. Section 89.6 is amended in paragraph (b)(1) by removing the last entry in the table and adding a new entry in its place and in paragraph (b)(2) by adding in alpha-numeric order a new entry to the table to read as follows:

§ 89.6 Reference materials.

* * * * *

(b) * * *

(1) * * *

Document No. and name	40 CFR part 89 reference
* * *	* *
ASTM E29–93a: ‘‘Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications’’	89.120; 89.207; 89.509

(2) * * *

Document number and name	40 CFR part 89 reference
* * *	* *
SAE J1151 December 1991: ‘‘Methane Measurement Using Gas Chromatography’’	89.309

* * * * *

Subpart B—[Amended]

15. The newly designated § 89.102 is amended by revising paragraph (a) and

adding new paragraphs (c), (d), (e), (f), and (g) to read as follows:

§ 89.102 Effective dates, optional inclusion.

(a) This subpart applies to all engines described in § 89.101 with the following power rating and manufactured after the following dates:

(1) Less than 19 kW and manufactured on or after January 1, 2000;

(2) Greater than or equal to 19 kW but less than 37 kW and manufactured on or after January 1, 1999;

(3) Greater than or equal to 37 kW but less than 75 kW and manufactured on or after January 1, 1998;

(4) Greater than or equal to 75 kW but less than 130 kW and manufactured on or after January 1, 1997;

(5) Greater than or equal to 130 kW but less than 560 kW and manufactured on or after January 1, 1996;

(6) Greater than or equal to 560 kW and manufactured on or after January 1, 2000.

* * * * *

(c) Engines meeting the voluntary standards described in § 89.112(f) may be designated as Blue Sky Series engines through the 2004 model year.

(d) *Implementation flexibility for equipment and vehicle manufacturers.* Nonroad equipment and vehicle manufacturers and may take any of the otherwise prohibited actions identified in § 89.1003(a)(1) with respect to the following nonroad equipment and vehicles, subject to the requirements of paragraph (e) of this section. The following allowances apply separately to each engine power category subject to standards under § 89.112:

(1) *Percent-of-production allowances*—(i) *Farm equipment or vehicles at or above 37 kW.* For farm equipment or vehicles with engines rated at or above 37 kW, a manufacturer may take any of the actions identified in § 89.1003(a)(1) [Alternative 1: for up to 30 percent of its U.S.-directed production volume of such equipment and vehicles in the first year that Tier 2 engine standards apply to such engines, and for up to 15 percent of its U.S.-directed production volume in each of the seven years following the first year,] [Alternative 2: for a portion of its U.S.-directed production volume of such equipment and vehicles during the eight years immediately following the date on which Tier 2 engine standards first apply to engines used in such equipment and vehicles, provided that the eight-year sum of these portions in each year, as expressed as a percentage for each year, does not exceed 135, and] provided that all such equipment and vehicles or equipment must contain Tier 1 engines;

(ii) *Farm equipment or vehicles rated under 37 kW.* For farm equipment or vehicles with engines rated under 37 kW, a manufacturer may take any of the actions identified in § 89.1003(a)(1) [Alternative 1: for up to 30 percent of its U.S.-directed production volume of such equipment and vehicles in the first year that Tier 1 engine standards apply to such engines, and for up to 15 percent of its U.S.-directed production volume in each of the three [seven] years following the first year] [Alternative 2: for a portion of its U.S.-directed production volume of such equipment and vehicles during the four [eight] years immediately following the date on which Tier 1 engine standards first apply to engines used in such equipment and vehicles, provided that the four[eight]-year sum of these portions in each year, as expressed as a percentage for each year, does not exceed 75 [135]];

(iii) *Other equipment rated at or above 37 kW.* For all other nonroad equipment and vehicles with engines rated at or above 37 kW, a manufacturer may take any of the actions identified in § 89.1003(a)(1) [Alternative 1: for up to 15 percent of its U.S.-directed production volume of such equipment and vehicles in the first year that Tier 2 engine standards apply to such engines, and for up to 5 percent of its U.S.-directed production volume in each of the six years following the first year,] [Alternative 2: for a portion of its U.S.-directed production volume of such equipment and vehicles during the seven years immediately following the date on which Tier 2 engine standards first apply to engines used in such equipment and vehicles, provided that the seven-year sum of these portions in each year, as expressed as a percentage for each year, does not exceed 45, and] provided that all such equipment and vehicles or equipment must contain Tier 1 engines;

(iv) *Other equipment rated under 37 kW.* For all other nonroad equipment and vehicles with engines rated under 37 kW, a manufacturer may take any of the actions identified in § 89.1003(a)(1) [Alternative 1: for up to 15 percent of its U.S.-directed production volume of such equipment and vehicles in the first year that Tier 1 engine standards apply to such engines, and for up to 5 percent of its U.S.-directed production volume in each of the three [six] years following the first year][Alternative 2: for a portion of its U.S.-directed production volume of such equipment and vehicles during the four [seven] years immediately following the date on which Tier 1 engine standards first apply to engines used in such equipment and vehicles, provided that the four[seven]-year sum of these portions in each year, as expressed as a percentage for each year, does not exceed 30 [45]].

(2) *Small volume allowances.* A nonroad equipment or vehicle manufacturer may exceed the production percentages in paragraph (d)(1) of this section in any of the years for which these percentages apply, provided that in each regulated power category, the manufacturer's excepted equipment and vehicles in that year does not exceed 100 units[, and is limited to a single equipment or vehicle model].

Potential Alternative for Paragraph (d)(2)

(d)(2) *Small volume allowances.* A nonroad equipment or vehicle manufacturer may exceed the production percentages in paragraph (d)(1) of this section, provided that in each regulated power category, the manufacturer's total of excepted equipment and vehicles over the years in which the percent-of-production allowance applies does not exceed 100 units times the number of years in which the percent-of-production allowance applies[, and is limited to a single equipment or vehicle model].

(3) Emission credit-derived allowances. A nonroad equipment or vehicle manufacturer may exceed the allowances in paragraphs (d)(1) and (d)(2) of this section in any of the years for which these allowances apply, by retiring sufficient NMHC + NO_X and PM emission credits obtained under the provisions of subpart C of this part. Equipment or vehicles for which these emission credit-derived allowances are used shall be excluded from the determinations required in paragraph (e) of this section.

(i) The amount of emission credits, in megagrams, to be retired for each additional allowance shall be determined separately for NMHC + NO_X and for PM as follows:

Emission credits = [(Previous level)—(New level)] × (Category PR) × (UL) × (10^{-6})

Where:

Previous level = 10.5 g/kW-hr NMHC + NO_X and 0.54 g/kW-hr PM if the equipment for which the allowance is being used has an engine rated at or above 37 kW, or 16.0 g/kW-hr NMHC + NO_X and 1.2 g/kW-hr for PM if the equipment for which the allowance is being used has an engine rated under 37 kW.

New level = The emission standard that would apply to the engine used in the equipment if no allowance were to be used.

Category PR = The midpoint of the power range in § 89.112 applying to the engine used in the equipment for which the allowance is being used.

UL = The useful life for the engine family, in hours.

(ii) A nonroad equipment or vehicle manufacturer choosing to retire emission credits must submit an end-of-the-year report in accordance with the requirements of § 89.211 in each year that credits are retired.

(4) *Inclusion of previous-tier engines.* Equipment and vehicles built with previous tier or noncertified engines under the existing inventory provisions of § 89.1003(b)(4) need not be included in determining compliance with paragraphs (d)(1), (d)(2), and (d)(3) of this section, at the manufacturer's option.

(e) *Determination of compliance and recordkeeping.* The following shall apply to nonroad equipment or vehicle manufacturers who produce excepted equipment or vehicles under the provisions of paragraph (d) of this section:

(1) After each year in which excepted equipment or vehicles are produced, a determination of compliance with the requirements of paragraph (d) of this section shall be made. This determination shall be based on actual production information from the subject year and shall be made within 3 months after the availability of such information. Should any such determination reveal that a production percentage allowance (or small volume allowance where applied) for a power category has been exceeded for the subject year, the nonroad equipment or vehicle manufacturer shall adjust that category's percentage allowance and small volume allowance for the year after the subject year. The percentage allowance shall be recalculated by subtracting the excess percentage of excepted machines from the percentage allowance that would otherwise apply in the year after the subject year (from zero in the year after the final year of the allowance). The small volume allowance shall be recalculated by subtracting the excess number of excepted machines in the subject year from 100 (from zero in the year after the final year of the allowance). If both the recalculated percentage allowance and the recalculated small volume allowance for the year after the subject year is less than zero in any power category, then the manufacturer is in violation of section 203 of the Act and § 89.1003.

Potential Alternative for Paragraph (e)(1)

(e)(1) For each power category in which excepted equipment or vehicles are produced, a determination of compliance with the requirements of paragraph (d) of this section shall be made. This determination shall be made no later than December 31 of the year following the last year in which allowances apply, and shall be based on actual production information from the subject years. Should any such determination reveal that both the percentage allowance and the small volume allowance have been exceeded, then the manufacturer is in violation of section 203 of the Act and § 89.1003.

(2) A nonroad equipment or vehicle manufacturer shall keep records of all equipment and vehicles excepted under the provisions of paragraph (d) of this section, for each power category in which exceptions are taken. These records shall include equipment and engine model numbers, serial numbers, and dates of manufacture, and engine rated power. In addition, the manufacturer shall keep records sufficient to demonstrate the determinations of compliance required in paragraph (e)(1) of this section. All such records shall be kept until at least two full years after the final year in which exceptions are available for each power category.

(f) Hardship relief. Nonroad equipment and vehicle manufacturers, and post-manufacture marinizers, that qualify as small entities under 13 CFR part 121 may take any of the otherwise prohibited actions identified in § 89.1003(a)(1) beyond those allowed under paragraph (d) of this section, subject to approval by the Administrator and the following requirements:

(1) Application for relief must be submitted to the Engine Programs and Compliance Division of the EPA in writing prior to the earliest date in which the applying manufacturer would be in violation of § 89.1003.

(2) Evidence must be provided that the conditions causing the impending violation are not substantially the fault of the applying manufacturer.

(3) Evidence must be provided that the applying manufacturer may be forced to permanently close or sell its equipment-producing operation if relief is not granted.

(4) Any relief granted must begin within one year after the implementation date of the standard applying to engines being used in the equipment for which relief is requested, and may not exceed one year in duration.

(g) *Allowance for the production of engines.* Engine manufacturers may take any of the otherwise prohibited actions identified in § 89.1003(a)(1) with regard to uncertified engines or Tier 1 engines, as appropriate, if the engine manufacturer has received written assurance that the engine is required to meet the demand for engines created under paragraphs (d) and (f) of this section.

16. The newly designated § 89.104 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§ 89.104 Useful life, recall, and warranty periods.

(a) The useful life is based on the rated power and rated speed of the engine.

(1) For all engines rated under 19 kW, and for constant speed engines rated under 37 kW rated speeds greater than or equal to 3,000 rpm, the useful life is a period of 3,000 hours or five years of use, whichever first occurs.

(2) For all other engines rated at or above 19 kW and under 37 kW, the useful life is a period of 5,000 hours or seven years of use, whichever first occurs.

(3) For all engines rated at or above 37 kW, the useful life is a period of 8,000 hours of operation or ten years of use, whichever first occurs.

(b) Engines are subject to recall testing for a period based on the rated power and rated speed of the engines. However, in a recall, engines in the subject class or category would be subject to recall regardless of actual years or hours of operation.

(1) For all engines rated under 19 kW and for constant speed engines rated under 37 kW with rated speeds greater than or equal to 3,000 rpm, the engines are subject to recall testing for a period of 2,250 hours or four years of use, whichever first occurs.

(2) For all other engines rated at or above 19 kW and under 37 kW, the engines are subject to recall for a period of 3,750 hours or five years of use, whichever first occurs.

(3) For all engines rated at or above 37 kW, the engines are subject to recall for a period of 6,000 hours of operation or seven years of use, whichever first occurs.

(c) Warranties imposed by the Clean Air Act for engines rated under 19 kW are for 1,500 hours of operation or three years of use, whichever first occurs. For engines rated at or above 19 kW, warranties imposed by the Clean Air Act are for 3,000 hours of operation or five years of use, whichever first occurs.

* * * * *

17. The newly designated § 89.109 is revised to read as follows:

§ 89.109 Maintenance instructions and minimum allowable maintenance intervals.

(a) The manufacturer must furnish or cause to be furnished to the ultimate purchaser of each new nonroad engine written instructions for the maintenance needed to ensure proper functioning of the emission control system. Paragraphs (b) through (g) of this section do not apply to Tier 1 engines with rated power at or above 37 kW.

(b) Maintenance performed on equipment, engines, subsystems or components used to determine exhaust emission deterioration factors is classified as either emission-related or nonemission-related and each of these can be classified as either scheduled or unscheduled. Further, some emission-related maintenance is also classified as critical emission-related maintenance.

(c) This paragraph (c) specifies emission-related scheduled maintenance for purposes of obtaining durability data and for inclusion in maintenance instructions furnished to purchasers of new nonroad engines. The maintenance intervals specified below are minimum intervals:

(1) All emission-related scheduled maintenance for purposes of obtaining durability data must occur at the same hours of use intervals that will be specified in the manufacturer's maintenance instructions furnished to the ultimate purchaser of the engine under paragraph (a) of this section. This maintenance schedule may be updated as necessary throughout the testing of the engine, provided that no maintenance operation is deleted from the maintenance schedule after the operation has been performed on the test vehicle or engine.

(2) Any emission-related maintenance which is performed on vehicles, engines, subsystems, or components must be technologically necessary to assure in-use compliance with the emission standards. The manufacturer must submit data which demonstrate to the Administrator that all of the emission-related scheduled maintenance which is to be performed is technologically necessary. Scheduled maintenance must be approved by the Administrator prior to being performed or being included in the maintenance instructions provided to the purchasers under paragraph (a) of this section. The Administrator has determined that emission-related maintenance in addition to or at shorter intervals than those outlined in paragraphs (c)(3) and (c)(4) of this section is not technologically necessary to ensure in-use compliance and therefore will not be accepted. However, the Administrator may determine that maintenance even more restrictive (e.g., longer intervals) than that listed in paragraphs (c)(3) and (c)(4) of this section is also not technologically necessary.

(3) For nonroad compression-ignition engines, the adjustment, cleaning, repair, or replacement listed in paragraphs (c)(3)(i) through (c)(3)(iii) of this section shall occur at 1,500 hours of use and at 1,500-hour intervals thereafter.

(i) Exhaust gas recirculation system-related filters and coolers.

(ii) Positive crankcase ventilation valve.

(iii) Fuel injector tips (cleaning only).

(4) The adjustment, cleaning and repair in paragraphs (c)(4)(i) through (c)(4)(vii) of this section shall occur at 3,000 hours of use and at 3,000-hour intervals thereafter for nonroad compression-ignition engines rated under 130 kW, or at 4,500-hour intervals thereafter for nonroad compression-ignition engines rated at or above 130 kW.

(i) Fuel injectors.

(ii) Turbocharger.

(iii) Electronic engine control unit and its associated sensors and actuators.

(iv) Particulate trap or trap-oxidizer system (including related components).

(v) Exhaust gas recirculation system (including all related control valves and tubing) except as otherwise provided in paragraph (c)(3)(i) of this section.

(vi) Catalytic convertor.

(vii) Any other add-on emission-related component (i.e., a component whose sole or primary purpose is to reduce emissions or whose failure will significantly degrade emission control and whose function is not integral to the design and performance of the engine).

(5)(i) The components listed in paragraphs (c)(5)(i)(A) through (c)(5)(i)(F) of this section are currently defined as critical emission-related components.

(A) Catalytic convertor.

(B) Electronic engine control unit and its associated sensors and actuators.

(C) Exhaust gas recirculation system (including all related filters, coolers, control valves, and tubing).

(D) Positive crankcase ventilation valve.

(E) Particulate trap or trap-oxidizer system.

(F) Any other add-on emission-related component (i.e., a component whose sole or primary purpose is to reduce emissions or whose failure will significantly degrade emission control and whose function is not integral to the design and performance of the engine).

(ii) All critical emission-related scheduled maintenance must have a reasonable likelihood of being performed in-use. The manufacturer shall be required to show the reasonable likelihood of such maintenance being performed in-use. Critical emission-related scheduled maintenance items which satisfy one of the conditions defined in paragraphs (c)(5)(ii)(A) through (c)(5)(ii)(F) of this section will be accepted as having a reasonable likelihood of the maintenance item being performed in-use.

(A) Data are presented which establish for the Administrator a connection between emissions and vehicle performance such that as emissions increase due to lack of maintenance, vehicle performance will simultaneously deteriorate to a point unacceptable for typical driving.

(B) Survey data are submitted which adequately demonstrate to the Administrator that, at an 80 percent confidence level, 80 percent of such engines already have this critical maintenance item performed in-use at the recommended interval(s).

(C) A clearly displayed visible signal system approved by the Administrator is installed to alert the equipment operator that maintenance is due. A signal bearing the message ''maintenance needed'' or ''check engine,'' or a similar message approved by the Administrator, shall be actuated at the appropriate usage point or by component failure. This signal must be continuous while the engine is in operation and not be easily eliminated without performance of the required maintenance. Resetting the signal shall be a required step in the maintenance operation. The method for resetting the signal system shall be approved by the Administrator. The system must not be designed to deactivate upon the end of the useful life of the engine or thereafter.

(D) A manufacturer may desire to demonstrate through a survey that a critical maintenance item is likely to be performed without a visible signal on a maintenance item for which there is no prior in-use experience without the signal. To that end, the manufacturer may in a given model year market up to 200 randomly selected vehicles per critical emission-related maintenance item without such visible signals, and monitor the performance of the critical maintenance item by the owners to show compliance with paragraph (c)(5)(ii)(B) of this section. This option is restricted to two consecutive model years and may not be repeated until any previous survey has been completed. If the critical maintenance involves more than one engine family, the sample will be sales weighted to ensure that it is representative of all the families in question.

(E) The manufacturer provides the maintenance free of charge, and clearly informs the customer that the maintenance is free in the instructions provided under paragraph (a) of this section.

(F) Any other method which the Administrator approves as establishing a reasonable likelihood that the critical maintenance will be performed in-use.

(iii) Visible signal systems used under paragraph (c)(5)(ii)(C) of this section are considered an element of design of the emission control system. Therefore, disabling, resetting, or otherwise rendering such signals inoperative without also performing the indicated maintenance procedure is a prohibited act.

(d) Nonemission-related scheduled maintenance which is reasonable and technologically necessary (e.g., oil change, oil filter change, fuel filter change, air filter change, cooling system maintenance, adjustment of idle speed, governor, engine bolt torque, valve lash, injector lash, timing, lubrication of the exhaust manifold heat control valve, etc.) may be performed on durability vehicles at the least frequent intervals recommended by the manufacturer to the ultimate purchaser, (e.g., not the intervals recommended for severe service).

(e) Adjustment of engine idle speed on emission data engines may be performed once before the low-hour emission test point. Any other engine, emission control system, or fuel system adjustment, repair, removal, disassembly, cleaning, or replacement on emission data vehicles shall be performed only with advance approval of the Administrator.

(f) Equipment, instruments, or tools may not be used to identify malfunctioning, maladjusted, or defective engine components unless the same or equivalent equipment, instruments, or tools will be available to dealerships and other service outlets and:

(1) Are used in conjunction with scheduled maintenance on such components; or

(2) Are used subsequent to the identification of a vehicle or engine malfunction, as provided in paragraph (e) of this section for emission data engines; or

(3) Unless specifically authorized by the Administrator.

(g) All test data, maintenance reports, and required engineering reports shall be compiled and provided to the Administrator in accordance with § 89.124.

18. The newly designated § 89.110 is amended by removing ''and'' at the end of paragraph (b)(9), by adding a semicolon at the end of paragraph (b)(10), and by adding new paragraphs (b)(11) and (b)(12) to read as follows:

§ 89.110 Emission control information label.

* * * * *

(b) * * *

(11) Engines belonging to an engine family that has been certified as a constant-speed engine using the test cycle specified in Table 2 of appendix B to subpart E of this part must contain the statement on the label: ''constant-speed only'';

(12)(i) Engines meeting the voluntary standards described in § 89.112(f)(1) to be designated as Blue Sky Series engines must contain the statement on the label: ''Blue Sky—Class A''.

(ii) Engines meeting the voluntary standards described in § 89.112(f)(2) to be designated as Blue Sky Series engines must contain the statement on the label: ''Blue Sky—Class AA''.

(iii) Engines meeting the voluntary standards described in § 89.112(f)(3) to be designated as Blue Sky Series engines must contain the statement on the label: ''Blue Sky—Class AAA''.

* * * * *

19. The newly designated § 89.112 is amended by revising paragraphs (a), (b), and (d), and adding new paragraphs (e) and (f) to read as follows:

§ 89.112 Oxides of nitrogen, carbon monoxide, hydrocarbon, and particulate matter exhaust emission standards.

(a) Nonroad engines to which this subpart is applicable must meet the exhaust emission standards contained in Table 1 as follows:

TABLE 1.—EMISSION STANDARDS (G/KW-HR)

Rated brake power (kW)	Tier	Model year	NO_X	HC	NMHC+NO_X	CO	PM
kW<8	Tier 1	2000	....	....	10.5	8.0	1.0
	Tier 2	2005	....	....	7.5	8.0	0.80
8≤kW<19	Tier 1	2000	....	....	9.5	6.6	0.80
	Tier 2	2005	....	....	7.5	6.6	0.80
19≤kW<37	Tier 1	1999	....	....	9.5	5.5	0.80
	Tier 2	2004	....	....	7.5	5.5	0.60
37≤kW<75	Tier 1	1998	9.2	....	....	....	....
	Tier 2	2004	....	....	7.5	5.0	0.40
	Tier 3	2008	....	....	4.7	5.0	....
75≤kW<130	Tier 1	1997	9.2	....	....	....	....
	Tier 2	2003	....	....	6.6	5.0	0.30
	Tier 3	2007	....	....	4.0	5.0	....
130≤kW<225	Tier 1	1996	9.2	1.3	....	11.4	0.54
	Tier 2	2003	....	....	6.6	3.5	0.20
	Tier 3	2006	....	....	4.0	3.5	....
225≤kW<450	Tier 1	1996	9.2	1.3	....	11.4	0.54
	Tier 2	2001	....	....	6.4	3.5	0.20
	Tier 3	2006	....	....	4.0	3.5	....
450≤kW<560	Tier 1	1996	9.2	1.3	....	11.4	0.54
	Tier 2	2002	....	....	6.4	3.5	0.20
	Tier 3	2006	....	....	4.0	3.5	....
kW≥560	Tier 1	2000	9.2	1.3	....	11.4	0.54
	Tier 2	2006	....	....	6.4	3.5	0.20

(b) Exhaust emissions of oxides of nitrogen, carbon monoxide, hydrocarbon, and nonmethane hydrocarbon are measured using the procedures set forth in subpart E of this part.

* * * * *

(d) In lieu of the NO_X standards, NMHC + NO_X standards, and PM standards specified in paragraph (a) of this section, manufacturers may elect to include engine families in the averaging, banking, and trading program, the provisions of which are specified in subpart C of this part. The manufacturer must set a family emission limit (FEL) not to exceed the levels contained in Table 2. The FEL established by the manufacturer serves as the standard for that engine family. Table 2 follows:

TABLE 2.—UPPER LIMIT FOR FAMILY EMISSION LIMITS (G/KW-HR)

Rated brake power (kW)	Tier	Model year	NO_X FEL	NMHC+ NO_X FEL	PM FEL
kW<8	Tier 1	2000	....	16.0	1.2
	Tier 2	2005	....	10.5	1.0
8≤kW<19	Tier 1	2000	....	16.0	1.2
	Tier 2	2005	....	9.5	0.80
19≤kW<37	Tier 1	1999	....	16.0	1.2
	Tier 2	2004	....	9.5	0.80
37≤kW<75	Tier 1	1998	14.6	....	....
	Tier 2	2004	....	10.5	1.2
	Tier 3	2008	....	7.5	
75≤kW<130	Tier 1	1997	14.6	....	....
	Tier 2	2003	....	10.5	1.2
	Tier 3	2007	....	6.6	
130≤kW<225	Tier 1	1996	14.6	....	....
	Tier 2	2003	....	10.5	0.54
	Tier 3	2006	....	6.6	
225≤kW<450	Tier 1	1996	14.6	....	....
	Tier 2	2001	....	10.5	0.54
	Tier 3	2006	....	6.4	
450≤kW<560	Tier 1	1996	14.6	....	....
	Tier 2	2002	....	10.5	0.54
	Tier 3	2006	....	6.4	
kW≥560	Tier 1	2000	14.6	....	....
	Tier 2	2006	....	10.5	0.54

(e) Naturally aspirated nonroad engines to which this subpart is applicable shall not discharge crankcase emissions into the ambient atmosphere. For engines rated under 37 kW, this provision applies to all 2001 model year engines and later models. For engines rated at or above 37 kW, this provision applies to all Tier 2 engines and later models. This provision does not apply to engines using turbochargers, pumps, blowers, or superchargers for air induction.

(f) Engines may be designated ''Blue Sky Series'' engines through the 2004 model year by meeting the following voluntary standards, which apply to all certification and in-use testing. Emissions are measured using the procedures set forth in 40 CFR part 86, subpart N. Manufacturers may use an alternate procedure to demonstrate the desired level of emission control if approved in advance by the Administrator. Engines meeting the requirements to qualify as Blue Sky Series engines must be capable of maintaining a comparable level of emission control when tested using the procedures set forth in paragraph (c) of this section and subpart E of this part. The numerical emission levels measured using the procedures from this part may be up to 20 percent higher than those measured using the procedures from 40 CFR part 86, subpart N, and still be considered comparable. Engines designated as Blue Sky Series engines must meet the requirements related to in-use durability detailed in §§ 89.104, 89.109, 89.118, and 89.130; alternatively, manufacturers may fulfull these requirements with the comparable provisions from 40 CFR part 86.

(1) Engines certified to voluntary standards at least 35 percent below the numerical level established for Tier 2 engines, for both particulate matter and NMHC + NO_X, may be designated as a ''Blue Sky Series engine—Class A''. Manufacturers must also demonstrate compliance with the numerical level established for CO emissions from the applicable tier of engines, as described in paragraph (a) of this section, and with the smoke emission standards described in § 86.113 of this chapter. This designation will no longer be available beginning in the year for which Tier 2 standards apply to an engine's power category.

(2) Engines certified to voluntary standards at least 50 percent below the numerical level established for Tier 2 engines, for both particulate matter and NMHC + NO_X, may be designated as a ''Blue Sky Series engine—Class AA''. Manufacturers must also demonstrate compliance with the numerical level established for CO emissions from the applicable tier of engines, as described in paragraph (a) of this section, and with the smoke emission standards described in § 86.113 of this chapter.

(3) Engines certified to voluntary standards at least 65 percent below the numerical level established for Tier 2 engines, for both particulate matter and NMHC + NO_X, may be designated as a ''Blue Sky Series engine—Class AAA''. Manufacturers must also demonstrate compliance with the numerical level established for CO emissions from the applicable tier of engines, as described in paragraph (a) of this section, and with the smoke emission standards described in § 86.113 of this chapter.

20. The newly designated § 89.117 is amended by revising paragraph (a) and adding a new paragraph (d) to read as follows:

§ 89.117 Test fleet selection.

(a) The manufacturer must select for testing, from each engine family, the engine with the most fuel injected per stroke of an injector, primarily at the speed of maximum torque and secondarily at rated speed.

* * * * *

(d) For establishing deterioration factors, the manufacturer shall select the engines, subsystems, or components to be used to determine exhaust emission deterioration factors for each engine-family control system combination. Whether engines, subsystems, or components are used, they shall be selected so that their emission deterioration characteristics may be expected to represent those of in-use engines, based on good engineering judgment.

21. The newly designated § 89.118 is amended by adding a new paragraph (e) to read as follows:

§ 89.118 Service accumulation.

* * * * *

(e) This paragraph (e) describes service accumulation requirements for the purpose of deterioration factor development. Paragraphs (b) through (d) of this section also apply here.

(1) *Service accumulation on engines, subsystems, or components selected by the manufacturer under § 89.117(d).* The manufacturer determines the form and extent of this service accumulation, consistent with good engineering practice, and describes it in the application for certification.

(2) *Determination of exhaust emission deterioration factors.* The manufacturer determines the deterioration factors based on the service accumulation in paragraph (e)(1) of this section and related testing, according to the manufacturer's procedures.

(3) *Alternatives to service accumulation and testing for the determination of a deterioration factor.* A written explanation of the appropriateness of using an alternative must be included in the application for certification.

(i) *Carryover and carryacross of durability emission data.* In lieu of testing an emission data or durability data engine selected under § 89.117(d), and submitting data therefore, a manufacturer may, with Administrator approval, use exhaust emission deterioration data on a similar engine for which certification to the same standard has previously been obtained or for which all applicable data required under § 89.124 has previously been submitted. This data must be submitted in the application for certification.

(ii) *Use of on-highway deterioration data.* In the case where a manufacturer produces a certified on-highway engine that is similar to the nonroad engine to be certified, deterioration data from the on-highway engine may be applied to the nonroad engine. This application of deterioration data from an on-highway engine to a nonroad engine is subject to Administrator approval, and the determination of whether the engines are similar must be based on good engineering judgment.

(iii) *Engineering analysis for established technologies.* (A) In the case where an engine family uses technology which is well established, an analysis based on good engineering practices may be used in lieu of testing to determine a deterioration factor for that engine family.

(B) Engines using exhaust gas recirculation or aftertreatment are excluded from the provision set forth in paragraph (e)(3)(iii)(A) of this section.

(C) Engines for which the certification levels are not at or below the Tier 3 $NMHC+NO_X$ or PM standards described in § 89.112 are considered established technology.

(D) Manufacturers may petition the Administrator to consider an engine with a certification level below the Tier 3 $NMHC+NO_X$ and PM standards as established technology. This petition must be based on proof that the technology used is not significantly different than that used on engines that have certification levels that are not below the Tier 3 $NMHC+NO_X$ and PM levels.

(E) The manufacturer shall provide a written statement to the Administrator that all data, analyses, test procedures, evaluations, and other documents, on which the deterioration factor is based, are available to the Administrator upon request.

22. The newly designated § 89.119 is amended by revising paragraph (d) to read as follows:

§ 89.119 Emission tests.

* * * * *

(d) *Test fuels.* EPA may use the fuel specified in either Table 4 or Table 5 of Appendix A to subpart D of this part in confirmatory testing or other testing on any test engine.

23. The newly designated § 89.120 is amended by revising paragraph (c) and adding paragraph (e) to read as follows:

§ 89.120 Compliance with emission standards.

* * * * *

(c) For each nonroad engine family, except Tier 1 engines with rated power at or above 37 kW that do not employ aftertreatment, a deterioration factor must be determined and applied.

(1) The applicable exhaust emission standards (or family emission limits, as appropriate) for nonroad compression-ignition engines apply to the emissions of engines for their useful life.

(2) Since emission control efficiency generally decreases with the accumulation of service on the engine, deterioration factors will be used in combination with emission data engine test results as the basis for determining compliance with the standards.

(3)(i) This paragraph (c)(3) describes the procedure for determining compliance of an engine with emission standards (or family emission limits, as appropriate), based on deterioration factors supplied by the manufacturer. Deterioration factors shall be established using applicable emission test procedures. $NMHC + NO_X$ deterioration factors shall be established based on the sum of the pollutants. When establishing deterioration factors for $NMHC + NO_X$, a negative deterioration (emissions decrease from the official emissions test result) for one pollutant may not offset deterioration of the other pollutant. Where negative deterioration occurs for NO_X or NMHC, the official exhaust emission test result shall be used for purposes of determining the $NMHC + NO_X$ deterioration factor.

(ii) Separate exhaust emission deterioration factors, determined from tests of engines, subsystems, or components conducted by the manufacturer, shall be supplied for each engine-system combination. Separate factors shall be established for NMHC, CO, NO_X, $NMHC + NO_X$, and exhaust particulate. For smoke testing, separate factors shall also be established for the acceleration mode (designated as ''A''), the lugging mode (designated as ''B''), and peak opacity (designated as ''C'').

(iii) Compression-ignition nonroad engines not utilizing aftertreatment technology (e.g., particulate traps). For NMHC, CO, NO_X, $NMHC + NO_X$, and exhaust particulate, the official exhaust emission results for each emission data engine at the selected test point shall be adjusted by addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph (c).

(iv) Compression-ignition nonroad engines utilizing aftertreatment technology (e.g., particulate traps). For NMHC, CO, NO_X, $NMHC + NO_X$, and exhaust particulate, the official exhaust emission results for each emission data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph (c).

(v) For acceleration smoke (''A''), lugging smoke (''B''), and peak opacity

("C"), the official exhaust emission results for each emission data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However if the deterioration supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph (c).

(vi) The emission values to compare with the standards (or family emission limits, as appropriate) shall be the adjusted emission values of paragraphs (c)(3) (iii) through (v) of this section, rounded to the same number of significant figures as contained in the applicable standard in accordance with ASTM E29–93a, for each emission data engine. This procedure has been incorporated by reference (see § 89.6).

(4) Every test engine of an engine family must comply with all applicable standards (or family emission limits, as appropriate), as determined in paragraph (c)(3)(vi) of this section, before any engine in that family will be certified.

* * * * *

(e) For the purposes of setting an NMHC + NO_X certification level or FEL, one of the following options shall be used for the determination of NMHC for an engine family. The manufacturer must declare which option is used in its application for certification of that engine family.

(1) THC may be used in lieu of NMHC for the standards set forth in § 89.112.

(2) The manufacturer may choose its own method to analyze methane with prior approval of the Administrator.

(3) The manufacturer may assume that two percent of the measured THC is methane (NMHC=0.98×THC).

24. The newly designated § 89.126 is amended by revising paragraph (c) to read as follows:

§ 89.126 Denial, revocation of certificate of conformity.

* * * * *

(c) If a manufacturer knowingly commits an infraction specified in paragraph (b)(1) or (b)(4) of this section, knowingly commits any other fraudulent act which results in the issuance of a certificate of conformity, or fails to comply with the conditions specified in §§ 89.203(d), 89.206(c), 89.209(c) or 89.210(g), the Administrator may deem such certificate void ab initio.

* * * * *

25. A new § 89.130 is added to subpart B to read as follows:

§ 89.130 Rebuild practices.

(a) The provisions of this section are applicable to engines subject to the standards prescribed in section § 89.112 and are applicable to the process of engine rebuilding (or rebuilding a portion of an engine or engine system). This section does not apply to Tier 1 engines rated at or above 37 kW. The process of engine rebuilding generally includes disassembly, replacement of multiple parts due to wear, and reassembly, and also may include the removal of the engine from the vehicle and other acts associated with rebuilding an engine. Any deviation from the provisions contained in this section is a prohibited act.

(b) When rebuilding an engine, portions of an engine, or an engine system, there must be a reasonable technical basis for knowing that the resultant engine is equivalent, from an emissions standpoint, to a certified configuration (i.e., tolerances, calibrations, specifications) of the same or newer model year as the original engine. A reasonable basis would exist if:

(1) Parts installed, whether the parts are new, used, or rebuilt, are such that a person familiar with the design and function of motor vehicle engines would reasonably believe that the parts perform the same function with respect to emission control as the original parts; and

(2) Any parameter adjustment or design element change is made only:

(i) In accordance with the original engine manufacturer's instructions; or

(ii) Where data or other reasonable technical basis exists that such parameter adjustment or design element change, when performed on the engine or similar engines, is not expected to adversely affect in-use emissions.

(c) When an engine is being rebuilt and remains installed or is reinstalled in the same equipment, it must be rebuilt to a configuration of the same or later model year as the original engine. When an engine is being replaced, the replacement engine must be an engine of (or rebuilt to) a configuration of the same or later model year as the original engine.

(d) At time of rebuild, emission-related codes or signals from on-board monitoring systems may not be erased or reset without diagnosing and responding appropriately to the diagnostic codes, regardless of whether the systems are installed to satisfy requirements in § 89.109 or for other reasons and regardless of form or interface. Diagnostic systems must be free of all such codes when the rebuilt engine is returned to service. Such signals may not be rendered inoperative during the rebuilding process.

(e) When conducting a rebuild without removing the engine from the equipment, or during the installation of a rebuilt engine, all critical emission-related components listed in § 86.109–99(d) of this chapter not otherwise addressed by paragraphs (b) through (d) of this section must be checked and cleaned, adjusted, repaired, or replaced as necessary, following manufacturer recommended practices.

(f) Records shall be kept by parties conducting activities included in paragraphs (b) through (e) of this section. The records shall include at minimum the hours of operation at time of rebuild, a listing of work performed on the engine, and emission-related control components including a listing of parts and components used, engine parameter adjustments, emission-related codes or signals responded to and reset, and work performed under paragraph (e) of this section.

(1) Parties may keep records in whatever format or system they choose as long as the records are understandable to an EPA enforcement officer or can be otherwise provided to an EPA enforcement officer in an understandable format when requested.

(2) Parties are not required to keep records of information that is not reasonably available through normal business practices including information on activities not conducted by themselves or information that they cannot reasonably access.

(3) Parties may keep records of their rebuilding practices for an engine family rather than on each individual engine rebuilt in cases where those rebuild practices are followed routinely.

(4) Records must be kept for a minimum of two years after the engine is rebuilt.

Subpart C—[Amended]

26. The newly designated § 89.203 is revised to read as follows:

§ 89.203 General provisions.

(a) The averaging, banking, and trading programs for NO_X, NMHC + NO_X, and PM emissions from eligible nonroad engines are described in this subpart. Participation in these programs is voluntary.

(b) Tier 1 engines rated at or above 37 kW. (1) A nonroad engine family is eligible to participate in the averaging, banking, and trading program for NO_X emissions and the banking and trading program for PM emissions if it is subject to regulation under subpart B of this part with certain exceptions specified in paragraph (b)(2) of this section. No averaging, banking, and trading program is available for meeting the Tier 1 HC, CO, or smoke emission standards specified in subpart B of this part. No averaging program is available for meeting the Tier 1 PM emission standards specified in subpart B of this part.

(2) Nonroad engines may not participate in the averaging, banking, and trading programs if they are subject to state engine emission standards, are exported, or use an alternate or special test procedure under § 89.114. Meeting the voluntary standards described in § 89.112(f) for Blue Sky Series engines does not preclude participation in the averaging, banking, and trading programs; however, participation in the averaging, banking, and trading programs depends on manufacturers developing test data on a steady-state test cycle, as specified in § 89.410(a), for credit computation purposes.

(3) A manufacturer may certify one or more nonroad engine families at NO_X family emission limits (FELs) above or below the Tier 1 NO_X emission standard, provided the summation of the manufacturer's projected balance of all NO_X credit transactions in a given model year is greater than or equal to zero, as determined under § 89.207(a). A manufacturer may certify one or more nonroad engine families at PM FELs below the Tier 2 PM emission standard that will be applicable to those engine families.

(i) FELs for NO_X may not exceed the Tier 1 upper limit specified in § 89.112(d).

(ii) An engine family certified to an FEL is subject to all provisions specified in subparts B, D, E, F, G, H, I, J, and K of this part, except that the applicable FEL replaces the emission standard for the family participating in the averaging, banking, and trading program.

(iii) A manufacturer of an engine family with an NO_X FEL exceeding the Tier 1 NO_X emission standard must obtain NO_X emission credits sufficient to address the associated credit shortfall via averaging, banking, or trading.

(iv) An engine family with a NO_X FEL below the applicable Tier 1 standard may generate emission credits for averaging, banking, trading, or a combination thereof. An engine family with a PM FEL below the Tier 2 standard that will be applicable to that engine family may generate emission credits for banking, trading, or a combination thereof. Emission credits may not be used to offset an engine family's emissions that exceed its applicable FEL. Credits may not be used to remedy nonconformity determined by a Selective Enforcement Audit (SEA) or by recall (in-use) testing. However, in the case of an SEA failure, credits may be used to allow subsequent production of engines for the family in question if the manufacturer elects to recertify to a higher FEL.

(4) NO_X credits generated in a given model year may be used to address credit shortfalls with other engines during that model year or in any subsequent model year except as noted under paragraph (b)(5)(ii) of this section. PM credits may be used to address credit shortfalls with Tier 2 and later engines greater than or equal to 37 kW and Tier 1 and later engines less than 37 kW and greater than or equal to 19 kW. Credits generated in one model year may not be used for prior model years.

(5) Using Tier 1 NO_X credits for showing compliance with Tier 2 NMHC + NO_X credits.

(i) A manufacturer may use NO_X credits from engines subject to the Tier 1 standards to address NMHC + NO_X credit shortfall with engines in the same averaging set subject to Tier 2 NMHC + NO_X emission standards.

(ii) NO_X credits generated from Tier 1 engines may not be used to address credit shortfalls with engines subject to the Tier 3 NMHC + NO_X standards.

(c) *Tier 2 and later engines rated at or above 37 kW and Tier 1 and later engines rated under 37 kW.* (1) A nonroad engine family is eligible to participate in the averaging, banking, and trading programs for NMHC + NO_X emissions and PM emissions if it is subject to regulation under subpart B of this part with certain exceptions specified in subsection (c)(2) of this section. No averaging, banking, and trading program is available for meeting the CO or smoke emission standards specified in subpart B of this part.

(2) Nonroad engines may not participate in the averaging, banking, and trading programs if they are subject to state engine emission standards, are exported, or use an alternate or special test procedure under § 89.114. Meeting the voluntary standards described in § 89.112(f) for Blue Sky Series engines does not preclude participation in the averaging, banking, and trading programs; however, participation in the averaging, banking, and trading programs depends on manufacturers developing test data on a steady-state test cycle, as specified in § 89.410(a), for credit computation purposes.

(3)(i) A manufacturer may certify one or more nonroad engine families at FELs above or below the applicable NMHC + NO_X emission standard and PM emission standard, provided the summation of the manufacturer's projected balance of all NMHC + NO_X credit transactions and the summation of the manufacturer's projected balance of all PM credit transactions in a given model year in a given averaging set is greater than or equal to zero, as determined under § 89.207(b).

(A) FELs for NMHC + NO_X and FELs for PM may not exceed the upper limits specified in § 89.112(d).

(B) An engine family certified to an FEL is subject to all provisions specified in subparts B, D, E, F, G, H, I, J, and K of this part, except that the applicable FEL replaces the emission standard for the family participating in the averaging, banking, and trading program.

(C) A manufacturer of an engine family with an FEL exceeding the applicable emission standard must obtain emission credits sufficient to address the associated credit shortfall via averaging, banking, or trading, within the restrictions described in §§ 89.204(c) and 89.206(b)(4).

(D) An engine family with an FEL below the applicable standard may generate emission credits for averaging, banking, trading, or a combination thereof. Emission credits may not be used to offset an engine family's emissions that exceed its applicable FEL. Credits may not be used to remedy nonconformity determined by a Selective Enforcement Audit (SEA) or by recall (in-use) testing. However, in the case of an SEA failure, credits may be used to allow subsequent production of engines for the family in question if the manufacturer elects to recertify to a higher FEL.

(ii)(A) In lieu of generating credits under paragraph (c)(3)(i) of this section, a manufacturer may certify one or more nonroad engine families rated under 37 kW at family emission limits (FELs) above or below the applicable NMHC + NO_X emission standard and PM emission standard. The summation of the manufacturer's projected balance of all NMHC + NO_X credit transactions and the summation of the manufacturer's projected balance of all PM credit transactions in a given model year, as determined under § 89.207(b), is allowed to be less than zero. Separate calculations shall be required for the following two categories of engines: engines rated under 19 kW and engines rated at or above 19kW and under 37 kW.

(B) A penalty equal to ten percent of the year end negative credit balance shall be added to the negative credit balance. The resulting negative credit balance shall be carried into the next model year.

(C) For engines rated under 19 kW, a manufacturer will be allowed to carry over a negative credit balance until December 31, 2003. For engines rated at or above 19 kW and under 37 kW, a manufacturer will be allowed to carry over a negative credit balance until December 31, 2002. As of these dates, the summation of the manufacturer's projected balance of all NMHC + NO_X credit transactions and the summation of the manufacturer's projected balance of all PM credit transactions must be greater than or equal to zero.

(D) FELs for NMHC + NO_X and FELs for PM may not exceed the upper limits specified in § 89.112(d).

(E) An engine family certified to an FEL is subject to all provisions specified in subparts B, D, E, F, G, H, I, J, and K of this part, except that the applicable NMHC + NO_X FEL or PM FEL replaces the NMHC + NO_X emission standard or PM emission standard for the family participating in the averaging and banking program.

(F) A manufacturer of an engine family with an FEL exceeding the applicable emission standard must obtain emission credits sufficient to address the associated credit shortfall via averaging or banking. The exchange of emission credits generated under this program with other nonroad engine manufacturers in trading is not allowed.

(G) An engine family with an FEL below the applicable standard may generate emission credits for averaging, banking, or a combination thereof. Emission credits may not be used to offset an engine family's emissions that exceed its applicable FEL. Credits may not be used to remedy nonconformity determined by a Selective Enforcement Audit (SEA) or by recall (in-use) testing. However, in the case of an SEA failure, credits may be used to allow subsequent production of engines for the family in question if the manufacturer elects to recertify to a higher FEL.

(4)(i) Except as noted in paragraphs (c)(4)(ii), (c)(4)(iii), and (c)(4)(iv) of this section, credits generated in a given model year may be used during that model year or used in any subsequent model year. Except as allowed under paragraph (c)(3)(ii) of this section, credits generated in one model year may not be used for prior model years.

(ii) Credits generated from engines rated under 19 kW prior to the implementation date of the applicable Tier 2 standards, shall expire on December 31, 2007.

(iii) Credits generated from engines rated under 19 kW under the provisions of paragraph (c)(3)(ii) shall expire on December 31, 2003.

(iv) Credits generated from engines rated at or above 19 kW and under 37 kW under the provisions of paragraph (c)(3)(ii) shall expire on December 31, 2002.

(d) Manufacturers must demonstrate compliance under the averaging, banking, and trading programs for a particular model year by 270 days after the model year. Engine families without an adequate amount of emission credits, except as allowed under paragraph (c)(3)(ii) of this section, will violate the conditions of the certificates of conformity. The certificates of conformity may be voided ab initio under § 89.126(c) for those engine families.

(e) Engine families may not generate credits for one pollutant while also using credits for another pollutant in the same model year.

(f) An engine manufacturer may exchange NO_X emission credits, NMHC + NO_X emission credits, and PM emission credits to equipment or vehicle manufacturers in trading. Such credits may be used within the provisions specified in § 89.102(d)(3).

27. The newly designated § 89.204 is revised to read as follows:

§ 89.204 Averaging.

(a) *Tier 1 engines rated at or above 37 kW.* (1) A manufacturer may use averaging to offset an emission exceedance of a nonroad engine family caused by a NO_X FEL above the applicable emission standard. NO_X credits used in averaging may be obtained from credits generated by another engine family in the same model year, credits banked in a previous model year, or credits obtained through trading.

(2) Credits scheduled to expire in the earliest model year must be used first, before using other available credits.

(b) *Tier 2 and later engines rated at or above 37 kW and Tier 1 and later engines rated under 37 kW.* (1) A manufacturer may use averaging to offset an emission exceedance of a nonroad engine family caused by an NMHC + NO_X FEL or a PM FEL above the applicable emission standard. Credits used in averaging may be obtained from credits generated by another engine family in the same model year, credits banked in previous model years that have not expired, or credits obtained through trading. The use of credits shall be within the restrictions described in paragraph (c) of this section and § 89.206(b)(4).

(2) Credits scheduled to expire in the earliest model year must be used first, before using other available credits.

(c) *Averaging sets for emission credits.* The averaging and trading of NO_X emission credits, NMHC + NO_X emission credits, and PM emissions credits will only be allowed between engine families in the same averaging set. The averaging sets for the averaging and trading of NO_X emission credits, NMHC + NO_X emission credits, and PM emission credits for nonroad engines are defined as follows:

(1) Eligible engines, other than marine diesel engines rated at or above 19 kW, constitute an averaging set.

(2) Marine diesel engines rated at or above 19 kW constitute an averaging set. Emission credits generated from marine diesel engines rated at or above 19 kW may be used to address credit shortfalls for eligible engines other than marine diesel engines rated at or above 19 kW.

(3) Eligible engines, other than marine diesel engines rated under 19 kW, constitute an averaging set.

(4) Marine diesel engines rated under 19 kW constitute an averaging set. Emission credits generated from marine diesel engines rated under 19 kW may be used to address credit shortfalls for eligible engines other than marine diesel engines rated under 19 kW.

28. The newly designated § 89.205 is revised to read as follows:

§ 89.205 Banking.

(a) *Tier 1 engines rated at or above 37 kW.* (1) A manufacturer of a nonroad engine family with a NO_X FEL below the applicable standard for a given model year may bank credits in that model year for use in averaging and trading in any subsequent model year.

(2) A manufacturer of a nonroad engine family may bank NO_X credits up to one calendar year prior to the effective date of mandatory certification. Such engines must meet the requirements of subparts A, B, D, E, F, G, H, I, J, and K of this part.

(3)(i) A manufacturer of a nonroad engine family may bank PM credits from Tier 1 engines under the provisions specified in § 89.207(b) for use in averaging and trading in the Tier 2 or later timeframe provided the engine family is certified without an FEL above the Tier 1 NO_X standard.

(ii) Such engine families are subject to all provisions specified in subparts B, D, E, F, G, H, I, J, and K of this part, except that the applicable PM FEL replaces the PM emission standard for the family participating in the banking and trading program.

(b) *Tier 2 and later engines rated at or above 37 kW and Tier 1 and later engines rated under 37 kW.* (1) A manufacturer of a nonroad engine family with an NMHC + NO_X FEL or a PM FEL below the applicable standard for a given model year may bank credits in that model year for use in averaging and trading in any following model year.

(2) For engine rated under 37 kW, a manufacturer of a nonroad engine family may bank credits prior to the effective date of mandatory certification. Such engines must meet the requirements of subparts A, B, D, E, F, G, H, I, J, and K of this part.

(c) A manufacturer may bank actual credits only after the end of the model year and after EPA has reviewed the manufacturer's end-of-year reports. During the model year and before submittal of the end-of-year report, credits originally designated in the certification process for banking will be considered reserved and may be redesignated for trading or averaging in the end-of-year report and final report.

(d) Credits declared for banking from the previous model year that have not been reviewed by EPA may be used in averaging or trading transactions. However, such credits may be revoked at a later time following EPA review of the end-of-year report or any subsequent audit actions.

29. The newly designated § 89.206 is revised to read as follows:

§ 89.206 Trading.

(a) *Tier 1 engines rated at or above 37 kW.* (1) A nonroad engine manufacturer may exchange emission credits with other nonroad engine manufacturers within the same averaging set in trading.

(2) Credits for trading can be obtained from credits banked in a previous model year or credits generated during the model year of the trading transaction.

(3) Traded credits can be used for averaging, banking, or further trading transactions within the restrictions described in § 89.204(c).

(b) *Tier 2 and later engines rated at or above 37 kW and Tier 1 and later engines rated under 37 kW.* (1) A nonroad engine manufacturer may exchange emission credits with other nonroad engine manufacturers within the same averaging set in trading.

(2) Credits for trading can be obtained from credits banked in previous model years that have not expired or credits generated during the model year of the trading transaction.

(3) Traded credits can be used for averaging, banking, or further trading transactions within the restrictions described in § 89.204(c) and paragraph (b)(4) of this section.

(4) Emission credits generated from engines rated at or above 19 kW utilizing indirect fuel injection may not be traded to other manufacturers.

(c) In the event of a negative credit balance resulting from a transaction, both the buyer and the seller are liable, except in cases involving fraud. Certificates of all engine families participating in a negative trade may be voided ab initio under § 89.126(c).

30. The newly designated § 89.207 is revised to read as follows:

§ 89.207 Credit calculation.

(a) *NO_X credits from Tier 1 engines rated at or above 37 kW.* (1) For each participating engine family, emission credits (positive or negative) are to be calculated according to one of the following equations and rounded, in accordance with ASTM E29–93a, to the nearest one-tenth of a megagram (Mg). This procedure has been incorporated by reference (see § 89.6). Consistent units are to be used throughout the equation.

(i) For determining credit availability from all engine families generating credits:

$$\text{Emission credits} = (\text{Std}-\text{FEL}) \times (\text{Volume}) \times (\text{AvgPR}) \times (\text{UL}) \times (\text{Adjustment}) \times (10^{-6})$$

(ii) For determining credit usage for all engine families requiring credits to offset emissions in excess of the standard:

$$\text{Emission credits} = (\text{Std}-\text{FEL}) \times (\text{Volume}) \times (\text{AvgPR}) \times (\text{UL}) \times (10^{-6})$$

Where:

Std = the applicable Tier 1 NO_X nonroad engine emission standard, in grams per brake horsepower hour.

FEL = the NO_X family emission limit for the engine family in grams per brake horsepower hour.

Volume = the number of nonroad engines eligible to participate in the averaging, banking, and trading program within the given engine family during the model year. Engines sold to equipment or vehicle manufacturers under the provisions of § 89.102(g) shall not be included in this number. Quarterly production projections are used for initial certification. Actual applicable production/sales volumes is used for end-of-year compliance determination.

AvgPR = the average power rating of all of the configurations within an engine family, calculated on a sales-weighted basis.

UL = the useful life for the engine family, in hours.

Adjustment = a one-time adjustment, as specified in paragraph (a)(2) of this section, to be applied to Tier 1 NO_X credits to be banked or traded for determining compliance with the Tier 1 NO_X standards or Tier 2 NO_X+NMHC standards specified in subpart B of this part. Banked credits traded in a subsequent model year will not be subject to an additional adjustment. Banked credits used in a subsequent model year's averaging program will not have the adjustment restored.

(2) If an engine family is certified to a NO_X FEL of 8.0 g/kW-hr or less, an Adjustment value of 1.0 shall be used in the credit generation calculation described in paragraph (a)(1)(i) of this section. If an engine family is certified to a NO_X FEL above 8.0 g/kW-hr, an Adjustment value of 0.65 shall be used in the credit generation calculation described in paragraph (a)(1)(i) of this section. If the credits are to be used by the credit-generating manufacturer for averaging purposes in the same model year in which they are generated, an Adjustment value of 1.0 shall be used for all engines regardless of the level of the NO_X FEL.

(b) *NMHC + NO_X Credits from Tier 2 and later engines rated at or above 37 kW and Tier 1 and later engines rated under 37 kW and PM credits from all engines.* (1) For each participating engine family, NO_X + NMHC emission credits and PM emission credits (positive or negative) are to be calculated according to one of the following equations and rounded, in accordance with ASTM E29–93a, to the nearest one-tenth of a megagram (Mg). This procedure has been incorporated by reference (see § 89.6). Consistent units are to be used throughout the equation.

(i) For determining credit availability from all engine families generating credits:

$$\text{Emission credits} = (\text{Std}-\text{FEL}) \times (\text{Volume}) \times (\text{AvgPR}) \times (\text{UL}) \times (10^{-6})$$

(ii) For determining credit usage for all engine families requiring credits to offset emissions in excess of the standard:

$$\text{Emission credits} = (\text{Std}-\text{FEL}) \times (\text{Volume}) \times (\text{AvgPR}) \times (\text{UL}) \times (10^{-6})$$

Where:

Std = the current and applicable nonroad engine emission standard, in grams per brake horsepower hour, except for PM calculations where it is the applicable nonroad engine Tier 2 PM emission standard, and except for engines rated under 19 kW where it is the applicable nonroad engine Tier 2 emission standard, in grams per brake horsepower hour. (Engines rated under 19 kW participating in the averaging and banking program provisions of § 89.203(c)(3)(ii) shall use the Tier 1 standard for credit calculations.)

FEL = the family emission limit for the engine family in grams per brake horsepower hour.

Volume = the number of nonroad engines eligible to participate in the averaging, banking, and trading program within the given engine family during the model year. Engines sold to equipment or vehicle manufacturers under the provisions of § 89.102(g) shall not be included in this number. Quarterly production projections are used for initial certification. Actual applicable production/sales volumes is used for end-of-year compliance determination.
AvgPR = the average power rating of all of the configurations within an engine family, calculated on a sales-weighted basis.
UL = the useful life for the given engine family, in hours.

31. The newly designated § 89.208 is revised to read as follows:

§ 89.208 Labeling.

For all nonroad engines included in the averaging, banking, and trading programs, the family emission limits to which the engine is certified must be included on the label required in § 89.110.

32. The newly designated § 89.209 is amended by revising paragraph (a) to read as follows:

§ 89.209 Certification.

(a) In the application for certification a manufacturer must:

(1) Declare its intent to include specific engine families in the averaging, banking, and trading programs.

(2) Submit a statement that the engines for which certification is requested will not, to the best of the manufacturer's belief, cause the manufacturer to have a negative credit balance when all credits are calculated for all the manufacturer's engine families participating in the averaging, banking, and trading programs, except as allowed under § 89.203(c)(3)(ii).

(3) Declare the applicable FELs for each engine family participating in averaging, banking, and trading.

(i) The FELs must be to the same number of significant digits as the emission standard for the applicable pollutant.

(ii) In no case may the FEL exceed the upper limits prescribed in § 89.112(d).

(4) Indicate the projected number of credits generated/needed for this family; the projected applicable production/sales volume, by quarter; and the values required to calculate credits as given in § 89.207.

(5) Submit calculations in accordance with § 89.207 of projected emission credits (positive or negative) based on quarterly production projections for each participating family.

(6)(i) If the engine family is projected to have negative emission credits, state specifically the source (manufacturer/engine family or reserved) of the credits necessary to offset the credit deficit according to quarterly projected production, or, if the engine family is to be included in the provisions of § 89.203(c)(3)(ii), state that the engine family will be included in those provisions.

(ii) If the engine family is projected to generate credits, state specifically (manufacturer/engine family or reserved) where the quarterly projected credits will be applied.

* * * * *

33. The newly designated § 89.210 is amended by revising paragraphs (b) and (c) to read as follows:

§ 89.210 Maintenance of records.

* * * * *

(b) The manufacturer of any nonroad engine family that is certified under the averaging, banking, and trading programs must establish, maintain, and retain the following adequately organized and indexed records for each such family:

(1) EPA engine family;

(2) Family emission limits (FEL);

(3) Power rating for each configuration tested;

(4) Projected applicable production/sales volume for the model year; and

(5) Actual applicable production/sales volume for the model year.

(c) Any manufacturer producing an engine family participating in trading reserved credits must maintain the following records on a quarterly basis for each engine family in the trading program:

(1) The engine family;

(2) The actual quarterly and cumulative applicable production/sales volume;

(3) The values required to calculate credits as given in § 89.207;

(4) The resulting type and number of credits generated/required;

(5) How and where credit surpluses are dispersed; and

(6) How and through what means credit deficits are met.

* * * * *

34. The newly designated § 89.211 is amended by revising paragraphs (a) and (c) to read as follows:

§ 89.211 End-of-year and final reports.

(a) End-of-year and final reports must indicate the engine family, the actual applicable production/sales volume, the values required to calculate credits as given in § 89.207, and the number of credits generated/required. Manufacturers must also submit how and where credit surpluses were dispersed (or are to be banked) and/or how and through what means credit deficits were met. Copies of contracts related to credit trading must be included or supplied by the broker, if applicable. The report shall include a calculation of credit balances to show that the summation of the manufacturer's use of credits results in a credit balance equal to or greater than zero, except as allowed under § 89.203(c)(3)(ii).

* * * * *

(c)(1) End-of-year reports must be submitted within 90 days of the end of the model year to: Director, Engine Programs and Compliance Division (6405–J), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

(2) Final reports must be submitted within 270 days of the end of the model year to: Director, Engine Programs and Compliance Division (6405–J), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

* * * * *

35. The newly designated § 89.212 is revised to read as follows:

§ 89.212 Notice of opportunity for hearing.

Any voiding of the certificate under §§ 89.203(d), 89.206(c), 89.209(c) and 89.210(g) will be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with §§ 89.512 and 89.513 and, if a manufacturer requests such a hearing, will be made only after an initial decision by the Presiding Officer.

Subpart D—[Amended]

36. The newly designated § 89.302 is revised to read as follows:

§ 89.302 Definitions.

The definitions in subpart A of this part apply to this subpart. For terms not defined in this part, the definitions in part 86, subparts A, D, I, and N, of this chapter apply to this subpart.

37. The newly designated § 89.304 is amended by revising paragraph (c) to read as follows:

§ 89.304 Equipment required for gaseous emissions; overview.

* * * * *

(c) Analyzers used are a non-dispersive infrared (NDIR) absorption type for carbon monoxide and carbon dioxide analysis; a heated flame ionization (HFID) type for hydrocarbon analysis; and a chemiluminescent detector (CLD) or heated chemiluminescent detector (HCLD) for oxides of nitrogen analysis. A gas chromatograph (GC) may also be required for methane analysis. Sections

89.309 through 89.324 set forth a full description of analyzer requirements and specifications.

38. The newly designated § 89.307 is amended by revising paragraphs (b)(7) and (b)(8) to read as follows:

§ 89.307 Dynamometer calibration.

* * * * *

(b) * * *

(7) The measured torque must be within either 2 percent of point or 1 percent of the engine maximum torque of the calculated torque.

(8) If the measured torque is not within the above requirements adjust or repair the system. Repeat steps in paragraphs (b)(1) through (b)(6) of this section with the adjusted or repaired system.

* * * * *

39. The newly designated § 89.308 is amended by revising paragraph (b) to read as follows:

§ 89.308 Sampling system requirements for gaseous emissions.

* * * * *

(b) If water is removed by condensation, the sample gas temperature shall be monitored within the water trap or the sample dewpoint shall be monitored downstream. In either case, the indicated temperature shall not exceed 7 °C.

40. The newly designated § 89.309 is amended by removing and reserving paragraph (a)(3) and revising paragraphs (a)(4)(iii), (a)(5)(i)(C), and (a)(5)(i)(D) and adding paragraph (a)(6) to read as follows:

§ 89.309 Analyzers required for gaseous emissions.

(a) * * *

(3) [Reserved]

(4) * * *

(iii) The FID oven must be capable of maintaining temperature within 5.5 °C of the set point.

* * * * *

(5) * * *

(i) * * *

(C) For raw analysis, an ice bath or other cooling device located after the NO_X converter (optional for dilute analysis).

(D) A chemiluminescent detector (CLD or HCLD).

* * * * *

(6) *Methane analysis.* (i) Using a methane analyzer consisting of a gas chromatograph combined with an FID, the measurement of methane shall be in accordance with SAE Recommended Practice J1151, ''Methane Measurement Using Gas Chromatography.'' (Incorporated by reference pursuant to § 86.1(b)(2).)

(ii) As an option, the manufacturer may choose the analyzer to be used for methane measurement with the prior approval of the Administrator.

* * * * *

41. The newly designated § 89.310 is amended by revising paragraphs (a)(1) and (c) to read as follows:

§ 89.310 Analyzer accuracy and specifications.

(a) * * *

(1) *Response time.* As necessary, measure and account for the response time of the analyzer.

* * * * *

(c) *Emission measurement accuracy—Bagged sampling.* (1) Good engineering practice dictates that exhaust emission sample analyzer readings below 15 percent of full-scale chart deflection should generally not be used.

(2) Some high resolution read-out systems, such as computers, data loggers, and so forth, can provide sufficient accuracy and resolution below 15 percent of full scale. Such systems may be used provided that additional calibrations of at least 4 non-zero nominally equally spaced points, using good engineering judgement, below 15 percent of full scale are made to ensure the accuracy of the calibration curves. If a gas divider is used, the gas divider must conform to the accuracy requirements specified in § 89.312(c). The procedure in paragraph (c)(3) of this section may be used for calibration below 15 percent of full scale.

(3) The following procedure shall be followed:

(i) Span the l analyzer using a calibration gas meeting the accuracy requirements of § 89.312(c), within the operating range of the analyzer, and at least 90% of full scale.

(ii) Generate a calibration over the full concentration range at a minimum of 6, approximately equally spaced, points (e.g. 15, 30, 45, 60, 75, and 90 percent of the range of concetrations provided by the gas divider). If a gas divider or blender is being used to calibrate the analyzer and the requirements of paragraph (c)(2) of this section are met, verify that a second calibration gas between 10 and 20 percent of full scale can be named within 2 percent of its certified concentration.

(iii) If a gas divider or blender is being used to calibrate the analyzer, input the value of a second calibration gas (a span gas may be used for the CO2 analyzer) having a named concentration between 10 and 20 percent of full scale. This gas shall be included on the calibration curve. Continue adding calibration points by dividing this gas until the requirements of paragraph (c)(2) of this section are met.

(iv) Fit a calibration curve per §§ 89.319 through 89.322 for the full scale range of the analyzer using the calibration data obtained with both calibration gases.

* * * * *

42. The newly designated § 89.312 is amended by revising paragraphs (c)(2), (d), and (f) and adding a new paragraph (g) to read as follows:

§ 89.312 Analytical gases.

* * * * *

(c) * * *

(2) Mixtures of gases having the following chemical compositions shall be available:

C_3H_8 and purified synthetic air;
C_3H_8 and purified nitrogen (optional for raw measurements);
CO and purified nitrogen;
NO_X and purified nitrogen (the amount of NO_2 contained in this calibration gas must not exceed 5 percent of the NO content);
CO_2 and purified nitrogen.

* * * * *

(d) Oxygen interference check gases shall contain propane with 350 ppmC±75 ppmC hydrocarbon. The three oxygen interference gases shall contain 21%±1% O_2,10%±1% O_2, and 5%±1% O_2. The concentration value shall be determined to calibration gas tolerances by chromatographic analysis of total hydrocarbons plus impurities or by dynamic blending. Nitrogen shall be the predominant diluent with the balance oxygen.

* * * * *

(f) Hydrocarbon analyzer burner air. The concentration of oxygen for raw sampling must be within 1 mole percent of the oxygen concentration of the burner air used in the latest oxygen interference check (%O_2I). If the difference in oxygen concentration is greater than 1 mole percent, then the oxygen interference must be checked and, if necessary, the analyzer adjusted to meet the %O_2I requirements. The burner air must contain less than 2 ppmC hydrocarbon.

(g) Gases for the methane analyzer shall be single blends of methane using air as the diluent.

43. The newly designated § 89.314 is amended by revising paragraphs (a) and (b) to read as follows:

§ 89.314 Pre- and post-test calibration of analyzers.

* * * * *

(a) The calibration is checked by using a zero gas and a span gas whose nominal value is between 75 percent and 100 percent of full-scale, inclusive, of the measuring range.

(b) After the end of the final mode, a zero gas and the same span gas will be used for rechecking. As an option,the zero and span may be rechecked at the end of each mode or each test segment. The analysis will be considered acceptable if the difference between the two measuring results is less than 2 percent of full scale.

§ 89.316 [Amended]

44. The newly designated § 89.316 is amended by removing and reserving paragraph (b).

45. The newly designated § 89.317 is amended by revising paragraphs (g), (h), and (k) to read as follows:

§ 89.317 NO_X converter check.

* * * * *

(g) Turn on the NO_X generator O_2 (or air) supply and adjust the O_2 (or air) flow rate so that the NO indicated by the analyzer is about 10 percent less than indicated in paragraph (f) of this section. Record the concentration of NO in this NO+O_2 mixture.

(h) Switch the NO_X generator to the generation mode and adjust the generation rate so that the NO measured on the analyzer is 20 percent of that measured in paragraph (f) of this section. There must be at least 10 percent unreacted NO at this point. Record the concentration of residual NO.

* * * * *

(k) Turn off the NO_X generator O_2 (or air) supply. The analyzer will now indicate the NO_X in the original NO-in-N_2 mixture. This value should be no more than 5 percent above the value indicated in paragraph (f) of this section.

* * * * *

46. The newly designated § 89.318 is amended by revising paragraphs (c)(2)(i) and (c)(2)(iv) to read as follows:

§ 89.318 Analyzer interference checks.

* * * * *

(c) * * *

(2) *NO_X analyzer water quench check.* (i) This check applies to wet measurements only. An NO span gas having a concentration of 80 to 100 percent of full scale of a normal operating range shall be passed through the CLD (or HCLD) and the response recorded as D. The NO span gas shall then be bubbled through water at room temperature and passed through the CLD (or HCLD) and the analyzer response recorded as AR. Determine and record the bubbler absolute operating pressure and the bubbler water temperature. (It is important that the NO span gas contains minimal NO_2 concentration for this check. No allowance for absorption of NO_2 in water has been made in the following quench calculations. This test may be optionally run in the NO mode to minimize the effect of any NO_2 in the NO span gas.)

* * * * *

(iv)(A) The maximum raw or dilute exhaust water vapor concentration expected during testing (designated as Wm) can be estimated from the CO_2 span gas (or as defined in the equation in this paragraph and designated as A) criteria in paragraph (c)(1) of this section and the assumption of a fuel atom H/C ratio of 1.8:1 as:

$Wm(\%)=0.9\times A(\%)$

Where:

A= maximum CO_2 concentration expected in the sample system during testing.

(B) Percent water quench shall not exceed 3 percent and shall be calculated by:

$$\%\text{Water Quench} = 100 \times \frac{\text{D1} - \text{AR}}{\text{D1}} \times \frac{\text{Wm}}{\text{Z1}}$$

47. The newly designated § 89.319 is amended by revising paragraphs (b)(1), (b)(2), (c), (d) introductory text, (d)(2), and (d)(6) to read as follows:

§ 89.319 Hydrocarbon analyzer calibration.

* * * * *

(b) *Initial and periodic optimization of detector response.* * * *

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 89.312(e)) and zero-grade air.

(2) Optimize the FID's response on the most common operating range. The response is to be optimized with respect to fuel pressure or flow. Efforts shall be made to minimize response variations to different hydrocarbon species that are expected to be in the exhaust. Good engineering judgement is to be used to trade off optimal FID response to propane-in-air against reductions in relative responses to other hydrocarbons. A good example of trading off response on propane for relative responses to other hydrocarbon species is given in Society of Automotive Engineers (SAE) Paper No. 770141, ‘‘Optimization of Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts’’; author Glenn D. Reschke. It is also required that the response be set to optimum condition with respect to air flow and sample flow. Heated Flame Ionization Detectors (HFIDs) must be at their specified operating temperature. One of the following procedures is required for FID or HFID optimization:

(i) The procedure outlined in Society of Automotive Engineers (SAE) paper No. 770141, ‘‘Optimization of a Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts’’; author, Glenn D. Reschke. This procedure has been incorporated by reference. See § 89.6.

(ii) The HFID optimization procedures outlined in 40 CFR 86.331–79.

(iii) Alternative procedures may be used if approved in advance by the Administrator.

(iv) The procedures specified by the manufacturer of the FID or HFID.

* * * * *

(c) *Initial and periodic calibration.* Prior to introduction into service, after any maintenance which could alter calibration, and monthly thereafter, the FID or HFID hydrocarbon analyzer shall be calibrated on all normally used instrument ranges using the steps in this paragraph (c). Use the same flow rate and pressures as when analyzing samples. Calibration gases shall be introduced directly at the analyzer, unless the ‘‘overflow’’ calibration option of § 86.1310–90(b)(3)(i) of this chapter for the HFID is taken. New calibration curves need not be generated each month if the existing curve can be verified as continuing to meet the requirements of paragraph (c)(3) of this section.

(1) Adjust analyzer to optimize performance.

(2) Zero the hydrocarbon analyzer with zero-grade air.

(3) Calibrate on each used operating range with propane-in-air (dilute or raw) or propane-in-nitrogen (raw) calibration gases having nominal concentrations starting between 10–15 percent and increasing in at least six incremental steps to 90 percent (e.g., 15, 30, 45, 60, 75, and 90 percent of that range) of that range. The incremental steps are to be spaced to represent good engineering practice. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at each non-zero data point and within ±0.3 percent of full scale on the zero, the best-fit non-linear equation which represents the data to within these limits shall be used to determine concentration.

(d) *Oxygen interference optimization (Required for raw).* Choose a range where the oxygen interference check gases will fall in the upper 50 percent.

Conduct the test, as outlined in this paragraph, with the oven temperature set as required by the instrument manufacturer. Oxygen interference check gas specifications are found in § 89.312(d).

* * * * *

(2) Span the analyzer with the 21% oxygen interference gas specified in § 89.312(d).

* * * * *

(6) Calculate the percent of oxygen interference (designated as percent O_2I) for each mixture in paragraph (d)(4) of this section as follows:

percent $O_2I=((B-C)\times100)/B$

Where:

A= hydrocarbon concentration (ppmC) of the span gas used in paragraph (d)(2) of this section.

B= hydrocarbon concentration (ppmC) of the oxygen interference check gases used in paragraph (d)(4) of this section.

C= analyzer response (ppmC) = A/D.

D= (percent of full-scale analyzer response due to A) $\times$ (percent of full-scale analyzer response due to B).

* * * * *

48. The newly designated § 89.320 is amended by revising paragraph (c) to read as follows:

§ 89.320 Carbon monoxide analyzer calibration.

* * * * *

(c) *Initial and periodic calibration.* Prior to its introduction into service, after any maintenance which could alter calibration, and every two months thereafter, the NDIR carbon monoxide analyzer shall be calibrated. New calibration curves need not be generated every two months if the existing curve can be verified as continuing to meet the requirements of paragraph (c)(3) of this section.

(1) Adjust the analyzer to optimize performance.

(2) Zero the carbon monoxide analyzer with either zero-grade air or zero-grade nitrogen.

(3) Calibrate on each used operating range with carbon monoxide-in-N_2 calibration gases having nominal concentrations starting between 10 and 15 percent and increasing in at least six incremental steps to 90 percent (e.g., 15, 30, 45, 60, 75, and 90 percent) of that range. The incremental steps are to be spaced to represent good engineering practice. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each non-zero data point and within ±0.3 percent of full scale on the zero, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds these limits, the best-fit non-linear equation which represents the data to within these limits shall be used to determine concentration.

* * * * *

49. The newly designated § 89.321 is amended by revising paragraph (c) to read as follows:

§ 89.321 Oxides of nitrogen analyzer calibration.

* * * * *

(c) *Initial and periodic calibration.* Prior to its introduction into service, after any maintenance which could alter calibration, and monthly thereafter, the chemiluminescent oxides of nitrogen analyzer shall be calibrated on all normally used instrument ranges. New calibration curves need not be generated each month if the existing curve can be verified as continuing to meet the requirements of paragraph (c)(3) of this section. Use the same flow rate as when analyzing samples. Proceed as follows:

(1) Adjust analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with zero-grade air or zero-grade nitrogen.

(3) Calibrate on each normally used operating range with NO-in-N_2 calibration gases with nominal concentrations starting at between 10 and 15 percent and increasing in at least six incremental steps to 90 percent (e.g., 15, 30, 45, 60, 75, and 90 percent) of that range. The incremental steps are to be spaced to represent good engineering practice. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each non-zero data point and within ±0.3 percent of full scale on the zero, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds these limits, the best-fit non-linear equation which represents the data to within these limits shall be used to determine concentration.

* * * * *

50. The newly designated § 89.322 is amended by revising paragraph (a) to read as follows:

§ 89.322 Carbon dioxide analyzer calibration.

(a) Prior to its introduction into service, after any maintenance which could alter calibration, and bi-monthly thereafter, the NDIR carbon dioxide analyzer shall be calibrated on all normally used instrument ranges. New calibration curves need not be generated each month if the existing curve can be verified as continuing to meet the requirements of paragraph (a)(3) of this section. Proceed as follows:

(1) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance.

(2) Zero the carbon dioxide analyzer with either zero-grade air or zero-grade nitrogen.

(3) Calibrate on each normally used operating range with carbon dioxide-in-N_2 calibration or span gases having nominal concentrations starting between 10 and 15 percent and increasing in at least six incremental steps to 90 percent (e.g., 15, 30, 45, 60, 75, and 90 percent) of that range. The incremental steps are to be spaced to represent good engineering practice. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each non-zero data point and within ±0.3 percent of full scale on the zero, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds these limits, the best-fit non-linear equation which represents the data to within these limits shall be used to determine concentration.

* * * * *

51. The newly designated § 89.324 is revised to read as follows:

§ 89.324 Calibration of other equipment.

(a) Other test equipment used for testing shall be calibrated as often as required by the instrument manufacturer or necessary according to good practice.

(b) If a methane analyzer is used, the methane analyzer shall be calibrated prior to introduction into service and monthly thereafter:

(1) Follow the manufacturer's instructions for instrument startup and operation. Adjust the analyzer to optimize performance.

(2) Zero the methane analyzer with zero-grade air.

(3) Calibrate on each normally used operating range with CH_4 in air with nominal concentrations starting between 10 and 15 percent and increasing in at least six incremental steps to 90 percent (e.g., 15, 30, 45, 60, 75, and 90 percent) of that range. The incremental steps are to be spaced to represent good engineering practice. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each non-zero data point and within ±0.3 percent of full scale on the zero, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds these limits, the best-fit non-linear equation

which represents the data to within these limits shall be used to determine concentration.

52. The newly designated § 89.328 is amended by revising paragraphs (b)(1) and (b)(2) to read as follows:

§ 89.328 Inlet and exhaust restrictions.

* * * * *

(b) * * *

(1) Equip the test engine with an air inlet system presenting an air inlet restriction within 5 percent of the upper limit at maximum air flow, as specified by the engine manufacturer for a clean air cleaner. A system representative of the installed engine may be used. In other cases a test shop system may be used.

(2) The exhaust backpressure must be within 5 percent of the upper limit at maximum declared power, as specified by the engine manufacturer. A system representative of the installed engine may be used. In other cases a test shop system may be used.

53. The newly designated § 89.330 is amended by revising paragraph (b)(2) to read as follows:

§ 89.330 Lubricating oil and test fuels.

* * * * *

(b) * * *

(2) Use petroleum fuel meeting the specifications in Table 4 in Appendix A of this subpart, or substantially equivalent specifications approved by the Administrator, for exhaust emission testing. Alternatively, petroleum fuel meeting the specifications in Table 5 in Appendix A of this subpart may be used in exhaust emission testing. The grade of diesel fuel used must be commercially designated as ''Type 2–D'' grade diesel fuel and recommended by the engine manufacturer.

* * * * *

54.–57. Tables 1 through 4 of Appendix A to subpart D are revised to read as follows:

Appendix A to Subpart D—Tables

TABLE 1.—ABBREVIATIONS USED IN SUBPART D OF THIS PART

CLD	Chemiluminescent detector.
CO	Carbon monoxide.
CO_2	Carbon dioxide.
HC	Hydrocarbons.
HCLD	Heated chemiluminescent detector.
HFID	Heated flame ionization detector.
GC	Gas chromatograph.
NDIR	Non-dispersive infra-red analyzer.
NIST	National Institute for Standards and Testing.
NO	Nitric Oxide.
NO_2	Nitrogen Dioxide.
NO_X	Oxides of nitrogen.
O_2	Oxygen.

TABLE 2.—SYMBOLS USED IN SUBPARTS D AND E OF THIS PART.

Symbol	Term	Unit
conc	Concentration (ppm by volume).	ppm
f	Engine specific parameter considering atmospheric conditions.	
F_{FCB}	Fuel specific factor for the carbon balance calculation.	
F_{FD}	Fuel specific factor for exhaust flow calculation on dry basis.	
F_{FH}	Fuel specific factor representing the hydrogen to carbon ratio.	
F_{FW}	Fuel specific factor for exhaust flow calculation on wet basis.	
FR	Rate of fuel consumed	g/h
G_{AIRW}	Intake air mass flow rate on wet basis.	kg/h
G_{AIRD}	Intake air mass flow rate on dry basis.	kg/h
G_{EXHW}	Exhaust gas mass flow rate on wet basis.	kg/h
G_{Fuel}	Fuel mass flow rate	kg/h
H	Absolute humidity (water content related to dry air).	g/kg
i	Subscript denoting an individual mode.	
K_H	Humidity correction factor.	
L	Percent torque related to maximum torque for the test mode.	%

TABLE 2.—SYMBOLS USED IN SUBPARTS D AND E OF THIS PART.—Continued

Symbol	Term	Unit
mass	Pollutant mass flow	g/h
$n_{d,i}$	Engine speed (average at the i'th mode during the cycle).	1/min
P_s	Dry atmospheric pressure.	kPa
P_d	Test ambient saturation vapor pressure at ambient temperature.	kPa
P	Observed brake power output uncorrected.	kW
P_{AUX}	Declared total power absorbed by auxiliaries fitted for the test.	kW
P_M	Maximum power measured at the test speed under test conditions.	kW
P_i	$P_i = P_{M,i} + P_{AUX,i}$	
P_B	Total barometric pressure (average of the pre-test and post-test values).	kPa
P_v	Saturation pressure at dew point temperature.	kPa
R_a	Relative humidity of the ambient air.	%
S	Dynamometer setting	kW
T	Absolute temperature at air inlet.	K
T_{be}	Air temperature after the charge air cooler (if applicable) (average).	K
T_{clout}	Coolant temperature outlet (average).	K
T_{Dd}	Absolute dewpoint temperature.	K
$T_{d,i}$	Torque (average at the i'th mode during the cycle).	N-m
T_{SC}	Temperature of the intercooled air.	K
$T_{ref.}$	Reference temperature	K
V_{EXHD}	Exhaust gas volume flow rate on dry basis.	m^3/h
V_{AIRW}	Intake air volume flow rate on wet basis.	m^3/h
P_B	Total barometric pressure.	kPa
V_{EXHW}	Exhaust gas volume flow rate on wet basis.	m^3/h
WF	Weighing factor	
WF_E	Effective weighing factor	

TABLE 3.—MEASUREMENT ACCURACY AND CALIBRATION FREQUENCY

No.	Item	Calibration accuracy[1]	Calibration frequency
1	Engine speed	±2%	30 days.
2	Torque	±2%	30 days.
3	Fuel consumption (raw measurement)	±2% of engine maximum	30 days.
4	Air consumption (raw measurement)	±2% of engine maximum	As required.
5	Coolant temperature	±2°K	As required.
6	Lubricant temperature	±2°K	As required.
7	Exhaust backpressure	±0.5%	As required.
8	Inlet depression	±0.5%	As required.
9	Exhaust gas temperature	±15°K	As required.

TABLE 3.—MEASUREMENT ACCURACY AND CALIBRATION FREQUENCY—Continued

No.	Item	Calibration accuracy [1]	Calibration frequency
10	Air inlet temperature (combustion air)	±2°K	As required.
11	Atmospheric pressure	±0.5%	As required.
12	Humidity (combustion air) (relative)	±3.0%	As required.
13	Fuel temperature	±2°K	As required.
14	Temperature with regard to dilution tunnel	±2°K	As required.
15	Dilution air humidity (specific)	±3%	As required.
16	HC analyzer	±2%	Monthly or as required.
17	CO analyzer	±2%	Bi-monthly or as required.
18	NO_X analyzer	±2%	Monthly or as required.
19	Methane analyzer	±2%	Monthly or as required.
20	NO_X converter efficiency check	90%	Monthly.
21	CO_2 analyzer	±2%	Monthly or as required.

[1] All accuracy requirements pertain to the final recorded value which is inclusive of the data acquisition system.

TABLE 4.—FEDERAL TEST FUEL SPECIFICATIONS

Item	Procedure (ASTM) [1]	Value (type 2–D)
Cetane	D613–86	42–48
Distillation Range:		
IPB, °C	D86–90	171–204
10% point, °C	D86–90	204–235
50% point, °C	D86–90	243–283
90% point, °C	D86–90	293–332
EP, °C	D86–90	321–366
Gravity, API	D287–92	33–37
Total sulfur, % mass	D129–91 or D2622–92	>0.05–0.5
Hydrocarbon composition:		
Aromatics, % vol.	D1319–89	[2] 10
Parafins	D1319–89	([3])
Napthenes		
Olefins		
Flashpoint, °C (minimum)	D93–90	54
Viscosity @ 38 °C, centistokes	D445–88	2.0–3.2

[1] All ASTM procedures in this table have been incorporated by reference. See § 89.6.
[2] Minimum.
[3] Remainder.

* * * * *

Appendix A, Table 5 [Amended]

58. Table 5 of Appendix A to subpart D is amended by revising the heading to read as follows:

* * * * *

TABLE 5.—CALIFORNIA TEST FUEL SPECIFICATIONS

* * * * *

Subpart E—[Amended]

59. The newly designated § 89.401 is amended by revising paragraph (b) to read as follows:

§ 89.401 Scope; applicability.

* * * * *

(b) Exhaust gases, either raw or dilute, are sampled while the test engine is operated using the appropriate test cycle on an engine dynamometer. The exhaust gases receive specific component analysis determining concentration of pollutant, exhaust volume, the fuel flow, and the power output during each mode. Emissions are reported as grams per kilowatt hour (g/kW-hr).

* * * * *

60. The newly designated § 89.402 is revised to read as follows:

§ 89.402 Definitions.

The definitions in subpart A of this part apply to this subpart. For terms not defined in this part, the definitions in part 86, subparts A, D, I, and N, of this chapter apply to this subpart.

61. The newly designated § 89.404 is amended by revising paragraph (b) and removing paragraph (e) to read as follows:

§ 89.404 Test procedure overview.

* * * * *

(b) The test is designed to determine the brake-specific emissions of hydrocarbons, carbon monoxide, oxides of nitrogen, and particulate matter. For more information on particulate matter sampling, see § 89.112(c). The test cycles consist of various steady-state operating modes that include different combinations of engine speeds and loads. These procedures require the determination of the concentration of each pollutant, exhaust volume, the fuel flow, and the power output during each mode. The measured values are weighted and used to calculate the grams of each pollutant emitted per kilowatt hour (g/kW-hr).

* * * * *

62. The newly designated § 89.405 is amended by revising paragraphs (d), (e), and (f) to read as follows:

§ 89.405 Recorded information.

* * * * *

(d) Test data; pre-test.

(1) Date and time of day.

(2) Test number.

(3) Intermediate speed and rated speed as defined in § 89.2 and maximum observed torque for these speeds.

(4) Recorder chart or equivalent. Identify for each test segment zero traces for each range used, and span traces for each range used.

(5) Air temperature after and pressure drop across the charge air cooler (if applicable) at maximum observed torque and rated speed.

(e) Test data; modal.

(1) Recorder chart or equivalent. Identify for each test mode the emission concentration traces and the associated analyzer range(s). Identify the start and finish of each test.

(2) Observed engine torque.

(3) Observed engine rpm.

(4) Record engine torque and engine rpm continuously during each mode with a chart recorder or equivalent recording device.

(5) Intake air flow (for raw mass flow sampling method only) and depression for each mode.

(6) Engine intake air temperature at the engine intake or turbocharger inlet for each mode.

(7) Mass fuel flow (for raw sampling) for each mode.

(8) Engine intake humidity.

(9) Coolant temperature outlet.

(10) Engine fuel inlet temperature at the pump inlet.

(f) Test data; post-test.

(1) Recorder chart or equivalent. Identify the zero traces for each range used and the span traces for each range used. Identify hangup check, if performed.

(2) Total number of hours of operation accumulated on the engine.

63. The newly designated § 89.406 is amended by revising paragraphs (b) and (c)(1) to read as follows:

§ 89.406 Pre-test procedures.

* * * * *

(b) Replace or clean the filter elements and then vacuum leak check the system per § 89.316(a). Allow the heated sample line, filters, and pumps to reach operating temperature.

(c) * * *

(1) Check the sample-line temperatures (see § 89.309 (a)(4)(ii) and (a)(5)(i)(A)).

* * * * *

64. The newly designated § 89.407 is amended by revising paragraphs (a), (c), and (d)(2) to read as follows:

§ 89.407 Engine dynamometer test run.

(a) Measure and record the temperature of the air supplied to the engine, the fuel temperature, the intake air humidity, and the observed barometric pressure during the sampling for each mode. The fuel temperature shall be less than or equal to 43 °C during the sampling for each mode.

* * * * *

(c) The following steps are taken for each test:

(1) Install instrumentation and sample probes as required.

(2) Perform the pre-test procedure as specified in § 89.406.

(3) Read and record the general test data as specified in § 89.405(c).

(4) Start cooling system.

(5) Precondition (warm up) the engine in the following manner:

(i) For variable-speed engines:

(A) Operate the engine at idle for 2 to 3 minutes;

(B) Operate the engine at approximately 50 percent power at the peak torque speed for 5 to 7 minutes;

(C) Operate the engine at rated speed and maximum horsepower for 25 to 30 minutes;

(ii) For constant-speed engines:

(A) Operate the engine at minimum load for 2 to 3 minutes;

(B) Operate the engine at 50 percent load for 5 to 7 minutes;

(C) Operate the engine at maximum load for 25 to 30 minutes;

(iii) Optional. It is permitted to precondition the engine at rated speed and maximum horsepower until the oil and water temperatures are stabilized. The temperatures are defined as stabilized if they are maintained within ±2 percent of point on an absolute basis for 2 minutes. The engine must be operated a minimum of 10 minutes for this option. This optional procedure may be substituted for the procedure in paragraph (c)(5)(i)or (c)(5)(ii) of this section;

(iv) Optional. If the engine has been operating on service accumulation for a minimum of 40 minutes, the service accumulation may be substituted for the procedure in paragraphs (c)(5)(i) through (iii) of this section.

(6) Read and record all pre-test data specified in § 89.405(d).

(7) Start the test cycle (see § 89.410) within 20 minutes of the end of the warmup. (See paragraph (c)(13) of this section.) A mode begins when the speed and load requirements are stabilized to within the requirements of § 89.410(b). A mode ends when valid emission sampling for that mode ends. For a mode to be valid, the speed and load requirements must be maintained continuously during the mode. Sampling in the mode may be repeated until a valid sample is obtained as long as the speed and torque requirements are met.

(8) Calculate the torque for any mode with operation at rated speed.

(9) During the first mode with intermediate speed operation, if applicable, calculate the torque corresponding to 75 and 50 percent of the maximum observed torque for the intermediate speed.

(10) Record all modal data specified in § 89.405(e) during a minimum of the last 60 seconds of each mode.

(11) Record the analyzer(s) response to the exhaust gas during the minimum of the last 60 seconds of each mode.

(12) Test modes may be repeated, as long as the engine is preconditioned by running the previous mode. In the case of the first mode of any cycle, precondition according to paragraph (c)(5) of this section.

(13) If a delay of more than 20 minutes, but less than 4 hours, occurs between the end of one mode and the beginning of another mode, precondition the engine by running the previous mode. If the delay exceeds 4 hours, the test shall include preconditioning (begin at paragraph (c)(2) of this section).

(14) The speed and load points for each mode are listed in Tables 1 through 4 of Appendix B of this subpart. The engine speed and load shall be maintained as specified in § 89.410(b).

(15) If at any time during a test mode, the test equipment malfunctions or the specifications in paragraph (c)(14) of this section are not met, the test mode is void and may be aborted. The test mode may be restarted by preconditioning with the previous mode.

(16) Fuel flow and air flow during the idle load condition may be determined just prior to or immediately following the dynamometer sequence, if longer times are required for accurate measurements.

(d) * * *

(2) Each analyzer range that may be used during a test mode must have the zero and span responses recorded prior to the execution of the test . Only the zero and span for the range(s) used to measure the emissions during the test are required to be recorded after the completion of the test .

* * * * *

65. The newly designated § 89.408 is amended by revising paragraph (e) to read as follows:

§ 89.408 Post-test procedures.

* * * * *

(e) For a valid test, the zero and span checks performed before and after each test for each analyzer must meet the following requirements:

(1) The span drift (defined as the change in the difference between the zero response and the span response) must not exceed 3 percent of full-scale chart deflection for each range used.

(2) The zero response drift must not exceed 3 percent of full-scale chart deflection.

66. The newly designated § 89.410 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§ 89.410 Engine test cycle.

(a) *Test cycles.* The manufacturer shall determine from of the following test cycles the most appropriate cycle for each engine family using the following guidelines. These cycles shall be used to test engines on a dynamometer.

(1) The 8-mode test cycle described in Table 1 of Appendix B of this subpart may be used for any land-based or auxiliary marine diesel engine.

(2) The 5-mode test cycle described in Table 2 of Appendix B of this subpart may be used for any constant-speed engine (see § 89.2). Any engine certified under this test cycle must meet the labeling requirements of § 89.110(b)(11).

(3) The 6-mode test cycle described in Table 3 of Appendix B of this subpart may be used for any land-based or auxiliary marine diesel engine rated under 19 kW.

(4) The 4-mode test cycle described in Table 4 of Appendix B of this subpart is intended for all propulsion marine diesel engines. Manufacturers may measure emissions from propulsion marine diesel engines using the 8-mode test cycle described in Table 1 of Appendix B of this subpart if the engine has been derived from a model already certified with that cycle, if approved in advance by the Administrator.

(b) During each non-idle mode, hold the specified load to within 2 percent of the engine maximum value and speed to within ±2 percent of point. During each idle mode, speed must be held within the manufacturer's specifications for the engine, and the throttle must be in the fully closed position and torque must not exceed 5 percent of the peak torque value of mode 5.

(c) For any mode except those involving either idle or full-load operation, if the operating conditions specified in paragraph (b) of this section cannot be maintained, the Administrator may authorize deviations from the specified load conditions. Such deviations shall not exceed 10 percent of the maximum torque at the test speed. The minimum deviations above and below the specified load necessary for stable operation shall be determined by the manufacturer and approved by the Administrator prior to the test run.

* * * * *

67. The newly designated § 89.411 is amended by revising paragraph (e)(5) to read as follows:

§ 89.411 Exhaust sample procedure—gaseous components.

* * * * *

(e) * * *

(5) If the difference between the readings obtained is 2 percent of full scale deflection or more, clean the sample probe and the sample line.

* * * * *

68. The newly designated § 89.412 is amended by revising paragraph (c)(3) and removing and reserving paragraph (g)(1) to read as follows:

§ 89.412 Raw gaseous exhaust sampling and analytical system description.

* * * * *

(c) * * *

(3) The location of optional valve V16 may not be greater than 61 cm from the sample pump.

* * * * *

(g) * * *

(1) [Reserved]

* * * * *

69. The newly designated § 89.413 is amended by revising paragraph (d) and removing paragraph (e) to read as follows:

§ 89.413 Raw sampling procedures.

* * * * *

(d) All heated sampling lines shall be fitted with a heated filter to extract solid particles from the flow of gas required for analysis. The sample line for CO and CO_2 analysis may be heated or unheated.

70. The newly designated § 89.414 is amended by revising paragraph (a) to read as follows:

§ 89.414 Air flow measurement specifications.

(a) The air flow measurement method used must have a range large enough to accurately measure the air flow over the engine operating range during the test. Overall measurement accuracy must be ±2 percent of the maximum engine value for all modes. The Administrator must be advised of the method used prior to testing.

* * * * *

71. The newly designated § 89.415 is revised to read as follows:

§ 89.415 Fuel flow measurement specifications.

The fuel flow rate measurement instrument must have a minimum accuracy of 2 percent of the engine maximum fuel flow rate. The controlling parameters are the elapsed time measurement of the event and the weight or volume measurement.

72. The newly designated § 89.418 is amended by revising paragraphs (c) and (d), the table in paragraph (e), paragraphs (f) introductory text and (f)(1), and the text of paragraph (g) preceding the equation to read as follows:

§ 89.418 Raw emission sampling calculations.

* * * * *

(c) When applying G_{EXHW} the measured ''dry'' concentration shall be corrected to a wet basis, if not already measured on a wet basis. This section is applicable only for measurements made on raw exhaust gas. Correction to a wet basis shall be according to the following formula:

$Conc_{WET} = K_W \times Conc_{\text{''dry''}}$

Where:

K_W is determined according to the equations in paragraphs (c)(1), (c)(2), and (c)(3) of this section.

(1) For measurements using the mass flow method (see § 89.416(a)):

$$K_W = \left[1 - F_{FH} \times \frac{G_{fuel}}{G_{aird}}\right] - K_{W1} \quad \text{only applicable for raw exhaust}$$

$$F_{FH} = ALF \times 0.1448 \times \frac{1}{1 + \left(\frac{G_{fuel}}{G_{airw}}\right)} \quad \text{for diesel fuel only}$$

ALF=Hydrogen mass percentage of fuel
= 13.12 for $CH_{1.8}$ fuel.

$$ALF = \frac{1.008 \times \alpha}{12.01 + 1.008 \times \alpha} \times 100$$

α=H/C mole ratio of the fuel.

(2) For measurements using the fuel consumption and exhaust gas concentrations method (see § 89.416(b)):

$$K_W = \frac{1}{1 + 1.8 \times 0.005 \times \left[\frac{DCO}{10^4} + DCO_2\right]} - K_{W1}$$

$$\left(\frac{f}{a}\right) = \frac{4.77(1+\alpha/4)(f/a)(f/a)\ stoich}{\frac{1}{X}\left[\frac{DCO}{2\times(10)^6}\right] - \left(\frac{DHC}{\times(10)^6}\right) + \frac{\alpha}{4}\left(1 - \frac{DHC}{\times(10)^6}\right) - \frac{.75\alpha}{\left(\frac{K}{\frac{DCO}{\times(10)^6}}\right) + \left(\frac{(1-K)}{1-\frac{DHC}{\times(10)^6}}\right)}}$$

or

$$\left(\frac{f}{a}\right) = \frac{G_{fuel}}{G_{aird}} = \frac{\text{Mass Fuel Measured}}{G_{airw} \times \left(1 - \frac{H}{1000}\right)}$$

K=3.5

$$X = \frac{DCO_2}{10^2} + \frac{DCO}{10^6} + \frac{DHC}{10^6}$$

$$(f/a)Stoich = \frac{M_{c+}\alpha M_H}{138.18(1+\alpha/4)}$$

(3) For both methods, H is calculated as specified in paragraph (d)(1) of this section:

$$K_{W1} = \frac{1.608 \times H}{1000 + 1.608 \times H}$$

(d) As the NO_X emission depends on intake air conditions, the NO_X concentration shall be corrected for intake air temperature and humidity with the factor K_H given in the following formula. For engines operating on alternative combustion cycles, other correction formulas may be used if they can be justified or validated. The formula follows:

$$K_H = \frac{1}{1 + A(H - 10.71) + B(T - 298)}$$

Where:

A=0.309 (f/a)–0.0266

B=−0.209 (f/a)+0.00954

T=temperature of the air in K

H=humidity of the inlet air in grams of water per kilogram of dry air, in which:

$$H = \frac{6.22 \times R_a \times p_d}{p_R - (p_d \times R_a \times 10^{-2})}$$

or

$$H = \frac{622 \times P_v}{(P_B - P_v)}$$

(e) * * *

Gas	u	v	w	Conc.
NO_X	0.001587	0.00205	0.00205	ppm.
CO	0.000966	0.00125	0.00125	ppm.
HC	0.000478	—	0.000618	ppm.
CO_2	15.19	19.64	19.64	Percent.

NOTE: The given coefficients u, v, and w are calculated for 273.15 °K (0 °C) and 101.3 kPa. In cases where the reference conditions vary from those stated, an error may occur in the calculations.

(f) The following equations may be used to calculate the coefficients u, v, and w in paragraph (e) of this section for other conditions of temperature and pressure:

(1) For the calculation of u, v, and w for NO_X (as NO_2), CO, HC (in paragraph (e) of this section as $CH_{1.80}$), CO_2, and O_2:

Where:

$w = 4.4615 . 10^{-5} \times M$ if conc. in ppm

$w = 4.4615 . 10^{-1} \times M$ if conc. in percent

v=w

$u = w/\rho_{Air}$

M=Molecular weight

ρ_{Air}=Density of dry air at 273.15 °K (0 °C), 101.3 kPa=1.293 kg/m^3

* * * * *

(g) The emission shall be calculated for all individual components in the following way where power at idle is equal to zero:

* * * * *

§ 89.423 [Removed and reserved]

73. Remove and reserve the newly designated § 89.423.

74. The newly designated § 89.424 is amended by revising paragraphs (a), (d)(6), and (e) to read as follows:

§ 89.424 Dilute emission sampling calculations.

(a) The final reported emission test results are computed by use of the following formula:

$$A_{WM} = \frac{\sum_{i=1}^{i=n} (g_i \times WF_i)}{\sum_{i=1}^{i=n-1} (P_i \times WF_i)}$$

Where:

A_{wm}=Weighted mass emission level (HC, CO, CO_2, PM, or NO_X) in g/kW-hr.

g_i=Mass flow in grams per hour, = grams measured during the mode divided by the sample time for the mode.

WF_i=Effective weighing factor.

P_i=Power measured during each mode (Power set = zero for the idle mode)

* * * * *

(d) * * *

(6) Equations for H and K_H are found in § 89.418.

Wet concentration = Kw X dry concentration

Where:

Kw=

$1-(\alpha/200)\times CO_{2e}(') - ((1.608\times H)/(7000+1.608\times H))$, or

$1-(\alpha/200)\times CO_{2e}(') - ((1.608\times H)/(1000+1.608\times H))$

for SI units.

$CO_{2e}(')$ = either CO_{2e} or CO_{2e}' as applicable.

$CO_{2e}(')$ = average intergrated carbon dioxide concentration (wet basis) in percent (for continuous measurement).

(e) The final modal reported brake-specific fuel consumption (bsfc) shall be computed by use of the following formula:

$$bsfc = \frac{M}{kW - hr}$$

Where:

bsfc = brake-specific fuel consumption for a mode in grams of fuel per kilowatt-hour (kW-hr).

M = mass of fuel in grams, used by the engine during a mode.

kW-hr = total kilowatts integrated with respect to time for a mode.

* * * * *

§ 89.425 [Removed and reserved]

75. Remove and reserve the newly designated § 89.425.

76.–80. Appendix B to subpart E of part 89 is revised to read as follows:

Appendix B to Subpart E of Part 89—Tables

TABLE 1.—8-MODE TEST CYCLE FOR VARIABLE-SPEED ENGINES

Test segment	Mode No.	Engine speed [1]	Observed torque [2] (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
1	1	Rated	100	5.0	0.15
1	2	Rated	75	5.0	.15
1	3	Rated	50	5.0	.15
1	4	Rated	10	5.0	.10
2	5	Int	100	5.0	.10
2	6	Int	75	5.0	.10
2	7	Int	50	5.0	.10

TABLE 1.—8-MODE TEST CYCLE FOR VARIABLE-SPEED ENGINES—Continued

Test segment	Mode No.	Engine speed [1]	Observed torque [2] (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
2	8	Idle	0	5.0	.15

[1] Engine speed (non-idle): ±2 percent of point. Engine speed (idle): Within manufacturer's specifications. Idle speed is specified by the manufacturer.
[2] Torque (non-idle): Throttle fully open for 100 percent points. Other non-idle points: ±2 percent of engine maximum value. Torque (idle): Throttle fully closed. Load less than 5 percent of peak torque.

TABLE 2.—5-MODE TEST CYCLE FOR CONSTANT-SPEED ENGINES

Mode No.	Engine speed [1]	Observed torque [2] (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
1	Rated	100	5.0	0.05
2	Rated	75	5.0	0.25
3	Rated	50	5.0	0.30
4	Rated	25	5.0	0.30
5	Rated	10	5.0	0.10

[1] Engine speed: ±2 percent of point.
[2] Torque: Throttle fully open for 100 percent point. Other points: ±2 percent of engine maximum value.

TABLE 3.—6-MODE TEST CYCLE FOR ENGINES RATED UNDER 19 KW

Mode No.	Engine speed [1]	Observed torque [2] (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
1	Rated	100	5.0	0.09
2	Rated	75	5.0	.20
3	Rated	50	5.0	.29
4	Rated	25	5.0	.30
5	Rated	10	5.0	.07
6	Idle	0	5.0	.05

[1] Engine speed (non-idle): ±2 percent of point. Engine speed (idle): Within manufacturer's specifications. Idle speed is specified by the manufacturer.
[2] Torque (non-idle): Throttle fully open for operation at 100 percent point. Other nonidle points: ±2 percent of engine maximum value. Torque (idle): Throttle fully closed. Load less than 5 percent of peak torque.

TABLE 4.—4-MODE TEST CYCLE FOR PROPULSION MARINE DIESEL ENGINES

Mode No.	Engine speed [1] (percent of max. observed)	Observed power [2] (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
1	100	100	5.0	020
2	91	75	5.0	.50
3	80	50	5.0	.15
4	63	10	5.0	.15

[1] Engine speed: ±2 percent of point.
[2] Power: Throttle fully open for operation at 100 percent point. Other points: ±2 percent of engine maximum value.

Subpart F—[Amended]

81. The newly designated § 89.505 is amended by revising paragraph (e) to read as follows:

§ 89.505 Maintenance of records; submittal of information.

*   *   *   *   *

(e) All reports, submissions, notifications, and requests for approvals made under this subpart are addressed to: Director, Engine Programs and Compliance Division (6405–J), U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460.

82. The newly designated § 89.506 is amended by revising paragraph (g) to read as follows:

§ 89.506 Right of entry and access.

*   *   *   *   *

(g) A manufacturer is responsible for locating its foreign testing and manufacturing facilities in jurisdictions where local law does not prohibit an EPA enforcement officer(s) or EPA authorized representative(s) from conducting the entry and access activities specified in this section. EPA will not attempt to make any inspections which it has been informed that local foreign law prohibits.

83. The newly designated § 89.509 is amended by revising paragraphs (a) and (b) to read as follows:

§ 89.509 Calculation and reporting of test results.

(a) Initial test results are calculated following the applicable test procedure specified in § 89.508(a). The manufacturer rounds these results, in accordance with ASTM E29–93a, to the number of decimal places contained in the applicable emission standard expressed to one additional significant figure. This procedure has been incorporated by reference. See § 89.6.

(b) Final test results are calculated by summing the initial test results derived in paragraph (a) of this section for each test engine, dividing by the number of tests conducted on the engine, and rounding in accordance with the procedure specified in paragraph (a) of this section to the same number of decimal places contained in the applicable standard expressed to one additional significant figure.

* * * * *

84. The newly designated § 89.512 is amended by revising paragraph (b) to read as follows:

§ 89.512 Request for public hearing.

* * * * *

(b) The manufacturer's request must be filed with the Administrator not later than 15 days after the Administrator's notification of the decision to suspend or revoke, unless otherwise specified by the Administrator. The manufacturer must simultaneously serve two copies of this request upon the Director of the Engine Programs and Compliance Division and file two copies with the Hearing Clerk of the Agency. Failure of the manufacturer to request a hearing within the time provided constitutes a waiver of the right to a hearing. Subsequent to the expiration of the period for requesting a hearing as of right, the Administrator may, at her or his discretion and for good cause shown, grant the manufacturer a hearing to contest the suspension or revocation.

* * * * *

85. The newly designated § 89.513 is amended by revising paragraph (e)(2) to read as follows.

§ 89.513 Administrative procedures for public hearing.

* * * * *

(e) * * *

(2) To the maximum extent possible, testimony will be presented in written form. Copies of written testimony will be served upon all parties as soon as practicable prior to the start of the hearing. A certificate of service will be provided on or accompany each document or paper filed with the Hearing Clerk. Documents to be served upon the Director of the Engine Programs and Compliance Division must be sent by registered mail to: Director, Engine Programs and Compliance Division (6405–J), U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460. Service by registered mail is complete upon mailing.

* * * * *

Subpart G—[Amended]

86. The newly designated § 89.602 is amended by revising the definition for ''Fifteen working day hold period'' to read as follows:

§ 89.602 Definitions.

* * * * *

Fifteen working day hold period. The period of time between a request for final admission and the automatic granting of final admission (unless EPA intervenes) for a nonconforming nonroad engine conditionally imported pursuant to § 89.605 or § 89.609. Day one of the hold period is the first working day (see definition for ''working day'' in this section) after the Engine Programs and Compliance Division of EPA receives a complete and valid application for final admission.

* * * * *

87. The newly designated § 89.603 is amended by revising paragraph (d) to read as follows:

§ 89.603 General requirements for importation of nonconforming nonroad engines.

* * * * *

(d) The ICI must submit to the Engine Programs and Compliance Division of EPA a copy of all approved applications for certification used to obtain certificates of conformity for the purpose of importing nonconforming nonroad engines pursuant to § 89.605 or § 89.609. In addition, the ICI must submit to the Engine Programs and Compliance Division a copy of all approved production changes implemented pursuant to § 89.605 or subpart B of this part. Documentation submitted pursuant to this paragraph must be provided to the Engine Programs and Compliance Division within 10 working days of approval of the certification application (or production change) by EPA.

88. The newly designated § 89.604 is amended by revising paragraphs (c)(4) and (d) to read as follows:

§ 89.604 Conditional admission.

* * * * *

(c) * * *

(4) A copy of the written record is to be submitted to the Engine Programs and Compliance Division of EPA within five working days of the transfer date.

(d) Notwithstanding any other requirement of this subpart or U.S. Customs Service regulations, an ICI may also assume responsibility for the modification and testing of a nonconforming nonroad engine which was previously imported by another party. The ICI must be a holder of a currently valid certificate of conformity for that specific nonroad engine or authorized to import it pursuant to § 89.609 at the time of assuming such responsibility. The ICI must comply with all the requirements of § 89.603, § 89.604, and either § 89.605 or § 89.609, as applicable. For the purposes of this subpart, the ICI has ''imported'' the nonroad engine as of the date the ICI assumes responsibility for the modification and testing of the nonroad engine. The ICI must submit written notification to the Engine Programs and Compliance Division of EPA within 10 working days of the assumption of that responsibility.

89. The newly designated § 89.605 is amended by revising paragraphs (a)(2)(i), (a)(3)(vi), and (c) to read as follows:

§ 89.605 Final admission of certified nonroad engines.

(a) * * *

(2) * * *

(i) The ICI attests that the nonroad engine has been modified in accordance with the provisions of the ICI's certificate of conformity; presents to EPA a statement written by the applicable Original Engine Manufacturer (OEM) that the OEM must provide to the ICI, and to EPA, information concerning production changes to the class of nonroad engines described in the ICI's application for certification; delivers to the Engine Programs and Compliance Division of EPA notification by the ICI of any production changes already implemented by the OEM at the time of application and their effect on emissions; and obtains from EPA written approval to use this demonstration option; or

* * * * *

(3) * * *

(vi) A report concerning these production changes is to be made to the Engine Programs and Compliance Division of EPA within ten working days of initiation of the production change. The cause of any failure of an emission test is to be identified, if known;

* * * * *

(c) Except as provided in paragraph (b) of this section, EPA approval for final admission of a nonroad engine under this section is presumed to have been granted if the ICI does not receive oral or written notice from EPA to the contrary within 15 working days of the date that the Engine Programs and Compliance Division of EPA receives the ICI's application under paragraph (a) of this section. EPA notice of nonapproval may be made to any employee of the ICI. It is the responsibility of the ICI to ensure that the Engine Programs and Compliance Division of EPA receives the application and to confirm the date of receipt. During this 15 working day hold period, the nonroad engine is to be stored at a location where the Administrator has reasonable access to the nonroad engine for the Administrator's inspection. The storage is to be within 50 miles of the ICI's testing facility to allow the Administrator reasonable access for inspection and testing. A storage facility not meeting this criterion must be approved in writing by the Administrator prior to the submittal of the ICI's application under paragraph (a) of this section.

90. The newly designated § 89.609 is amended by revising paragraph (d) to read as follows:

§ 89.609 Final admission of modification nonroad engines and test nonroad engines.

* * * * *

(d) Except as provided in paragraph (c) of this section, EPA approval for final admission of a nonroad engine under this section is presumed to have been granted if the ICI does not receive oral or written notice from EPA to the contrary within 15 working days of the date that the Engine Programs and Compliance Division of EPA receives the ICI's application under paragraph (b) of this section. Such EPA notice of nonapproval may be made to any employee of the ICI. It is the responsibility of the ICI to ensure that the Engine Programs and Compliance Division of EPA receives the application and to confirm the date of receipt. During this 15 working day hold period, the nonroad engine is stored at a location where the Administrator has reasonable access to the nonroad engine for the Administrator's inspection. The storage is to be within 50 miles of the ICI's testing facility to allow the Administrator reasonable access for inspection and testing. A storage facility not meeting this criterion must be approved in writing by the Administrator prior to the submittal of the ICI's application under paragraph (b) of this section.

* * * * *

91. The newly designated § 89.610 is amended by revising paragraph (b)(1) to read as follows:

§ 89.610 Maintenance instructions, warranties, emission labeling.

* * * * *

(b) *Warranties.* (1) ICIs must submit to the Engine Programs and Compliance Division of EPA sample copies (including revisions) of any warranty documents required by this section prior to importing nonroad engines under this subpart.

* * * * *

92. The newly designated § 89.611 is amended by revising paragraph (g) to read as follows:

§ 89.611 Exemptions and exclusions.

* * * * *

(g) An application for exemption and exclusion provided for in paragraphs (b), (c), and (e) of this section is to be mailed to: U.S. Environmental Protection Agency, Office of Mobile Sources, Engine Programs and Compliance Division (6405–J), 401 M Street, SW., Washington, DC 20460, Attention: Imports.

Subpart J—[Amended]

93. Section 89.903 is amended by revising paragraph (b) to read as follows:

§ 89.903 Application of section 216(10) of the Act.

* * * * *

(b) EPA will maintain a list of nonroad engines that have been determined to be excluded because they are used solely for competition. This list will be available to the public and may be obtained by writing to the following address: Chief, Selective Enforcement Auditing Section, Engine Programs and Compliance Division (6405-–J), Environmental Protection Agency, 401 M Street SW, Washington, DC 20460.

* * * * *

94. Section 89.905 is amended by revising paragraph (f) to read as follows:

§ 89.905 Testing exemption.

* * * * *

(f) A manufacturer of new nonroad engines may request a testing exemption to cover nonroad engines intended for use in test programs planned or anticipated over the course of a subsequent one-year period. Unless otherwise required by the Director, Engine Programs and Compliance Division, a manufacturer requesting such an exemption need only furnish the information required by paragraphs (a)(1) and (d)(2) of this section along with a description of the record-keeping and control procedures that will be employed to assure that the engines are used for purposes consistent with paragraph (a) of this section.

95. Section 89.906 is amended by revising paragraphs (a)(3) introductory text, (a)(3)(iii)(D), and (b) to read as follows:

§ 89.906 Manufacturer-owned exemption and precertification exemption.

(a) * * *

(3) Unless the requirement is waived or an alternate procedure is approved by the Director, Engine Programs and Compliance Division, the manufacturer must permanently affix a label to each nonroad engine on exempt status. This label should—

* * * * *

(iii) * * *

(D) The statement ''This nonroad engine is exempt from the prohibitions of 40 CFR 89.1003.''

* * * * *

(b) Any independent commercial importer that desires a precertification exemption pursuant to § 89.611(b)(3) and is in the business of importing, modifying, or testing uncertified nonroad engines for resale under the provisions of subpart G of this part, must apply to the Director, Engine Programs and Compliance Division. The Director may require such independent commercial importer to submit information regarding the general nature of the fleet activities, the number of nonroad engines involved, and a demonstration that adequate record-keeping procedures for control purposes will be employed.

96. Section 89.911 is revised to read as follows:

§ 89.911 Submission of exemption requests.

Requests for exemption or further information concerning exemptions and/or the exemption request review procedure should be addressed to: Chief, Selective Enforcement Auditing Section, Engine Programs and Compliance Division (6405–J), Environmental Protection Agency, 401 M Street SW, Washington, DC 20460.

97. Section 89.1003 is amended by revising paragraphs (a)(3), (a)(5), (a)(6), and (b)(4) to read as follows:

§ 89.1003 Prohibited acts.

(a) * * *

(3)(i) For a person to remove or render inoperative a device or element of design installed on or in a nonroad engine, vehicle or equipment in compliance with regulations under this part prior to its sale and delivery to the ultimate purchaser, or for a person knowingly to remove or render inoperative such a device or element of design after the sale and delivery to the ultimate purchaser; or

(ii) For a person to manufacture, sell or offer to sell, or install, a part or component intended for use with, or as part of, a nonroad engine, vehicle or equipment, where a principal effect of the part or component is to bypass, defeat, or render inoperative a device or element of design installed on or in a nonroad engine in compliance with regulations issued under this part, and where the person knows or should know that the part or component is being offered for sale or installed for this use or put to such use; or

(iii) for a person to deviate from the provisions of § 89.130 when rebuilding an engine (or rebuilding a portion of an engine or engine system).

* * * * *

(5) For a person to circumvent or attempt to circumvent the residence time requirements of paragraph (2)(iii) of the nonroad engine definition in § 89.2.

(6) For a manufacturer of nonroad vehicles or equipment to distribute in commerce, sell, offer for sale, or introduce into commerce a nonroad vehicle or piece of equipment, manufactured on or after the model year applicable to engines in such vehicle or equipment under § 89.112, which contains an engine not covered by a certificate of conformity.

(b) * * *

(4) Certified nonroad engines shall be used in all vehicles and equipment manufactured on or after the applicable model years in § 89.112 that are self-propelled, portable, transportable, or are intended to be propelled while performing their function, unless the manufacturer of the vehicle or equipment can prove that the vehicle or equipment will be used in a manner consistent with paragraph (2) of the definition of nonroad engine in § 89.2. For any model year for which a new standard takes effect, nonroad vehicle and equipment manufacturers may continue to use previous model year nonroad engines until inventories of those engines are depleted; however, stockpiling of noncertified nonroad engines will be considered a violation of this section.

98. Section 89.1007 is amended by revising paragraph (c) to read as follows:

§ 89.1007 Warranty provisions.

* * * * *

(c) For the purposes of this section, the owner of any nonroad engine warranted under this part is responsible for the proper maintenance of the engine. Proper maintenance includes replacement and service, at the owner's expense at a service establishment or facility of the owner's choosing, of all parts, items, or devices related to emission control (but not designed for emission control) under the terms of the last sentence of section 207(a)(3) of the Act, unless such part, item, or device is covered by any warranty not mandated by this Act.

[FR Doc. 97–24237 Filed 9–23–97; 8:45 am]

BILLING CODE 6560–50–P