Federal Register

Friday,

May 18, 2007

Part II

Environmental Protection Agency

40 CFR Parts 60, 63, et al.

Control of Emissions from Nonroad Spark-Ignition Engines and Equipment; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 60, 63, 85, 89, 90, 91, 1027, 1045, 1048, 1051, 1054, 1060, 1065, 1068, and 1074

[EPA–HQ–OAR–2004–0008; FRL–8303–7]

RIN 2060–AM34

Control of Emissions from Nonroad Spark-Ignition Engines and Equipment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: We are proposing emission standards for new nonroad spark-ignition engines that will substantially reduce emissions from these engines. The proposed exhaust emission standards would apply in 2009 for new marine spark-ignition engines, including first-time EPA standards for sterndrive and inboard engines. The proposed exhaust emission standards would apply starting in 2011 and 2012 for different sizes of new land-based, spark-ignition engines at or below 19 kilowatts (kW). These small engines are used primarily in lawn and garden applications. We are also proposing evaporative emission standards for vessels and equipment using any of these engines. In addition, we are making other minor amendments to our regulations. We estimate that by 2030, the proposed standards would result in significant annual reductions of pollutant emissions from regulated engine and equipment sources nationwide, including 631,000 tons of volatile organic hydrocarbon emissions, 98,200 tons of NO_X emissions, and 6,300 tons of direct particulate matter ($PM_{2.5}$) emissions. These reductions correspond to significant reductions in the formation of ground-level ozone. We also expect to see annual reductions of 2,690,000 tons of carbon monoxide emissions, with the greatest reductions in areas where there have been problems with individual exposures. The requirements in this proposal would result in substantial benefits to public health and welfare and the environment. We estimate that by 2030, on an annual basis, these emission reductions would prevent 450 PM-related premature deaths, approximately 500 hospitalizations, 52,000 work days lost, and other quantifiable benefits every year. The total estimated annual benefits of this rule in 2030 are approximately $3.4 billion. Estimated costs in 2030 are many times less at approximately $240 million.

DATES: *Comments:* Comments must be received on or before August 3, 2007. Under the Paperwork Reduction Act, comments on the information collection provisions must be received by OMB on or before June 18, 2007.

ADDRESSES: Submit your comments, identified by Docket No. EPA–HQ–OAR–2004–0008, by one of the following methods:

www.regulations.gov: Follow the on-line instructions for submitting comments.

E-mail: a-and-r-docket@epa.gov.

Fax: (202) 260–4400.

Mail: Environmental Protection Agency, Air Docket, Mail-code 6102T, 1200 Pennsylvania Ave., NW., Washington, DC 20460. In addition, please mail a copy of your comments on the information collection provisions to the Office of Information and Regulatory Affairs, Office of Management and Budget (OMB), Attn: Desk Officer for EPA, 725 17th St., NW., Washington, DC 20503.

Hand Delivery: EPA Docket Center (EPA/DC), EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC, Attention Docket No. EPA–HQ–OAR–2004–0008. Such deliveries are accepted only during the Docket's normal hours of operation, special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2004–0008. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *www.regulations.gov* or e-mail. The *www.regulations.gov* Web site is an ''anonymous access'' system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through www.regulations.gov, your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional instructions on submitting comments, go to Unit XIII of the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: All documents in the docket are listed in the *www.regulations.gov* index. Although listed in the index, some information is not publicly available, such as CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the ''Control of Emissions from Nonroad Spark-Ignition Engines, Vessels and Equipment'' Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744 and the telephone number for the ''Control of Emissions from Nonroad Spark-Ignition Engines, Vessels, and Equipment'' Docket is (202) 566–1742.

Hearing: A hearing will be held at 9:30 a.m. on Tuesday, June 5, 2007 at the Sheraton Reston Hotel. The hotel is located at 11810 Sunrise Valley Drive in Reston, Virginia; their phone number is 703–620–9000. For more information on these hearings or to request to speak, see Section XIII.

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

SUPPLEMENTARY INFORMATION:

Does This Action Apply to Me?

This action will affect you if you produce or import new spark-ignition engines intended for use in marine vessels or in new vessels using such engines. This action will also affect you if you produce or import new spark-ignition engines below 19 kilowatts used in nonroad equipment, including agricultural and construction equipment, or produce or import such nonroad vehicles.

The following table gives some examples of entities that may have to follow the regulations; however, since these are only examples, you should carefully examine the proposed regulations. Note that we are proposing minor changes in the regulations that apply to a wide range of products that may not be reflected in the following table (see Section XI). If you have questions, call the person listed in the **FOR FURTHER INFORMATION CONTACT** section of this preamble:

Category	NAICS codes [a]	SIC codes [b]	Examples of potentially regulated entities
Industry	333618	3519	Manufacturers of new engines.
Industry	333111	3523	Manufacturers of farm machinery and equipment.
Industry	333112	3524	Manufacturers of lawn and garden tractors (home).
Industry	336612	3731, 3732	Manufacturers of marine vessels.
Industry	811112, 811198	7533, 7549	Commercial importers of vehicles and vehicle components.

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

What Should I Consider as I Prepare My Comments for EPA?

Submitting CBI. Do not submit this information to EPA through www.regulations.gov or e-mail. Clearly mark the part or all of the information that you claim to be CBI. For CBI information in a disk or CD ROM that you mail to EPA, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

Tips for Preparing Your Comments. When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, **Federal Register** date and page number).
- Follow directions—The agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.
- Explain why you agree or disagree; suggest alternatives and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Make sure to submit your comments by the comment period deadline identified.

Table of Contents

I. Introduction
A. Overview
B. Why Is EPA Taking This Action?
C. What Regulations Currently Apply to Nonroad Engines or Vehicles?
D. Putting This Proposal into Perspective
E. What Requirements Are We Proposing?
F. How Is This Document Organized?
II. Public Health and Welfare Effects
A. Ozone
B. Particulate Matter
C. Air Toxics
D. Carbon Monoxide
III. Sterndrive and Inboard Marine Engines
A. Overview
B. Engines Covered by This Rule
C. Proposed Exhaust Emission Standards
D. Test Procedures for Certification
E. Additional Certification and Compliance Provisions
F. Small-Business Provisions
G. Technological Feasibility
IV. Outboard and Personal Watercraft Engines
A. Overview
B. Engines Covered by This Rule
C. Proposed Exhaust Emission Standards
D. Changes to Existing OB/PWC Test Procedures
E. Additional Certification and Compliance Provisions
F. Other Adjustments to Regulatory Provisions
G. Small-Business Provisions
H. Technological Feasibility
V. Small SI Engines
A. Overview
B. Engines Covered by This Rule
C. Proposed Requirements
D. Testing Provisions
E. Certification and Compliance Provisions for Small SI Engines and Equipment
F. Small Business Provisions
G. Technological Feasibility
VI. Evaporative Emissions
A. Overview
B. Fuel Systems Covered by This Rule
C. Proposed Evaporative Emission Standards
D. Emission Credit Programs
E. Testing Requirements
F. Certification and Compliance Provisions
G. Small-Business Provisions
H. Technological Feasibility
VII. General Concepts Related to Certification and Other Requirements
A. Scope of Application
B. Emission Standards and Testing
C. Demonstrating Compliance
D. Other Concepts
VIII. General Nonroad Compliance Provisions
A. Miscellaneous Provisions (Part 1068, subpart A)
B. Prohibited Acts and Related Requirements (Part 1068, subpart B)
C. Exemptions (Part 1068, subpart C)
D. Imports (Part 1068, subpart D)
E. Selective Enforcement Audit (Part 1068, subpart E)
F. Defect Reporting and Recall (Part 1068, subpart F)
G. Hearings (Part 1068, subpart G)
IX. General Test Procedures
A. Overview
B. Special Provisions for Nonroad Spark-Ignition Engines
X. Energy, Noise, and Safety
A. Safety
B. Noise
C. Energy
XI. Proposals Affecting Other Engine and Vehicle Categories
A. State Preemption
B. Certification Fees
C. Amendments to General Compliance Provisions in 40 CFR Part 1068
D. Amendments Related to Large SI Engines (40 CFR Part 1048)
E. Amendments Related to Recreational Vehicles (40 CFR Part 1051)
F. Amendments Related to Heavy-Duty Highway Engines (40 CFR Part 85)
G. Amendments Related to Stationary Spark-Ignition Engines (40 CFR Part 60)
XII. Projected Impacts
A. Emissions from Small Nonroad and Marine Spark-Ignition Engines
B. Estimated Costs
C. Cost per Ton
D. Air Quality Impact
E. Benefits
F. Economic Impact Analysis
XIII. Public Participation
XIV. Statutory and Executive Order Reviews
A. Executive Order 12866: Regulatory Planning and Review
B. Paperwork Reduction Act
C. Regulatory Flexibility Act
D. Unfunded Mandates Reform Act
E. Executive Order 13132: Federalism

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments
G. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks
H. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.
I. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use
J. National Technology Transfer Advancement Act

I. Introduction

A. Overview

Air pollution is a serious threat to the health and well-being of millions of Americans and imposes a large burden on the U.S. economy. Ground-level ozone is linked to potentially serious health problems, especially respiratory effects, and environmental degradation. Carbon monoxide emissions are also related to health problems. Over the past quarter century, state and federal agencies have established emission control programs that make significant progress in addressing these concerns.

This proposal includes steps that would reduce the mobile-source contribution to air pollution in the United States. In particular, we are proposing standards that would require manufacturers to substantially reduce emissions from marine spark-ignition engines and from nonroad spark-ignition engines below 19 kW that are generally used in lawn and garden applications.[1] We refer to these as Marine SI engines and Small SI engines, respectively. The proposed standards are a continuation of the process of establishing standards for nonroad engines and vehicles as required by Clean Air Act section 213. All the nonroad engines subject to this proposal are already regulated under existing emission standards, except sterndrive and inboard marine engines, which will be subject to EPA emission standards for the first time.

Nationwide, emissions from Marine SI engines and Small SI engines contribute significantly to mobile source air pollution. By 2020 without the proposed requirements these engines will account for about 27 percent (1,352,000 tons) of mobile source volatile organic hydrocarbon compounds (VOC) emissions, 31 percent (16,374,000 tons) of mobile source carbon monoxide (CO) emissions, 4 percent (202,000 tons) of mobile source oxides of nitrogen (NO_X) emissions, and 16 percent (39,000 tons) of mobile source particulate matter ($PM_{2.5}$) emissions. The proposed standards will reduce exposure to these emissions and help avoid a range of adverse health effects associated with ambient ozone, CO, and PM levels. In addition, the proposed standards will help reduce acute exposure to CO, air toxics, and PM for persons who operate or who work with or are otherwise active in close proximity to these engines. They will also help address other environmental problems associated with Marine SI engines and Small SI engines, such as visibility impairment in our national parks and other wilderness areas. These effects are described in more detail in subsequent sections of this Preamble.

B. Why Is EPA Taking This Action?

Clean Air Act section 213(a)(1) directs us to study emissions from nonroad engines and vehicles to determine, among other things, whether these emissions ''cause, or significantly contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.'' Section 213(a)(2) further requires us to determine whether emissions of CO, VOC, and NO_X from all nonroad engines significantly contribute to ozone or CO concentrations in more than one nonattainment area. If we determine that emissions from all nonroad engines do contribute significantly to these nonattainment areas, section 213(a)(3) then requires us to establish emission standards for classes or categories of new nonroad engines and vehicles that cause or contribute to such pollution. We may also set emission standards under section 213(a)(4) regulating any other emissions from nonroad engines that we find contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare.

Specific statutory direction to propose standards for nonroad spark-ignition engines comes from section 428(b) of the 2004 Consolidated Appropriations Act, which requires EPA to propose regulations under the Clean Air Act ''that shall contain standards to reduce emissions from new nonroad spark-ignition engines smaller than 50 horsepower.''[2] As highlighted above and more fully described in Section II, these engines emit pollutants that contribute to ground-level ozone and ambient CO levels. Human exposure to ozone and CO can cause serious respiratory and cardiovascular problems. Additionally, these emissions contribute to other serious environmental degradation. This proposal implements Congress' mandate by proposing new requirements for particular nonroad engines and equipment that are regulated as part of EPA's overall nonroad emission control program.

We are proposing this rule under the procedural authority of section 307(d) of the Clean Air Act.

C. What Regulations Currently Apply to Nonroad Engines or Vehicles?

EPA has been setting emission standards for nonroad engines and/or vehicles since Congress amended the Clean Air Act in 1990 and included section 213. These amendments have led to a series of rulemakings to reduce the air pollution from this widely varying set of products. In these rulemakings, we divided the broad group of nonroad engines and vehicles into several different categories for setting application-specific requirements. Each category involves many unique characteristics related to the participating manufacturers, technology, operating characteristics, sales volumes, and market dynamics. Requirements for each category therefore take on many unique features regarding the stringency of standards, the underlying expectations regarding emission control technologies, the nature and extent of testing, and the myriad details that comprise the implementation of a compliance program.

At the same time, the requirements and other regulatory provisions for each engine category share many characteristics. Each rulemaking under section 213 sets technology-based standards consistent with the Clean Air Act and requires annual certification based on measured emission levels from test engines or vehicles. As a result, the broader context of EPA's nonroad emission control programs demonstrates both strong similarities between this rulemaking and the requirements adopted for other types of engines or vehicles and distinct differences as we take into account the unique nature of these engines and the companies that produce them.

We completed the Nonroad Engine and Vehicle Emission Study to satisfy Clean Air Act section 213(a)(1) in

[1] Otto-cycle engines (referred to here as spark-ignition or SI engines) typically operate on gasoline, liquefied petroleum gas, or natural gas. Diesel-cycle engines, referred to simply as ''diesel engines'' in this document, may also be referred to as compression-ignition or CI engines. These engines typically operate on diesel fuel, but other fuels may also be used.

[2] Pub. L. 108–199, Div G, Title IV, § 428(b), 118 Stat. 418 (January 23, 2004).

November 1991.[3] On June 17, 1994, we 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 (56 FR 31306). Since then we have undertaken several rulemakings to set emission standards for the various categories of nonroad engines. Table I–1 highlights the different engine or vehicle categories we have established and the corresponding cites for emission standards and other regulatory requirements. Table I–2 summarizes the series of EPA rulemakings that have set new or revised emission standards for any of these nonroad engines or vehicles. These actions are described in the following sections, with additional discussion to explain why we are not proposing more stringent standards for certain types of nonroad spark-ignition engines below 50 horsepower.

TABLE I–1.—NONROAD ENGINE CATEGORIES FOR EPA EMISSION STANDARDS

Engine categories	CFR cite for regulationse establishing emission standards	Cross reference to Table I.C–2
1. Locomotives engines	40 CFR Part 92	d
2. Marine diesel engines	40 CFR Part 94	g, i, j
3. Other nonroad diesel engines	40 CFR Parts 89 and 1039	a, e, k
4. Marine SI engines [4]	40 CFR Part 91	c
5. Recreational vehicles	40 CFR Part 1051	i
6. Small SI engines [5]	40 CFR Part 90	b, f, h
7. Large SI engines [4]	40 CFR Part 1048	i

TABLE I–2.—EPA'S RULEMAKINGS FOR NONROAD ENGINES

Nonroad engines (categories and sub-categories)	Final rulemaking	Date
a. Land-based diesel engines ≥37 kW Tier 1	56 FR 31306	June 17, 1994.
b. Small SI engines—Phase 1	60 FR 34581	July 3, 1995.
c. Marine SI engines—outboard and personal watercraft	61 FR 52088	October 4, 1996.
d. Locomotives	63 FR 18978	April 16, 1998.
e. Land-based diesel engines—Tier 1 and Tier 2 for engines <37 kW—Tier 2 and Tier 3 for engines ≥37 kW.	63 FR 56968	October 23, 1998.
f. Small SI engines (Nonhandheld)—Phase 2	64 FR 15208	March 30, 1999.
g. Commercial marine diesel <30 liters per cylinder	64 FR 73300	December 29, 1999.
h. Small SI engines (Handheld)—Phase 2	65 FR 24268	April 25, 2000.
i. Recreational vehicles, Industrial spark-ignition engines >19 kW, and Recreational marine diesel.	67 FR 68242	November 8, 2002.
j. Marine diesel engines ≥2.5 liters/cylinder	68 FR 9746	February 28, 2003.
k. Land-based diesel engines—Tier 4	69 FR 38958	June 29, 2004.

(1) Small SI Engines

We have previously adopted emission standards for nonroad spark-ignition engines at or below 19 kW in two phases. The first phase of these standards introduced certification and an initial level of emission standards for both handheld and nonhandheld engines. On March 30, 1999 we adopted a second phase of standards for nonhandheld engines, including both Class I and Class II engines, which are almost fully phased-in today (64 FR 15208).[6] These standards involved emission reductions based on improving engine calibrations to reduce exhaust emissions and added a requirement that emission standards must be met over the engines' entire useful life as defined in the regulations. We believe catalyst technology has now developed to the point that it can be applied to all nonhandheld Small SI engines to reduce exhaust emissions. Various emission control technologies are similarly available to address the different types of fuel evaporative emissions we have identified.

For handheld engines, we adopted Phase 2 exhaust emission standards in April 25, 2000 (65 FR 24268). These standards were based on the application of catalyst technology, with the expectation that manufacturers would have to make considerable investments to modify their engine designs and production processes. A technology review we completed in 2003 indicated that manufacturers were making progress toward compliance, but that additional implementation flexibility was needed if manufacturers were to fully comply with the regulations by 2010. This finding and a change in the rule were published in the **Federal Register** on January 12, 2004 (69FR1824). At this point, we have no information to suggest that manufacturers can uniformly apply new technology or make design improvements to reduce exhaust emissions below the Phase 2 levels. We therefore believe the Phase 2 standards continue to represent the greatest degree of emission reduction achievable for these engines.[7] However, we believe it is appropriate to apply evaporative emission standards to the handheld engines similar to those we are

[3] This study is available on EPA's web site at *http://www.epa.gov/otaq/equip-ld.*

[4] The term "Marine SI," used throughout this document, refers to all spark-ignition engines used to propel marine vessels. This includes outboard engines, personal watercraft engines, and sterndrive/inboard engines. See Section III for additional information.

[5] The terms "Small SI" and "Large SI" are used throughout this document. All nonroad spark-ignition engines not covered by our programs for Marine SI engines or recreational vehicles are either Small SI engines or Large SI engines. Small SI engines include those engines with maximum power at or below 19 kW, and Large SI engines include engines with maximum power above 19 kW.

[6] Handheld engines generally include those engines for which the operator holds or supports the equipment during operation; nonhandheld engines are Small SI engines that are not handled engines (see § 1054.801). Class I refers to nonhandheld engines with displacement below 225 cc; Class II refers to larger nonhandheld engines.

[7] Note that we refer to the handheld exhaust emission standards in 40 CFR part 1054 as Phase 3 standards. This is intended to maintain consistent terminology with the comparable standards in California rather than indicating an increase in stringency.

proposing for the nonhandheld engines. Manufacturers can control evaporative emissions in a way that has little or no impact on exhaust emissions.

(2) Marine SI Engines

On October 4, 1996 we adopted emission standards for spark-ignition outboard and personal watercraft engines that have recently been fully phased in (61 FR 52088). We decided not to finalize emission standards for sterndrive or inboard marine engines at that time. Uncontrolled emission levels from sterndrive and inboard marine engines were already significantly lower than the outboard and personal watercraft engines. We did, however, leave open the possibility of revisiting the need for emission standards for sterndrive and inboard engines in the future. See Section III for further discussion of the scope and background of past and current rulemakings for these engines.

We believe existing technology can be applied to all Marine SI engines to reduce emissions of harmful pollutants, including both exhaust and evaporative emissions. Manufacturers of outboard and personal watercraft engines can continue the trend of producing four-stroke engines and advanced-technology two-stroke engines to further reduce emissions. For sterndrive/inboard engines, manufacturers can add technologies, such as fuel injection and aftertreatment, that can safely and substantially improve the engines' emission control capabilities.

(3) Large SI Engines

We adopted emission standards for Large SI engines on November 8, 2002 (67 FR 68242). This includes Tier 1 standards for 2004 through 2006 model years and Tier 2 standards starting with 2007 model year engines. Manufacturers are today facing a considerable challenge to comply with the Tier 2 standards, which are already substantially more stringent than any of the standards proposed or contemplated for the other engine categories in this proposal. The Tier 2 standards also include evaporative emission standards, new transient test procedures, and additional exhaust emission standards to address off-cycle emissions, and diagnostic requirements. Stringent standards for this category of engines, and in particular, engines between 25 and 50 horsepower (19 to 37 kW), have been completed in the recent past, and are currently being implemented. Because of that we do not have information on the actual Tier 2 technology that manufacturers will use and do not have information at this time on possible advances in technology beyond Tier 2. We therefore believe the evidence provided in the recently promulgated rulemaking continues to represent the best available information regarding the appropriate level of standards for these engines under section 213 at this time. California Air Resources Board (ARB) has adopted an additional level of emission control for Large SI engines starting with the 2010 model year. However, as described in Section I.D.1, their new standards would not increase overall stringency beyond that reflected in the federal standards. As a result, we believe it would be inappropriate to pursue more stringent emission standards for these engines in this rulemaking.

Note that the Large SI standards apply to nonroad spark-ignition engines above 19 kW. However, we adopted a special provision for engine families where production engines have total displacement at or below 1000 cc and maximum power at or below 30 kW, allowing these engine families to instead certify to the applicable standards for Small SI engines.

(4) Recreational Vehicles

We adopted exhaust and evaporative emission standards for recreational vehicles in our November 8, 2002 final rule (67FR68242). These standards apply to all-terrain vehicles, off-highway motorcycles, and snowmobiles.[8] These exhaust emission standards will be fully phased in starting with the 2007 model year. The evaporative emission standards apply starting with the 2008 model year.

Recreational vehicles will soon be subject to permeation requirements that are very similar to the requirements proposed in this rulemaking. We have also learned more about controlling running losses and diffusion emissions that may eventually lead us to propose comparable standards for recreational vehicles. We expect to revisit these questions in the context of a rulemaking to modify the duty cycle for all-terrain vehicles, as described below. Considering these new requirements for recreational vehicles in this later rulemaking would give us additional time to collect information to better understand the feasibility, costs, and benefits of applying these requirements to recreational vehicles.

The following sections describe the state of technology and regulatory requirements for the different types of recreational vehicles.

[8] Note that we treat certain high-speed off-road utility vehicles as all-terrain vehicles (see 40 CFR part 1051).

(a) All-Terrain Vehicles

The regulations for all-terrain vehicles (ATV) specify testing based on a chassis-based transient procedure. However, on an interim basis, we are permitting manufacturers the option to use a steady-state engine-based procedure to allow manufacturers an opportunity to develop the field operating data needed to determine if ATV operation is dominantly steady state or transient in nature and to develop an appropriate emission test cycle from that information. The emissions test procedure and duty cycle are critical to getting the degree of emission control expected from these engines. We are continuing to work toward a resolution of this test cycle development initiative in a separate action. The anticipated changes to the test cycle raise new questions we will need to work through before we are prepared to change the existing regulation and perhaps pursue new emission control requirements. In particular, we will need to further explore the extent to which the new duty cycle represents in-use operation and whether engine or chassis testing is more appropriate in simulating in-use operation for accurate emission characterization and measurements. We believe it is appropriate to consider more stringent exhaust emission standards for these engines after we have had the opportunity to address the emission test cycle issue and to thus establish a long-term testing protocols and related requirements.

(b) Off-Highway Motorcycles

For off-highway motorcycles, manufacturers are in many cases making a substantial transition to move away from two-stroke engines in favor of four-stroke engines. This transition is now underway. While it may eventually be appropriate to apply aftertreatment or other additional emission control technologies to off-highway motorcycles, we need more time for this transition to be completed and to assess the success of aftertreatment technologies such as catalysts on similar applications such as highway motorcycles. As EPA and manufacturers learn more in implementing emission standards, we would expect to be able to better judge the potential for broadly applying new technology to achieve further emission reductions from off-highway motorcycles.

(c) Snowmobiles

In our November 8, 2002 final rule we set three phases of exhaust emission standards for snowmobiles (67 FR

68242). Environmental and industry groups challenged the third phase of these standards. The court decision upheld much of EPA's reasoning for the standards, but vacated the NO_X standard and remanded the CO and HC standards to clarify the analysis and evidence upon which the standards are based. See *Bluewater Network, et al* v. *EPA*, 370 F 3d 1 (D.C. Cir. 2004). A large majority of snowmobile engines are rated below 50 hp and there is still a fundamental need for time to pass to allow us to assess the success of 4 stroke engine technology in the market place. This is an important of the assessment we need to conduct with regard to 2012 and later model year emission standards. Thus we believe is appropriate to address this in a separate rulemaking.[9] We expect to complete that work with sufficient lead time for manufacturers to meet any revised Phase 3 standards that we might adopt for the 2012 model year, consistent with the original rulemaking requirements.

(5) Nonroad Diesel Engines

The 2004 Consolidated Appropriations Act providing the specific statutory direction for this rulemaking focuses on nonroad spark-ignition engines. Nonroad diesel engines are therefore not included within the scope of that Congressional mandate. However, we have gone through several rulemakings to set standards for these engines under the broader authority of Clean Air Act section 213. In particular, we have divided nonroad diesel engines into three groups for setting emission standards. We adopted a series of standards for locomotives on April 16, 1998, including requirements to certify engines to emission standards when they are rebuilt (63 FR 18978). We also adopted emission standards for marine diesel engines over several different rulemakings, as described in Table I–2. These included separate actions for engines below 37 kW, engines installed in oceangoing vessels, engines installed in commercial vessels involved in inland and coastal waterways, and engines installed in recreational vessels. We have recently proposed new emission standards for both locomotive and marine diesel engines (72 FR 15938, April 3, 2007).

Finally, all other nonroad diesel engines are grouped together for EPA's emission standards. We have adopted multiple tiers of increasingly stringent standards in three separate rulemakings, as described in Table I–2. We most recently adopted Tier 4 standards based on the use of ultra-low sulfur diesel fuel and the application of exhaust aftertreatment technology (69 FR 38958, June 29, 2004).

[9] Only about 3 percent of snowmobiles are rated below 50 horsepower.

D. Putting This Proposal Into Perspective

Most manufacturers that will be subject to this rulemaking are also affected by regulatory developments in California and in other countries. Each of these is described in more detail below.

(1) State Initiatives

Clean Air Act section 209 prohibits California and other states from setting emission standards for new motor vehicles and new motor vehicle engines, but authorizes EPA to waive this prohibition for California, in which case other states may adopt California's standards. Similar preemption and waiver provisions apply for emission standards for nonroad engines and vehicles, whether new or in-use. However for new locomotives, new engines used in locomotives, and new engines used in farm or construction equipment with maximum power below 130 kW, California and other states are preempted and there is no provision for a waiver of preemption. In addition, in section 428 of the amendment to the 2004 Consolidated Appropriations Act, Congress further precluded other states from adopting new California standards for nonroad spark-ignition engines below 50 horsepower. In addition, the amendment required that we specifically address the safety implications of any California standards for these engines before approving a waiver of federal preemption. We are proposing to codify these changes to preemption in this rule.

California ARB has adopted requirements for five groups of nonroad engines: (1) Diesel- and Otto-cycle small off-road engines rated under 19 kW; (2) spark-ignition engines used for marine propulsion; (3) land-based nonroad recreational engines, including those used in all-terrain vehicles, off-highway motorcycles, go-carts, and other similar vehicles; (4) new nonroad spark-ignition engines rated over 19 kW not used in recreational applications; and (5) new land-based nonroad diesel engines rated over 130 kW. They have also approved a voluntary registration and control program for existing portable equipment.

In the 1990s California ARB adopted Tier 1 and Tier 2 standards for Small SI engines consistent with the federal requirements. In 2003, they moved beyond the federal program by adopting exhaust $HC+NO_X$ emission standards of 10 g/kW-hr for Class I engines starting in the 2007 model year and 8 g/kW-hr for Class II engines starting in the 2008 model year. In the same rule they adopted evaporative emission standards for nonhandheld equipment, requiring control of fuel tank permeation, fuel line permeation, diurnal emissions, and running losses.

California ARB has adopted two tiers of exhaust emission standards for outboard and personal watercraft engines beyond EPA's original standards. The most recent standards, which apply starting in 2008, require $HC+NO_X$ emission levels as low as 16 g/kW-hr. For sterndrive and inboard engines, California has adopted a 5 g/kW-hr $HC+NO_X$ emission standard for 2008 and later model year engines, with testing underway to confirm the feasibility of standards. California ARB's marine programs include no standards for exhaust CO emissions or evaporative emissions.

The California emission standards for recreational vehicles have a different form than the comparable EPA standards but are roughly equivalent in stringency. The California standards include no standards for controlling evaporative emissions. Another important difference between the two programs is California ARB's reliance on a provision allowing noncompliant vehicles to be used in certain areas that are less environmentally sensitive as long as they have a specified red sticker that would identify their lack of emission controls to prevent them from operating in other areas.

California ARB in 1998 adopted requirements that apply to new nonroad engines rated over 25 hp produced for California, with standards phasing in from 2001 through 2004. Texas has adopted these initial California ARB emission standards statewide starting in 2004. More recently, California ARB has proposed exhaust emission standards and new evaporative emission standards for these engines, consistent with EPA's 2007 model year standards. Their proposal also included an additional level of emission control for Large SI engines starting with the 2010 model year. However, their proposed standards would not increase overall stringency beyond that reflected in the federal standards. Rather, they aim to achieve reductions in $HC+NO_X$ emissions by removing the flexibility incorporated into the federal standards allowing manufacturers to have higher $HC+NO_X$ emissions by certifying to a more stringent CO standard.

(2) Actions in Other Countries

While the proposed emission standards will apply only to engines sold in the United States, we are aware that manufacturers in many cases are selling the same products into other countries. To the extent that we have the same emission standards as other countries, manufacturers can contribute to reducing air emissions without being burdened by the costs associated with meeting differing or inconsistent regulatory requirements. The following discussion describes our understanding of the status of emission standards in countries outside the United States.

Regulations for spark ignition engines in handheld and nonhandheld equipment are included in the ''Directive 97/68/EC of the European Parliament and of the Council of 16 December 1997 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 (OJ L 59, 27.2.1998, p. 1)'', as amended by ''Directive 2002/88/EC of the European Parliament and of the Council of 9 December 2002''. The Stage I emission standards are to be met by all handheld and nonhandheld engines by 24 months after entry into force of the Directive (as noted in a December 9, 2002 amendment to Directive 97/68/EC). The Stage I emission standards are similar to the U.S. EPA's Phase 1 emission standards for handheld and nonhandheld engines. The Stage II emission standards are implemented over time for the various handheld and nonhandheld engine classes from 2005 to 2009 with handheld engines ≥ 50cc on August 1, 2008. The Stage II emission standards are similar to EPA's Phase 2 emission standards for handheld and nonhandheld engines. Six months after these dates Member States shall permit placing on the market of engines, whether or not already installed in machinery, only if they meet the requirements of the Directive.

The European Commission has adopted emission standards for recreational marine engines, including both diesel and gasoline engines. These requirements apply to all new engines sold in member countries and began in 2006 for four-stroke engines and in 2007 for two-stroke engines. Table I–3 presents the European standards for diesel and gasoline recreational marine engines. The numerical emission standards for NO_X are based on the applicable standard from MARPOL Annex VI for marine diesel engines (See Table I–3). The European standards are roughly equivalent to the nonroad diesel Tier 1 emission standards for HC and CO. Emission measurements under the European standards rely on the ISO D2 duty cycle for constant-speed engines and the ISO E5 duty cycle for other engines.

TABLE I–3.—EUROPEAN EMISSION STANDARDS FOR RECREATIONAL MARINE ENGINES

[g/kW-hr]

Engine Type	HC	NO_X	CO	PM
Two-Stroke Spark-Ignition	$30 + 100/P^{0.75}$	10.0	150 + 600/P	
Four-Stroke Spark-Ignition	$6 + 50/P^{0.75}$	15.0	150 + 600/P	
Compression-Ignition	$1.5 + 2/P^{0.5}$	9.8	5.0	1.0

* P = rated power in kilowatts (kW)

E. What Requirements Are We Proposing?

EPA's emission control provisions require engine, vessel and equipment manufacturers to design and produce their products to meet the emission standards we adopt. To ensure that engines, vessels and equipment meet the expected level of emission control, we also require compliance with a variety of additional requirements, such as certification, labeling engines, and meeting warranty requirements. The following sections provide a brief summary of the new requirements we are proposing in this rulemaking. See the later sections for a full discussion of the proposal.

(1) Marine SI Engines and Vessels

We are proposing a more stringent level of emission standards for outboard and personal watercraft engines starting with the 2009 model year. The proposed standards for engines above 40 kW are 16 g/kW-hr for $HC+NO_X$ and 200 g/kW-hr for CO. For engines below 40 kW, the standards increase gradually based on the engine's maximum power. We expect manufacturers to meet these standards with improved fueling systems and other in-cylinder controls. The levels of the standards are consistent with the requirements recently adopted by California ARB with the advantage of a simplified form of the standard for different power ratings and with a CO emission standard. We are not pursuing catalyst-based emission standards for outboard and personal watercraft engines. As is discussed later in this preamble, the application of catalyst-based standards to the marine environment creates special technology challenges that must be addressed. Unlike the sterndrive/inboard engines discussed in the next paragraph, outboard and personal watercraft engines are not built from automotive engine blocks and are not as easily amenable to the fundamental engine modifications, fuel system upgrades, and other engine control modifications needed to get acceptable catalyst performance. This proposal is an appropriate next step in the evolution of technology-based standards for outboard and personal watercraft engines as they are likely to lead to the elimination of carbureted two-stroke engines in favor of direct-injection two-stroke engines and to encourage the fuel system upgrades and related engine modifications needed to achieve the required reductions and to potentially set the stage for future considerations.

We are proposing new exhaust emission standards for sterndrive and inboard marine engines. The proposed standards are 5.0 g/kW-hr for $HC+NO_X$ and 75.0 g/kW-hr for CO starting with the 2009 model year. We expect manufacturers to meet these standards with three-way catalysts and closed-loop fuel injection. To ensure proper functioning of these emission control systems in use, we are proposing a requirement that engines have a diagnostic system for detecting a failure in the emission control system. For sterndrive and inboard marine engines at or above 373 kW with high-performance characteristics (generally referred to as ''SD/I high-performance engines''), we are proposing an $HC+NO_X$ emission standard of 5.0 g/kW-hr and a CO standard of 350 g/kW-hr. We are also proposing a variety of other special provisions for these engines to reflect unique operating characteristics and to make it feasible to meet emission standards using emission credits. These standards are consistent with the requirements recently adopted by California ARB, with some adjustment to the provisions for SD/I high-performance engines and with a CO emission standard.

The emission standards described above relate to engine operation over a prescribed duty cycle for testing in the laboratory. We are also proposing not-to-exceed (NTE) standards that establish emission limits when engines operate under normal speed-load combinations that are not included in the duty cycles for the other engine standards.

We are proposing new standards to control evaporative emissions for all Marine SI vessels. The new standards include requirements to control fuel tank permeation, fuel line permeation, and diurnal emissions, including provisions to ensure that refueling emissions do not increase.

We are proposing to place these new regulations for Marine SI engines in 40 CFR part 1045 rather than changing the current regulations in 40 CFR part 91. This new part will allow us to improve the clarity of regulatory requirements and update our regulatory compliance program to be consistent with the provisions we have recently adopted for other nonroad programs. We are also making a variety of changes to 40 CFR part 91 to make minor adjustments to the current regulations and to prepare for the transition to 40 CFR part 1045.

(2) Small SI Engines and Equipment

We are proposing $HC+NO_X$ exhaust emission standards of 10.0 g/kW-hr for Class I engines starting in the 2012 model year and 8.0 g/kW-hr for Class II engines starting in the 2011 model year. For both classes of nonhandheld engines, we are proposing to maintain the existing CO standard of 610 g/kW-hr. We expect manufacturers to meet these standards by improving engine combustion and adding catalysts. These standards are consistent with the requirements recently adopted by California ARB.

For spark-ignition engines used in marine generators, we are proposing a more stringent Phase 3 CO emission standard of 5.0 g/kW-hr. This would apply equally to all sizes of engines subject to the Small SI standards.

We are proposing new evaporative emission standards for both handheld and nonhandheld engines. The new standards include requirements to control permeation from fuel tanks and fuel lines. For nonhandheld engines we are also proposing to require control of diffusion emissions and running losses.

We are proposing to place the new regulations for Small SI engines from 40 CFR part 90 to 40 CFR part 1054. This new part will allow us to improve the clarity of regulatory requirements and update our regulatory compliance program to be consistent with the provisions we have recently adopted for other nonroad programs.

F. How Is This Document Organized?

Since this proposal covers a broad range of engines and equipment that vary in design and use, many readers may be interested only in certain aspects of the proposal. We have therefore attempted to organize this preamble in a way that allows each reader to focus on the material of particular interest. The Air Quality discussion in Section II, however, is general in nature and applies to all the categories covered by this proposal.

The next several sections contain our proposal for Small SI engines and equipment and Marine SI engines and vessels. Sections III through V describe the proposed requirements related to exhaust emission standards for each of the affected engine categories, including standards, effective dates, testing information, and other specific requirements. Section VI details the proposed requirements related to evaporative emission requirements for all categories. Sections VII through IX contain some general concepts that are relevant to all of the engines, vessels and equipment covered by this proposal, such as certification requirements and general testing procedures and compliance provisions. Section X discusses how we took energy, noise, and safety factors into consideration for the proposed standards.

Section XI describes a variety of proposed provisions that affect other categories of engines besides those that are the primary subject of this proposal. This includes the following changes:

- We are proposing to reorganize the regulatory language related to preemption of state standards and to clarify certain provisions. We are also requesting comment regarding a petition to reconsider some of the provisions including the extent to which states may regulate the use and operation of nonroad engines and vehicles.
- We are incorporating new provisions related to certification fees for newly regulated products covered by this proposal. This involves some restructuring of the regulatory language. We are also proposing various technical amendments, such as identifying an additional payment method, that would apply broadly to our certification programs.
- We are proposing changes to 40 CFR part 1068 to clarify how the provisions apply with respect to evaporative emission standards. We are also proposing various technical amendments. These changes would apply to all types of nonroad engines that are subject to the provisions of part 1068.
- We are proposing several technical amendments for Large SI engines and recreational vehicles, largely to maintain consistency across programs for different categories of engines and vehicles.
- We are proposing to amend provisions related to the delegated-assembly exemption for heavy-duty highway engines as part of the effort to apply these provisions to Small SI engines, as described in Section V.E.2.
- We are proposing to apply the new standards for Small SI engines to the comparable stationary engines.

Section XII summarizes the projected impacts and benefits of this proposal. Finally, Sections XIII and XIV contain information about public participation and how we satisfy our various administrative requirements.

II. Public Health and Welfare Effects

The engines, vessels and equipment that would be subject to the proposed standards generate emissions of hydrocarbons (HC), nitrogen oxides (NO_X), particulate matter (PM) and carbon monoxide (CO) that contribute to nonattainment of the National Ambient Air Quality Standards (NAAQS) for ozone, PM and CO. These engines, vessels and equipment also emit hazardous air pollutants (air toxics) that are associated with a host of adverse health effects. Emissions from these engines, vessels and equipment also contribute to visibility impairment and other welfare and environmental effects.

The health and environmental effects associated with emissions from Small SI engines and equipment and Marine SI engines and vessels are a classic example of a negative externality (an activity that imposes uncompensated costs on others). With a negative externality, an activity's social cost (the cost on society imposed as a result of the activity taking place) exceeds its private cost (the cost to those directly engaged in the activity). In this case, as described in this section, emissions from Small SI engines and equipment and Marine SI engines and vessels impose public health and environmental costs on society. The market system itself cannot correct this externality. The end users of the equipment and vessels are often unaware of the environmental impacts of their use for lawn care or recreation. Because of this, consumers fail to send the market a signal to provide cleaner equipment and vessels. In addition, producers of these engines, equipment, and vessels are rewarded for emphasizing other aspects of these products (*e.g.*, total power). To correct this market failure and reduce the negative externality, it is necessary to give producers social cost signals. The standards EPA is proposing will accomplish this by mandating that Small SI engines and equipment and Marine SI engines and vessels reduce their emissions to a technologically feasible limit. In other words, with this proposed rule the costs of the services provided by these engines and equipment will account for social costs more fully.

This section summarizes the general health and welfare effects of these emissions. Interested readers are encouraged to refer to the Draft RIA for more in-depth discussions.

A. Ozone

Ground-level ozone pollution is formed by the reaction of volatile organic compounds (VOC), of which HC are the major subset, and NO_X in the lower atmosphere in the presence of heat and sunlight. These pollutants, often referred to as ozone precursors, are emitted by many types of pollution sources, such as highway and nonroad motor vehicles and engines (including those subject to this proposed rule), power plants, chemical plants, refineries, makers of consumer and commercial products, industrial facilities, and smaller area sources. The engine, vessel and equipment controls being proposed will reduce VOCs and NO_X.

The science of ozone formation, transport, and accumulation is complex.[10] Ground-level ozone is produced and destroyed in a cyclical set of chemical reactions, many of which are sensitive to temperature and sunlight. When ambient temperatures and sunlight levels remain high for several days and the air is relatively stagnant, ozone and its precursors can build up and result in more ozone than typically would occur on a single high-temperature day. Ozone also can be transported into an area from pollution sources found hundreds of miles upwind, resulting in elevated ozone levels even in areas with low VOC or NO_X emissions.

The current ozone NAAQS, established by EPA in 1997, has an 8-hour averaging time.[11] The 8-hour ozone NAAQS is based on well-documented science demonstrating that more people were experiencing adverse health effects at lower levels of exertion, over longer periods, and at lower ozone concentrations than addressed by the previous one-hour ozone NAAQS. The current ozone NAAQS addresses ozone exposures of concern for the general population and populations most at risk, including children active outdoors, outdoor workers, and individuals with pre-existing respiratory disease, such as asthma. The 8-hour ozone NAAQS is met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration over three years is less than or equal to 0.084 parts per million (ppm).

(1) Health Effects of Ozone

The health and welfare effects of ozone are well documented and are assessed in the EPA's 2006 ozone Air Quality Criteria Document (ozone AQCD) and staff paper.[12] [13] Ozone can irritate the respiratory system, causing coughing, throat irritation, and/or uncomfortable sensation in the chest. Ozone can reduce lung function and make it more difficult to breathe deeply, and breathing may become more rapid and shallow than normal, thereby limiting a person's activity. Ozone can also aggravate asthma, leading to more asthma attacks that require a doctor's attention and/or the use of additional medication. Animal toxicologic evidence indicates that with repeated exposure, ozone can inflame and damage the lining of the lungs, which may lead to permanent changes in lung tissue and irreversible reductions in lung function. People who are more susceptible to effects associated with exposure to ozone include children, the elderly, and individuals with respiratory disease such as asthma. There is also suggestive evidence that certain people may have greater genetic susceptibility. Those with greater exposures to ozone, for instance due to time spent outdoors (*e.g.*, outdoor workers), are also of concern.

The recent ozone AQCD also examined relevant new scientific information that has emerged in the past decade, including the impact of ozone exposure on such health effects as changes in lung structure and biochemistry, inflammation of the lungs, exacerbation and causation of asthma, respiratory illness-related school absence, hospital admissions and premature mortality. Animal toxicologic studies have suggested potential interactions between ozone and PM with increased responses observed to mixtures of the two pollutants compared to either ozone or PM alone. The respiratory morbidity observed in animal studies along with the evidence from epidemiologic studies supports a causal relationship between acute ambient ozone exposures and increased respiratory-related emergency room visits and hospitalizations in the warm season. In addition, there is suggestive evidence of a contribution of ozone to cardiovascular-related morbidity and non-accidental and cardiopulmonary mortality.

EPA typically quantifies ozone-related health impacts in its regulatory impact analyses (RIAs) when possible. In the analysis of past air quality regulations, ozone-related benefits have included morbidity endpoints and welfare effects such as damage to commercial crops. EPA has not recently included a separate and additive mortality effect for ozone, independent of the effect associated with fine particulate matter. For a number of reasons, including (1) Advice from the Science Advisory Board (SAB) Health and Ecological Effects Subcommittee (HEES) that EPA consider the plausibility and viability of including an estimate of premature mortality associated with short-term ozone exposure in its benefits analyses and (2) conclusions regarding the scientific support for such relationships in EPA's 2006 Air Quality Criteria for Ozone and Related Photochemical Oxidants (the CD), EPA is in the process of determining how to appropriately characterize ozone-related mortality benefits within the context of benefits analyses for air quality regulations. As part of this process, we are seeking advice from the National Academy of Sciences (NAS) regarding how the ozone-mortality literature should be used to quantify the reduction in premature mortality due to diminished exposure to ozone, the amount of life expectancy to be added and the monetary value of this increased life expectancy in the context of health benefits analyses associated with regulatory assessments. In addition, the Agency has sought advice on characterizing and communicating the uncertainty associated with each of these aspects in health benefit analyses.

Since the NAS effort is not expected to conclude until 2008, the agency is currently deliberating how best to

[10] U.S. EPA. Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–05/004aF–cF, 2006. This document is available in Docket EPA–HQ–OAR–2004–0008.

[11] EPA's review of the ozone NAAQS is underway and a proposal is scheduled for June 2007 with a final rule scheduled for March 2008.

[12] U.S. EPA. Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–05/004aF–cF, 2006. This document is available in Docket EPA–HQ–OAR–2004–0008.

[13] U.S. EPA (2007) Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–07–003. This document is available in Docket EPA–HQ–OAR–2004–0008.

characterize ozone-related mortality benefits in its rulemaking analyses in the interim. We do not quantify an ozone mortality benefit for the analysis of the proposed emission standards. So that we do not provide an incomplete picture of all of the benefits associated with reductions in emissions of ozone precursors, we have chosen not to include an estimate of total ozone benefits in the proposed RIA. By omitting ozone benefits in this proposal, we acknowledge that this analysis underestimates the benefits associated with the proposed standards. For more information regarding the quantified benefits included in this analysis, please refer to Chapter 8 of the Draft RIA.

(2) Plant and Ecosystem Effects of Ozone

Ozone contributes to many environmental effects, with impacts to plants and ecosystems being of most concern. Ozone can produce both acute and chronic injury in sensitive species depending on the concentration level and the duration of the exposure. Ozone effects also tend to accumulate over the growing season of the plant, so that even lower concentrations experienced for a longer duration have the potential to create chronic stress on vegetation. Ozone damage to plants includes visible injury to leaves and a reduction in food production through impaired photosynthesis, both of which can lead to reduced crop yields, forestry production, and use of sensitive ornamentals in landscaping. In addition, the reduced food production in plants and subsequent reduced root growth and storage below ground, can result in other, more subtle plant and ecosystems impacts. These include increased susceptibility of plants to insect attack, disease, harsh weather, interspecies competition and overall decreased plant vigor. The adverse effects of ozone on forest and other natural vegetation can potentially lead to species shifts and loss from the affected ecosystems, resulting in a loss or reduction in associated ecosystem goods and services. Lastly, visible ozone injury to leaves can result in a loss of aesthetic value in areas of special scenic significance like national parks and wilderness areas. The 2006 ozone AQCD presents more detailed information on ozone effects on vegetation and ecosystems.

(3) Current and Projected 8-Hour Ozone Levels

Currently, ozone concentrations exceeding the level of the 8-hour ozone NAAQS occur over wide geographic areas, including most of the nation's major population centers.[14] As of October, 2006 there are approximately 157 million people living in 116 areas designated as not in attainment with the 8-hour ozone NAAQS. There are 461 full or partial counties that make up the 116 8-hour ozone nonattainment areas. These numbers do not include the people living in areas where there is a potential risk of failing to maintain or achieve the 8-hour ozone NAAQS in the future.

EPA has already adopted many emission control programs that are expected to reduce ambient ozone levels. These control programs include the Clean Air Interstate Rule (70 FR 25162, May 12, 2005), as well as many mobile source rules, some of which are described in Section I of this preamble. As a result of these programs, the number of areas that fail to meet the 8-hour ozone NAAQS in the future is expected to decrease.

Based on the recent ozone modeling performed for the CAIR analysis, barring additional local ozone precursor controls, we estimate 37 eastern counties (where 24 million people are projected to live) will exceed the 8-hour ozone NAAQS in 2010.[15] [16] An additional 148 eastern counties (where 61 million people are projected to live) are expected to be within 10 percent of the 8-hour ozone NAAQS in 2010.

States with 8-hour ozone nonattainment areas will be required to take action to bring those areas into compliance in the future. Based on the final rule designating and classifying 8-hour ozone nonattainment areas (69 FR 23951, April 30, 2004), most 8-hour ozone nonattainment areas will be required to attain the 8-hour ozone NAAQS in the 2007 to 2014 time frame and then be required to maintain the 8-hour ozone NAAQS thereafter.[17] Emissions of ozone precursors from the engines, vessels and equipment subject to the proposed standards contribute to ozone in many, if not all, of these areas. Therefore, the expected HC and NO_X reductions from the standards proposed in this action will be useful to states in attaining or maintaining the 8-hour ozone NAAQS.

EPA's review of the ozone NAAQS is currently underway and a proposed decision in this review is scheduled for June 2007 with a final rule scheduled for March 2008. If the ozone NAAQS is revised then new nonattainment areas could be designated. While EPA is not relying on it for purposes of justifying this rule, the emission reductions from this rulemaking would also be helpful to states if there is an ozone NAAQS revision.

(4) Air Quality Modeling for Ozone

To model the ozone air quality benefits of this rule we used the Comprehensive Air Quality Model with Extension (CAMx). CAMx simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone. This model is commonly used in developing attainment demonstration State Implementation Plans (SIPs) as well as estimating the ozone reductions expected to occur from a reduction in emitted pollutants. Meteorological data are developed by a separate program, the Regional Atmospheric Modeling System (RAMS), and input into CAMx. The simulation periods modeled by CAMx include several multi-day periods when ambient measurements were representative of ozone episodes over the eastern United States: June 12–24, July 5–15 and August 7–21, 1995. The modeling domain we used includes the 37 eastern states modeled in the Clean Air Interstate Rule (CAIR). More detailed information is included in the Air Quality Modeling Technical Support Document (TSD), which is located in the docket for this rule.

Note that the emission control scenarios used in the air quality and benefits modeling are slightly different than the emission control program in this proposal reflecting further refinement of the regulatory program since we performed the air quality modeling for this proposal. Additional detail on the difference between the modeled and proposed inventories is included in Section 3.6 of the Draft RIA.

(5) Results of the Air Quality Modeling for Ozone

According to air quality modeling performed for this proposal, the proposed controls for emissions from the engines, vessels and equipment subject to the proposed standards are expected to provide nationwide improvements in ozone levels. On a population-weighted basis, the average modeled future-year 8-hour ozone design values would decrease by 0.7

[14] A map of the 8-hour ozone nonattainment areas is included in the RIA for this proposed rule.

[15] Technical Support Document for the Final Clean Air Interstate Rule Air Quality Modeling. This document is available in Docket EPA–HQ–OAR–2004–0008, Document # EPA–HQ–OAR–2004–0008–0484.

[16] We expect many of the 8-hour ozone nonattainment areas to adopt additional emission reduction programs but we are unable to quantify or rely upon future reductions from additional state and local programs that have not yet been adopted.

[17] The Los Angeles South Coast Air Basin 8-hour ozone nonattainment area will have until June 15, 2021 to reach attainment.

ppb in 2020 and 0.8 ppb in 2030.[18] Within areas predicted to have design values greater than 85 ppb the average decrease would be somewhat higher: 0.8 ppb in 2020 and 1.0 ppb in 2030.

B. Particulate Matter

Particulate matter (PM) represents a broad class of chemically and physically diverse substances. It can be principally characterized as discrete particles that exist in the condensed (liquid or solid) phase spanning several orders of magnitude in size. PM is further described by breaking it down into size fractions. PM_{10} refers to particles generally less than or equal to 10 micrometers (μm) in diameter. $PM_{2.5}$ refers to fine particles, those particles generally less than or equal to 2.5 μm in diameter. Inhalable (or ''thoracic'') coarse particles refer to those particles generally greater than 2.5 μm but less than or equal to 10 μm in diameter. Ultrafine PM refers to particles with diameters generally less than 100 nanometers (0.1 μm). Larger particles (>10 μm) tend to be removed by the respiratory clearance mechanisms, whereas smaller particles are deposited deeper in the lungs.

Fine particles are produced primarily by combustion processes and by transformations of gaseous emissions (*e.g.*, SO_x, NO_X and VOCs) in the atmosphere. The chemical and physical properties of $PM_{2.5}$ may vary greatly with time, region, meteorology and source category. Thus, $PM_{2.5}$, may include a complex mixture of different pollutants including sulfates, nitrates, organic compounds, elemental carbon and metal compounds. These particles can remain in the atmosphere for days to weeks and travel through the atmosphere hundreds to thousands of kilometers.

EPA's final rule to amend the PM NAAQS addressed revisions to the primary and secondary NAAQS for PM to provide increased protection of public health and welfare, respectively (71 FR 61144, October 17, 2006). The primary $PM_{2.5}$ NAAQS include a short-term (24-hour) and a long-term (annual) standard. The level of the 24-hour $PM_{2.5}$ NAAQS has been revised from 65μg/m^3 to 35μg/m^3 to provide increased protection against health effects associated with short-term exposures to fine particles. The current form of the 24-hour $PM_{2.5}$ standard was retained (*e.g.*, based on the 98th percentile concentration averaged over three years). The level of the annual $PM_{2.5}$ NAAQS was retained at 15μg/m^3, continuing protection against health effects associated with long-term exposures. The current form of the annual $PM_{2.5}$ standard was retained as an annual arithmetic mean averaged over three years, however, the following two aspects of the spatial averaging criteria were narrowed: (1) The annual mean concentration at each site shall be within 10 percent of the spatially averaged annual mean, and (2) the daily values for each monitoring site pair shall yield a correlation coefficient of at least 0.9 for each calendar quarter. With regard to the primary PM_{10} standards, the 24-hour PM_{10} NAAQS was retained at a level of 150μg/m^3 not to be exceeded more than once per year on average over a three-year period. Given that the available evidence does not suggest an association between long-term exposure to coarse particles at current ambient levels and health effects, EPA has revoked the annual PM_{10} standard.

With regard to the secondary PM standards, EPA has revised these standards to be identical in all respects to the revised primary standards. Specifically, EPA has revised the current 24-hour $PM_{2.5}$ secondary standard by making it identical to the revised 24-hour $PM_{2.5}$ primary standard, retained the annual $PM_{2.5}$ and 24-hour PM_{10} secondary standards, and revoked the annual PM_{10} secondary standards. This suite of secondary PM standards is intended to provide protection against PM-related public welfare effects, including visibility impairment, effects on vegetation and ecosystems, and material damage and soiling.

(1) Health Effects of PM

Scientific studies show ambient PM is associated with a series of adverse health effects. These health effects are discussed in detail in the 2004 EPA Particulate Matter Air Quality Criteria Document (PM AQCD) as well as the 2005 PM Staff Paper.[19] [20] Further discussion of health effects associated with PM can also be found in the Draft RIA.

Health effects associated with short-term exposures (*e.g.* hours to days) in ambient $PM_{2.5}$ include premature mortality, increased hospital admissions, heart and lung diseases, increased cough, adverse lower-respiratory symptoms, decrements in lung function and changes in heart rate rhythm and other cardiac effects. Studies examining populations exposed to different levels of air pollution over a number of years, including the Harvard Six Cities Study and the American Cancer Society Study, show associations between long-term exposure to ambient $PM_{2.5}$ and both total and cardiorespiratory mortality. In addition, the reanalysis of the American Cancer Society Study shows an association between fine particle and sulfate concentrations and lung cancer mortality. The engines, vessels and equipment covered in this proposal contribute to both acute and chronic $PM_{2.5}$ exposures. Additional information on acute exposures is available in Section 2.5 of the Draft RIA.

Recently, several studies have highlighted the adverse effects of PM specifically from mobile sources.[21] [22] Studies have also focused on health effects due to PM exposures on or near roadways.[23] Although these studies include all air pollution sources, including both spark-ignition (gasoline) and diesel powered vehicles, they indicate that exposure to PM emissions near roadways, thus dominated by mobile sources, are associated with health effects. The proposed controls may help to reduce exposures, and specifically exposures near the source, to mobile source related $PM_{2.5}$.

(2) Visibility

Visibility can be defined as the degree to which the atmosphere is transparent to visible light.[24] Visibility impairment

[18] A design value is the monitored reading used by EPA to determine an area's air quality status; *e.g.*, for ozone, the fourth highest reading measured over the most recent three years is the design value. (*http://www.epa.gov/OCEPAterms/dterms.html*).

[19] U.S. EPA (2004) Air Quality Criteria for Particulate Matter (Oct 2004), Volume I Document No. EPA600/P–99/002aF and Volume II Document No. EPA600/P–99/002bF. This document is available in Docket EPA–HQ–OAR–2004–0008. This document is available electronically at: *http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=87903.*

[20] U.S. EPA (2005) Review of the National Ambient Air Quality Standard for Particulate Matter: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper. EPA–452/R–05–005. This document is available electronically at *http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_cr_sp.html* and in Docket EPA–HQ–OAR–2004–0008.

[21] Laden, F.; Neas, L.M.; Dockery, D.W.; Schwartz, J. (2000) Association of Fine Particulate Matter from Different Sources with Daily Mortality in Six U.S. Cities. *Environmental Health Perspectives* 108: 941–947.

[22] Janssen, N.A.H.; Schwartz, J.; Zanobetti, A.; Suh, H.H. (2002) Air Conditioning and Source-Specific Particles as Modifiers of the Effect of PM_{10} on Hospital Admissions for Heart and Lung Disease. *Environmental Health Perspectives* 110: 43–49.

[23] Riediker, M.; Cascio, W.E.; Griggs, T.R..; Herbst, M.C.; Bromberg, P.A.; Neas, L.; Williams, R.W.; Devlin, R.B. (2003) Particulate Matter Exposures in Cars is Associated with Cardiovascular Effects in Healthy Young Men. *Am. J. Respir. Crit. Care Med.* 169: 934–940.

[24] National Research Council, 1993. Protecting Visibility in National Parks and Wilderness Areas. National Academy of Sciences Committee on Haze in National Parks and Wilderness Areas. National Academy Press, Washington, DC. This document is available in Docket EPA–HQ–OAR–2004–0008.

manifests in two principal ways: as local visibility impairment and as regional haze.[25] Local visibility impairment may take the form of a localized plume, a band or layer of discoloration appearing well above the terrain as a result from complex local meteorological conditions. Alternatively, local visibility impairment may manifest as an urban haze, sometimes referred to as a ''brown cloud.'' This urban haze is largely caused by emissions from multiple sources in the urban areas and is not typically attributable to only one nearby source or to long-range transport. The second type of visibility impairment, regional haze, usually results from multiple pollution sources spread over a large geographic region. Regional haze can impair visibility over large regions and across states.

Visibility is important because it has direct significance to people's enjoyment of daily activities in all parts of the country. Individuals value good visibility for the well-being it provides them directly, where they live and work, and in places where they enjoy recreational opportunities. Visibility is also highly valued in significant natural areas such as national parks and wilderness areas, and special emphasis is given to protecting visibility in these areas. For more information on visibility see the 2004 PM AQCD as well as the 2005 PM Staff Paper.[26] [27]

Fine particles are the major cause of reduced visibility in parts of the United States. To address the welfare effects of PM on visibility, EPA set secondary $PM_{2.5}$ standards that would act in conjunction with the establishment of a regional haze program. In setting this secondary standard, EPA concluded that $PM_{2.5}$ causes adverse effects on visibility in various locations, depending on PM concentrations and factors such as chemical composition and average relative humidity. The secondary (welfare-based) $PM_{2.5}$ NAAQS was established as equal to the suite of primary (health-based) NAAQS. Furthermore, section 169 of the Act provides additional authorities to remedy existing visibility impairment and prevent future visibility impairment in the 156 national parks, forests and wilderness areas categorized as mandatory class I Federal areas (62 FR 38680–81, July 18, 1997).[28] In July 1999 the regional haze rule (64 FR 35714) was put in place to protect the visibility in mandatory class I federal areas. Visibility can be said to be impaired in both $PM_{2.5}$ nonattainment areas and mandatory class I federal areas.

(a) Current Visibility Impairment

Recently designated $PM_{2.5}$ nonattainment areas indicate that, as of October 2006, almost 90 million people live in nonattainment areas for the 1997 $PM_{2.5}$ NAAQS. Thus, at least these populations would likely be experiencing visibility impairment, as well as many thousands of individuals who travel to these areas. In addition, while visibility trends have improved in mandatory Class I federal areas, the most recent data show that these areas continue to suffer from visibility impairment. In summary, visibility impairment is experienced throughout the U.S., in multi-state regions, urban areas, and remote mandatory class I federal areas.[29] [30] The mandatory class I federal areas are listed in Chapter 2 of the RIA for this action. The areas that have design values above the 1997 $PM_{2.5}$ NAAQS are also listed in Chapter 2 of the RIA for this action.

(b) Future Visibility Impairment

Recent modeling for the CAIR was used to project visibility conditions in mandatory class I federal areas across the country in 2015. The results for the mandatory class I federal areas suggest that these areas are predicted to continue to have annual average deciview levels above background in the future.[31] Modeling done for the PM NAAQS projected $PM_{2.5}$ levels in 2015. These projections include all sources of $PM_{2.5}$, including the engines, vessels and equipment covered in this rule, and suggest that $PM_{2.5}$ levels above the NAAQS will persist into the future.

The engines, vessels and equipment that would be subject to these proposed standards contribute to visibility concerns in these areas through both their primary PM emissions and their VOC and NO_X emissions, which contribute to the formation of secondary $PM_{2.5}$. Reductions in these direct and secondary PM emissions will help to improve visibility across the nation, including mandatory class I federal areas.

(3) Atmospheric Deposition

Wet and dry deposition of ambient particulate matter delivers a complex mixture of metals (*e.g.*, mercury, zinc, lead, nickel, aluminum, cadmium), organic compounds (*e.g.*, POM, dioxins, furans) and inorganic compounds (*e.g.*, nitrate, sulfate) to terrestrial and aquatic ecosystems. The chemical form of the compounds deposited is impacted by a variety of factors including ambient conditions (*e.g.*, temperature, humidity, oxidant levels) and the sources of the material. Chemical and physical transformations of the particulate compounds occur in the atmosphere as well as the media onto which they deposit. These transformations in turn influence the fate, bioavailability and potential toxicity of these compounds. Atmospheric deposition has been identified as a key component of the environmental and human health hazard posed by several pollutants including mercury, dioxin and PCBs.[32]

Adverse impacts on water quality can occur when atmospheric contaminants deposit to the water surface or when material deposited on the land enters a waterbody through runoff. Potential impacts of atmospheric deposition to waterbodies include those related to both nutrient and toxic inputs. Adverse effects to human health and welfare can occur from the addition of excess particulate nitrate nutrient enrichment, which contributes to toxic algae blooms and zones of depleted oxygen, which can lead to fish kills, frequently in coastal waters. Particles contaminated with heavy metals or other toxins may lead to the ingestion of contaminated fish, ingestion of contaminated water, damage to the marine ecology, and limited recreational uses. Several

This book can be viewed on the National Academy Press Website at *http://www.nap.edu/books/0309048443/html/.*

[25] See discussion in U.S. EPA , National Ambient Air Quality Standards for Particulate Matter; Proposed Rule; January 17, 2006, Vol71 p 2676. This information is available electronically at *http://epa.gov/fedrgstr/EPA-AIR/2006/January/Day-17/a177.pdf.*

[26] U.S. EPA (2004) Air Quality Criteria for Particulate Matter (Oct 2004), Volume I Document No. EPA600/P–99/002aF and Volume II Document No. EPA600/P–99/002bF. This document is available in Docket EPA–HQ–OAR–2004–0008.

[27] U.S. EPA (2005) Review of the National Ambient Air Quality Standard for Particulate Matter: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper. EPA–452/R–05–005. This document is available in Docket EPA–HQ–OAR–2004–0008.

[28] These areas are defined in section 162 of the Act as those national parks exceeding 6,000 acres, wilderness areas and memorial parks exceeding 5,000 acres, and all international parks which were in existence on August 7, 1977.

[29] US EPA, Air Quality Designations and Classifications for the Fine Particles ($PM_{2.5}$) National Ambient Air Quality Standards, December 17, 2004. (70 FR 943, Jan 5. 2005) This document is also available on the web at: *http://www.epa.gov/pmdesignations/.*

[30] US EPA. Regional Haze Regulations, July 1, 1999. (64 FR 35714, July 1, 1999).

[31] The deciview metric describes perceived visual changes in a linear fashion over its entire range, analogous to the decibel scale for sound. A deciview of 0 represents pristine conditions. The higher the deciview value, the worse the visibility, and an improvement in visibility is a decrease in deciview value.

[32] U.S. EPA (2000) Deposition of Air Pollutants to the Great Waters: Third Report to Congress. Office of Air Quality Planning and Standards. EPA–453/R–00–0005.

studies have been conducted in U.S. coastal waters and in the Great Lakes Region in which the role of ambient PM deposition and runoff is investigated.[33 34 35 36 37]

Adverse impacts on soil chemistry and plant life have been observed for areas heavily impacted by atmospheric deposition of nutrients, metals and acid species, resulting in species shifts, loss of biodiversity, forest decline and damage to forest productivity. Potential impacts also include adverse effects to human health through ingestion of contaminated vegetation or livestock (as in the case for dioxin deposition), reduction in crop yield, and limited use of land due to contamination.

(4) Current and Projected $PM_{2.5}$ Levels

In 2005 EPA designated 39 nonattainment areas for the 1997 $PM_{2.5}$ NAAQS based on air quality design values (using 2001–2003 or 2002–2004 measurements) and a number of other factors (70 FR 943, January 5, 2005).[38] These areas are comprised of 208 full or partial counties with a total population exceeding 88 million. As mentioned in Section II.B.2, the 1997 $PM_{2.5}$ NAAQS was recently revised and the 2006 $PM_{2.5}$ NAAQS became effective on December 18, 2006. Table II–1 presents the number of counties in areas currently designated as nonattainment for the 1997 $PM_{2.5}$ NAAQS as well as the number of additional counties that have monitored data that is violating the 2006 $PM_{2.5}$ NAAQS. Nonattainment areas will be designated with respect to the new 2006 $PM_{2.5}$ NAAQS in early 2010.

TABLE II–1.—FINE PARTICLE STANDARDS: CURRENT NONATTAINMENT AREAS AND OTHER VIOLATING COUNTIES

Nonattainment areas/other violating counties	Number of counties	Population [1]
1997 $PM_{2.5}$ Standards: 39 areas currently designated	208	88,394,000
2006 $PM_{2.5}$ Standards: counties with violating monitors [2]	49	18,198,676
Total	257	106,592,676

[1] Population numbers are from 2000 census data.
[2] This table provides an estimate of the counties violating the 2006 $PM_{2.5}$ NAAQS based on 2003–05 air quality data. The areas designated as nonattainment for the 2006 $PM_{2.5}$ NAAQS will be based on 3 years of air quality data from later years. Also, the county numbers in the summary table include only the counties with monitors violating the 2006 $PM_{2.5}$ NAAQS. The monitored county violations may be an underestimate of the number of counties and populations that will eventually be included in areas with multiple counties designated nonattainment.

Based on modeling performed for the PM NAAQS analysis, we estimate that 52 counties (where 53 million people are projected to live) will exceed the 2006 $PM_{2.5}$ standard in 2015.[39] In addition, 54 counties (where 27 million people are projected to live) are expected to be within 10 percent of the 2006 $PM_{2.5}$ NAAQS in 2015.

Areas designated as not attaining the 1997 $PM_{2.5}$ NAAQS will need to attain these standards in the 2010 to 2015 time frame, and then be required to maintain the NAAQS thereafter. The attainment dates associated with the potential new 2006 $PM_{2.5}$ nonattainment areas would likely be in the 2015 to 2020 timeframe. The emission standards being proposed in this action would become effective as early as 2009 making the expected HC, NO_X and PM inventory reductions from this rulemaking useful to states in attaining or maintaining the $PM_{2.5}$ NAAQS.

(5) Current PM_{10} Levels

As of October 2006 approximately 28.5 million people live in 46 designated PM_{10} nonattainment areas, which include all or part of 46 counties. These population numbers do not include the people living in areas where there is a potential risk of failing to maintain or achieve the PM_{10} NAAQS in the future. The expected PM, HC and NO_X inventory reductions from these proposed standards would be useful to states in maintaining the PM_{10} NAAQS.

C. Air Toxics

Emissions from the engines, vessels and equipment subject to the proposed standards contribute to ambient levels of gaseous air toxics known or suspected as human or animal carcinogens, or that have non-cancer health effects. These compounds include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter (POM), and naphthalene. All of these compounds, except acetaldehyde, were identified as national or regional risk drivers in the 1999 National-Scale Air Toxics Assessment (NATA) and have significant inventory contributions from mobile sources. That is, for a significant portion of the population, these compounds pose a significant portion of the total cancer risk from breathing outdoor air toxics. The reductions in the emissions from these engines, vessels and equipment would help reduce exposure to these harmful substances.

Air toxics can cause a variety of cancer and noncancer health effects. A number of the mobile source air toxic pollutants described in this section are known or likely to pose a cancer hazard in humans. Many of these compounds also cause adverse noncancer health effects resulting from chronic,[40] subchronic,[41] or acute[42] inhalation exposures. These include neurological, cardiovascular, liver, kidney, and respiratory effects as well as effects on the immune and reproductive systems.

[33] U.S. EPA (2004) National Coastal Condition Report II. Office of Research and Development/ Office of Water. EPA–620/R–03/002.

[34] Gao, Y., E.D. Nelson, M.P. Field, *et al.* 2002. Characterization of atmospheric trace elements on $PM_{2.5}$ particulate matter over the New York-New Jersey harbor estuary. *Atmos. Environ.* 36: 1077–1086.

[35] Kim, G., N. Hussain, J.R. Scudlark, and T.M. Church. 2000. Factors influencing the atmospheric depositional fluxes of stable Pb, 210Pb, and 7Be into Chesapeake Bay. *J. Atmos. Chem.* 36: 65–79.

[36] Lu, R., R.P. Turco, K. Stolzenbach, *et al.* 2003. Dry deposition of airborne trace metals on the Los Angeles Basin and adjacent coastal waters. *J. Geophys. Res.* 108(D2, 4074): AAC 11–1 to 11–24.

[37] Marvin, C.H., M.N. Charlton, E.J. Reiner, *et al.* 2002. Surficial sediment contamination in Lakes Erie and Ontario: A comparative analysis. *J. Great Lakes* Res. 28(3): 437–450.

[38] The full details involved in calculating a $PM_{2.5}$ design value are given in Appendix N of 40 CFR part 50.

[39] US EPA (2006). Regulatory Impact Analysis for the 2006 NAAQS for Particle Pollution. This document is available in Docket EPA-HQ–OAR–2004–0008.

[40] Chronic exposure is defined in the glossary of the Integrated Risk Information (IRIS) database (*http://www.epa.gov/iris*) as repeated exposure by the oral, dermal, or inhalation route for more than approximately 10% of the life span in humans (more than approximately 90 days to 2 years in typically used laboratory animal species).

[41] Defined in the IRIS database as exposure to a substance spanning approximately 10 of the lifetime of an organism.

[42] Defined in the IRIS database as exposure by the oral, dermal, or inhalation route for 24 hours or less.

Benzene. The EPA's Integrated Risk Information (IRIS) database lists benzene as a known human carcinogen (causing leukemia) by all routes of exposure, and that exposure is associated with additional health effects, including genetic changes in both humans and animals and increased proliferation of bone marrow cells in mice.[43 44 45] EPA states in its IRIS database that data indicate a causal relationship between benzene exposure and acute lymphocytic leukemia and suggests a relationship between benzene exposure and chronic non-lymphocytic leukemia and chronic lymphocytic leukemia. A number of adverse noncancer health effects including blood disorders, such as preleukemia and aplastic anemia, have also been associated with long-term exposure to benzene.[46 47] The most sensitive noncancer effect observed in humans, based on current data, is the depression of the absolute lymphocyte count in blood.[48 49] In addition, recent work, including studies sponsored by the Health Effects Institute (HEI), provides evidence that biochemical responses are occurring at lower levels of benzene exposure than previously known.[50 51 52 53] EPA's IRIS program has not yet evaluated these new data.

1,3-Butadiene. EPA has characterized 1,3-butadiene as carcinogenic to humans by inhalation.[54 55] The specific mechanisms of 1,3-butadiene-induced carcinogenesis are unknown. However, it is virtually certain that the carcinogenic effects are mediated by genotoxic metabolites of 1,3-butadiene. Animal data suggest that females may be more sensitive than males for cancer effects, but there are insufficient data in humans from which to draw conclusions about sensitive subpopulations. 1,3-Butadiene also causes a variety of reproductive and developmental effects in mice; no human data on these effects are available. The most sensitive effect was ovarian atrophy observed in a lifetime bioassay of female mice.[56]

Formaldehyde. Since 1987, EPA has classified formaldehyde as a probable human carcinogen based on evidence in humans and in rats, mice, hamsters, and monkeys.[57] EPA is currently reviewing recently published epidemiological data. For instance, recently released research conducted by the National Cancer Institute (NCI) found an increased risk of nasopharyngeal cancer and lymphohematopoietic malignancies such as leukemia among workers exposed to formaldehyde.[58 59] NCI is currently performing an update of these studies. A recent National Institute of Occupational Safety and Health (NIOSH) study of garment workers also found increased risk of death due to leukemia among workers exposed to formaldehyde.[60] Based on the developments of the last decade the working group of the International Agency for Research on Cancer (IARC) concluded in 2004 that formaldehyde is carcinogenic to humans (Group 1), a higher classification than previous IARC evaluations, on the basis of sufficient evidence in humans and sufficient evidence in experimental animals.

Formaldehyde exposure also causes a range of noncancer health effects, including irritation of the eyes (tearing of the eyes and increased blinking) and mucous membranes.

Acetaldehyde. Acetaldehyde is classified in EPA's IRIS database as a probable human carcinogen, based on nasal tumors in rats, and is considered toxic by the inhalation, oral, and intravenous routes.[61] The primary acute effect of exposure to acetaldehyde vapors is irritation of the eyes, skin, and respiratory tract.[62] The agency is currently conducting a reassessment of the health hazards from inhalation exposure to acetaldehyde.

Acrolein. Acrolein is intensely irritating to humans when inhaled, with acute exposure resulting in upper respiratory tract irritation and congestion. EPA determined in 2003 using the 1999 draft cancer guidelines that the human carcinogenic potential of acrolein could not be determined because the available data were inadequate. No information was available on the carcinogenic effects of acrolein in humans and the animal data provided inadequate evidence of carcinogenicity.[63]

Polycyclic Organic Matter (POM). POM is generally defined as a large class of organic compounds with multiple benzene rings and a boiling point greater than 100 degrees Celsius. One of these compounds, naphthalene, is discussed separately below. Polycyclic aromatic hydrocarbons (PAH) are a class of POM that contain only hydrogen and carbon atoms. A number of PAHs are known or suspected carcinogens.

---

43 U.S. EPA (2000). Integrated Risk Information System File for Benzene. This material is available electronically at *http://www.epa.gov/iris/subst/0276.htm.*

44 International Agency for Research on Cancer, IARC monographs on the evaluation of carcinogenic risk of chemicals to humans, Volume 29, Some industrial chemicals and dyestuffs, International Agency for Research on Cancer, World Health Organization, Lyon, France, p. 345–389, 1982.

45 Irons, R.D.; Stillman, W.S.; Colagiovanni, D.B.; Henry, V.A. (1992) Synergistic action of the benzene metabolite hydroquinone on myelopoietic stimulating activity of granulocyte/macrophage colony-stimulating factor in vitro, *Proc. Natl. Acad. Sci.* 89:3691–3695.

46 Aksoy, M. (1989). Hematotoxicity and carcinogenicity of benzene. *Environ. Health Perspect.* 82: 193–197.

47 Goldstein, B.D. (1988). Benzene toxicity. Occupational medicine. State of the Art Reviews. 3: 541–554.

48 Rothman, N., G.L. Li, M. Dosemeci, W.E. Bechtold, G.E. Marti, Y.Z. Wang, M. Linet, L.Q. Xi, W. Lu, M.T. Smith, N. Titenko-Holland, L.P. Zhang, W. Blot, S.N. Yin, and R.B. Hayes (1996) Hematotoxicity among Chinese workers heavily exposed to benzene. *Am. J. Ind. Med.* 29: 236–246.

49 EPA 2005 ''Full IRIS Summary for Benzene (CASRN 71–43–2)'' Environmental Protection Agency, Integrated Risk Information System (IRIS), Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH *http://www.epa.gov/iris/subst/0276.htm.*

50 Qu, O.; Shore, R.; Li, G.; Jin, X.; Chen, C.L.; Cohen, B.; Melikian, A.; Eastmond, D.; Rappaport, S.; Li, H.; Rupa, D.; Suramaya, R.; Songnian, W.; Huifant, Y.; Meng, M.; Winnik, M.; Kwok, E.; Li, Y.; Mu, R.; Xu, B.; Zhang, X.; Li, K. (2003). HEI Report 115, Validation & Evaluation of Biomarkers in Workers Exposed to Benzene in China.

51 Qu, Q., R. Shore, G. Li, X. Jin, L.C. Chen, B. Cohen, *et al.* (2002). Hematological changes among Chinese workers with a broad range of benzene exposures. *Am. J. Industr. Med.* 42: 275–285.

52 Lan, Qing, Zhang, L., Li, G., Vermeulen, R., *et al.* (2004). Hematotoxically in Workers Exposed to Low Levels of Benzene. *Science* 306: 1774–1776.

53 Turtletaub, K.W. and Mani, C. (2003). Benzene metabolism in rodents at doses relevant to human exposure from Urban Air. Research Reports Health Effect Inst. Report No.113.

54 U.S. EPA. (2002). Health Assessment of 1,3-Butadiene. Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC. Report No. EPA600–P–98–001F.

55 U.S. EPA (1998). A Science Advisory Board Report: Review of the Health Risk Assessment of 1,3-Butadiene. EPA–SAB–EHC–98.

56 Bevan, C.; Stadler, J.C.; Elliot, G.S.; *et al.* (1996) Subchronic toxicity of 4-vinylcyclohexene in rats and mice by inhalation. Fundam. Appl. Toxicol. 32:1–10.

57 U.S. EPA (1987). Assessment of Health Risks to Garment Workers and Certain Home Residents from Exposure to Formaldehyde, Office of Pesticides and Toxic Substances, April 1987.

58 Hauptmann, M.; Lubin, J.H.; Stewart, P.A.; Hayes, R.B.; Blair, A. 2003. Mortality from lymphohematopoetic malignancies among workers in formaldehyde industries. Journal of the National Cancer Institute 95: 1615–1623.

59 Hauptmann, M.; Lubin, J.H.; Stewart, P.A.; Hayes, R.B.; Blair, A. 2004. Mortality from solid cancers among workers in formaldehyde industries. American Journal of Epidemiology 159: 1117–1130.

60 Pinkerton, L.E. 2004. Mortality among a cohort of garment workers exposed to formaldehyde: an update. Occup. Environ. Med. 61: 193–200.

61 U.S. EPA (1988). Integrated Risk Information System File of Acetaldehyde. This material is available electronically at *http://www.epa.gov/iris/subst/0290.htm.*

62 U.S. EPA (1988). Integrated Risk Information System File of Acetaldehyde. This material is available electronically at *http://www.epa.gov/iris/subst/0290.htm.*

63 U.S. EPA. 2003. Integrated Risk Information System File of Acrolein. Research and Development, National Center for Environmental Assessment, Washington, DC. This material is available electronically at *http://www.epa.gov/iris/subst/0364.htm.*

Recent studies have found that maternal exposures to PAHs in a population of pregnant women were associated with several adverse birth outcomes, including low birth weight and reduced length at birth, as well as impaired cognitive development at age three.[64] [65] EPA has not yet evaluated these recent studies.

Naphthalene. Naphthalene is found in small quantities in gasoline and diesel fuels but is primarily a product of combustion. EPA recently released an external review draft of a reassessment of the inhalation carcinogenicity of naphthalene.[66] The draft reassessment recently completed external peer review.[67] Based on external peer review comments, additional analyses are being considered. California EPA has released a new risk assessment for naphthalene, and the IARC has reevaluated naphthalene and re-classified it as Group 2B: possibly carcinogenic to humans.[68] Naphthalene also causes a number of chronic non-cancer effects in animals, including abnormal cell changes and growth in respiratory and nasal tissues.[69]

In addition to reducing VOC, NO_X, CO and $PM_{2.5}$ emissions from these engines, vessels and equipment, the standards proposed in this document would also reduce air toxics emitted from these engines, vessels and equipment, thereby helping to mitigate some of the adverse health effects associated with operation of these engines, vessels and equipment.

D. Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas produced through the incomplete combustion of carbon-based fuels. The current primary NAAQS for CO are 35 ppm for the 1-hour average and nine ppm for the 8-hour average. These values are not to be exceeded more than once per year.

We have already found that emissions from nonroad engines contribute significantly to CO concentrations in more than one nonattainment area (59 FR 31306, June 17, 1994). We have also previously found that emissions from Small SI engines contribute to CO concentrations in more than one nonattainment area. We propose to find here, based on the information in this section of the preamble and Chapters 2 and 3 of the Draft RIA, that emissions from Marine SI engines and vessels likewise contribute to CO concentrations in more than one CO nonattainment area.

Carbon monoxide enters the bloodstream through the lungs, forming carboxyhemoglobin and reducing the delivery of oxygen to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Healthy individuals also are affected, but only at higher CO levels. Exposure to elevated CO levels is associated with impairment of visual perception, work capacity, manual dexterity, learning ability and performance of complex tasks. Carbon monoxide also contributes to ozone nonattainment since carbon monoxide reacts photochemically in the atmosphere to form ozone.[70] Additional information on CO related health effects can be found in the Carbon Monoxide Air Quality Criteria Document (CO AQCD).[71]

In addition to health effects from chronic exposure to ambient CO levels, acute exposures to higher levels are also a problem, see the Draft RIA for additional information. In recent years a substantial number of CO poisonings and deaths have occurred on and around recreational boats across the nation.[72] The actual number of deaths attributable to CO poisoning while boating is difficult to estimate because CO-related deaths in the water may be labeled as drowning. An interagency team consisting of the National Park Service, the U.S. Department of the Interior, and the National Institute for Occupational Safety and Health maintains a record of published CO-related fatal and nonfatal poisonings.[73] Between 1984 and 2004, 113 CO-related deaths and 458 non-fatal CO poisonings have been identified based on hospital records, press accounts and other information. Deaths have been attributed to exhaust from both onboard generators and propulsion engines. Houseboats, cabin cruisers, and ski boats are the most common types of boats associated with CO poisoning cases. These incidents have prompted other federal agencies, including the United States Coast Guard and National Park Service, to issue advisory statements and other interventions to boaters to avoid excessive CO exposure.[74]

As of October 2006, there were approximately 15 million people living in 6 areas (which include 10 counties) designated as nonattainment for CO. The CO nonattainment areas are presented in the Draft RIA.

EPA previously determined that emissions from nonroad engines and equipment contribute significantly to ozone and CO concentrations in more than one nonattainment area (59 FR 31306, June 17, 1994). EPA also determined that the categories of small land-based SI engines cause or contribute to ambient ozone and CO in more than one nonattainment area (65 FR 76790, Dec. 7, 2000). With regard to Marine SI engines and vessels, our NONROAD model indicates that these engines are present in each of the CO nonattainment areas and thus contribute to CO concentrations in those nonattainment areas. The CO contribution from Marine SI engines in classified CO nonattainment areas is presented in Table II–2.

[64] Perera, F.P.; Rauh, V.; Tsai, W–Y.; *et al.* (2002) Effect of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population. *Environ Health Perspect.* 111: 201–205.

[65] Perera, F.P.; Rauh, V.; Whyatt, R.M.; Tsai, W.Y.; Tang, D.; Diaz, D.; Hoepner, L.; Barr, D.; Tu, Y.H.; Camann, D.; Kinney, P. (2006) Effect of prenatal exposure to airborne polycyclic aromatic hydrocarbons on neurodevelopment in the first 3 years of life among inner-city children. Environ Health Perspect 114: 1287–1292.

[66] U.S. EPA. 2004. Toxicological Review of Naphthalene (Reassessment of the Inhalation Cancer Risk), Environmental Protection Agency, Integrated Risk Information System, Research and Development, National Center for Environmental Assessment, Washington, DC. This material is available electronically at *http://www.epa.gov/iris/subst/0436.htm.*

[67] Oak Ridge Institute for Science and Education. (2004). External Peer Review for the IRIS Reassessment of the Inhalation Carcinogenicity of Naphthalene. August 2004. *http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=86019.*

[68] International Agency for Research on Cancer (IARC). (2002). Monographs on the Evaluation of the Carcinogenic Risk of Chemicals for Humans. Vol. 82. Lyon, France.

[69] U.S. EPA. 1998. Toxicological Review of Naphthalene, Environmental Protection Agency, Integrated Risk Information System, Research and Development, National Center for Environmental Assessment, Washington, DC. This material is available electronically at *http://www.epa.gov/iris/subst/0436.htm.*

[70] U.S. EPA (2000). Air Quality Criteria for Carbon Monoxide, EPA/600/P–99/001F. This document is available in Docket EPA–HQ–OAR–2004–0008.

[71] U.S. EPA (2000). Air Quality Criteria for Carbon Monoxide, EPA/600/P–99/001F. This document is available in Docket EPA–HQ–OAR–2004–0008.

[72] Mott, J.S.; Wolfe, M.I.; Alverson, C.J.; Macdonald, S.C.; Bailey, C.R.; Ball, L.B.; Moorman, J.E.; Somers, J.H.; Mannino, D.M.; Redd, S.C. (2002) National Vehicle Emissions Policies and Practices and Declining US Carbon Monoxide-Related Mortality. JAMA 288:988–995.

[73] National Park Service; Department of the Interior; National Institute for Occupational Safety and Health. (2004) Boat-related carbon monoxide poisonings. This document is available electronically at *http://safetynet.smis.doi.gov/thelistbystate10–19–04.pdf* and in docket EPA–HQ–OAR–2004–0008.

[74] U.S Department of the Interior. (2004) Carbon monoxide dangers from generators and propulsion engines. On-board boats—compilation of materials. This document is available online at *http://safetynet.smis.doi.gov/COhouseboats.htm* and in docket EPA–HQ–OAR–2004–0008.

TABLE II–2.—CO EMISSIONS FROM MARINE SI ENGINES AND VESSELS IN CLASSIFIED CO NONATTAINMENT AREAS

Area	County	Category	CO (short tons in 2005)
Missoula, MT	Missoula	Marine SI	94
Las Vegas, NV	Clark	Marine SI	3,016
Reno, NV	Washoe	Marine SI	3,494
El Paso, TX	El Paso	Marine SI	37
South Coast Air Basin	Los Angeles	Marine SI	4,615
	Riverside	Marine SI	1,852
	Orange	Marine SI	5,360
	San Bernardino	Marine SI	2,507

Source: U.S. EPA, NONROAD 2005 model.

Based on the national inventory numbers in Chapter 3 of the Draft RIA and the local inventory numbers described in this section of the preamble, we propose to find that emissions of CO from Marine SI engines and vessels contribute to CO concentrations in more than one CO nonattainment area.

III. Sterndrive and Inboard Marine Engines

A. Overview

This section applies to sterndrive and inboard marine (SD/I) engines. Sterndrive and inboard engines are spark-ignition engines typically derived from automotive engine blocks for which a manufacturer will take steps to ''marinize'' the engine for use in marine applications. This marinization process includes choosing and optimizing the fuel management system, configuring a marine cooling system, adding intake and exhaust manifolds, and adding accessory drives and units. These engines typically have water-jacketed exhaust systems to keep surface temperatures low. Ambient surface water (seawater or freshwater) is generally added to the exhaust gases before the mixture is expelled under water.

As described in Section I, the initial rulemaking to set standards for Marine SI engines did not include final emission standards for SD/I engines. In that rulemaking, we finalized the finding under Clean Air Act section 213(a)(3) that all Marine SI engines cause or contribute to ozone concentrations in two or more ozone nonattainment areas in the United States. However, because uncontrolled SD/I engines appeared to be a low-emission alternative to outboard and personal watercraft engines in the marketplace, even after the emission standards for these engines were fully phased in, we decided to set emission standards only for outboard and personal watercraft engines. At that time, outboard and personal watercraft engines were almost all two-stroke engines with much higher emission rates compared to the SD/I engines, which were all four-stroke engines. We pointed out in that initial rulemaking that we wanted to avoid imposing costs on SD/I engines that could cause a market shift to increased use of the higher-emitting outboard engines, which would undermine the broader goal of achieving the greatest degree of emission control from the full set of Marine SI engines.

We believe now is an appropriate time to set standards for SD/I engines, for several reasons. First, the available technology for SD/I engines has developed significantly, so we are now able to anticipate substantial emission reductions. With the simultaneous developments in technology for outboard and personal watercraft engines, we can set standards that achieve substantial emission reductions from all Marine SI engines. Second, now that California has adopted standards for SD/I engines, the cost impact of setting new standards for manufacturers serving the California market is generally limited to the hardware costs of adding emission control technology; these manufacturers will be undergoing a complete redesign effort for these engines to meet the California standards. Third, we believe SD/I engines meeting the proposed standards will in many cases have performance advantages over pre-control engines, which will allow manufacturers of SD/I engines to promote their engines as having a greater value to justify any price increases. As a result, we believe we can achieve the maximum emission reductions from Marine SI engines by setting standards for SD/I engines based on the use of catalyst technology at the same time that we adopt more stringent standards for outboard and personal watercraft engines.

As described in Section II, we are proposing to make the finding under Clean Air Act section 213(a)(3) that Marine SI engines cause or contribute to CO concentrations in two or more nonattainment areas of the United States. We believe the proposed CO standards will also reduce the exposure of individual boaters and bystanders to potentially dangerous CO levels.

We believe catalyst technology is available for achieving these proposed standards. Catalysts have been used for decades in automotive applications to reduce emissions, and catalyst manufacturers have continued to develop and improve this technology. Design issues for using catalysts in marine applications are primarily centered on packaging catalysts in the water-jacketed, wet exhaust systems seen on most SD/I engines. Section III.G discusses recent development work that has shown success in packaging catalysts in SD/I applications. In addition, there are ongoing efforts in evaluating catalyst technology in SD/I engines being sponsored by the marine industry, U.S. Coast Guard, and California ARB.

B. Engines Covered by This Rule

(1) Definition of Sterndrive and Inboard Engines

For the purpose of this regulation, SD/I engines encompass all spark-ignition marine propulsion engines that are not outboard or personal watercraft engines. A discussion of the proposed new definitions for outboard and personal watercraft engines is in Section IV.B. We consider all the following to be SD/I engines: inboard, sterndrive (also known as inboard/outboard), airboat engines, and jet boat engines.

The existing definitions for sterndrive and inboard engines from 40 CFR part 91 are presented below:

- Sterndrive engine means a four stroke Marine SI engine that is designed such that the drive unit is external to the hull of the marine vessel, while the engine is internal to the hull of the marine vessel.
- Inboard engine means a four stroke Marine SI engine that is designed such that the propeller shaft penetrates the

hull of the marine vessel while the engine and the remainder of the drive unit is internal to the hull of the marine vessel.

We are proposing to amend the above definitions for determining which exhaust emission standards apply to spark-ignition marine engines in 2009. The new proposed definition would be a single term to include sterndrive and inboard engines together as a single engine category. The proposed definition for sterndrive/inboard also is drafted to include all engines not otherwise classified as outboard or personal watercraft engines. Note that we are proposing to revise the definitions of outboard and personal watercraft engines as described in Section IV.B.

The proposed definition has several noteworthy impacts. First, it removes a requirement that only four-stroke engines can qualify as sterndrive/inboard engines. We believe limiting the definition to include only four-stroke engines is unnecessarily restrictive and could create an incentive to use two-stroke (or rotary) engines to avoid the proposed catalyst-based standards. Second, it removes limitations caused by reference to propellers. The definition should not refer specifically to propellers, because there are other propulsion drives on marine vessels, such as jet drives, that could be used with SD/I engines. Third, as explained in the section on the OB/PWC definitions, the proposed definitions treat engines installed in open-bay vessels (*e.g.* jet boats) and in vessels over 4 meters long as SD/I engines. Finally, the existing definition does not clearly specify how to treat specialty vessels such as airboats or hovercraft that use engines that are similar to those in conventional SD/I applications. Under the discretion in the regulation allowing EPA to make judgments about the scope of the SD/I engine definition, we have classified airboats as SD/I engines. See 40 CFR 91.3 for the existing definitions of the marine engine classes. We continue to believe these engines share fundamental characteristics with traditional SD/I engines and should therefore be treated the same way. However, we believe the definitions should address these applications expressly to make clear which standards apply.

We request comment on the following proposed definition:

• Sterndrive/inboard engine means a spark-ignition engine that is used to propel a marine vessel, but is not an outboard engine or a personal watercraft engine. This includes engines on propeller-driven vessels, jet boats, airboats, and hovercraft.

High-performance SD/I engines are generally characterized by high-speed operation, supercharged air intake, customized parts, very high power densities, and a short time until rebuild (50 to 200 hours). Based on current SD/I product offerings, we are proposing to define a high-performance engine as an SD/I engine with maximum power at or above 373 kW (500 hp) that has design features to enhance power output such that the expected operating time until rebuild is substantially shorter than 480 hours.

(2) Exclusions and Exemptions

We are proposing to extend our basic nonroad exemptions to the SD/I engines and vessels covered by this proposal. These include the testing exemption, the manufacturer-owned exemption, the display exemption, and the national-security exemption. If the conditions for an exemption are met, then the engine is not subject to the exhaust emission standards. These exemptions are described in more detail under Section VIII.

In the rulemaking for recreational vehicles, we chose not to apply standards to hobby products by exempting all reduced-scale models of vehicles that are not capable of transporting a person (67 FR 68242, November 8, 2002). We are proposing to extend that same provision to SD/I marine engines (see § 1045.5).

The Clean Air Act provides for different treatment of engines used solely for competition. Rather than relying on engine design features that serve as inherent indicators of dedicated competitive use, as specified in the current regulations, we have taken the approach in more recent programs of more carefully differentiating competition and noncompetition models in ways that reflect the nature of the particular products. In the case of Marine SI engines, we do not believe there are engine design features that allow us to differentiate between engines that are used in high-performance recreational applications and those that are used solely for competition. We are therefore proposing that, starting January 1, 2009, Marine SI engines meeting all the following criteria would be considered to be used solely for competition, except in other cases where information is available indicating that engines are not used solely for competition (see § 1045.620):

• The engine (or a vessel in which the engine is installed) may not be displayed for sale in any public dealership or otherwise offered for sale to the general public.

• Sale of the vessel in which the engine is installed must be limited to professional racers or other qualified racers.

• The engine must have performance characteristics that are substantially superior to noncompetitive models (*e.g.* higher power-to-weight ratio).

• The engines must be intended for use only in racing events sanctioned (with applicable permits) by the Coast Guard or other public organization, with operation limited to racing events, speed record attempts, and official time trials.

Engine manufacturers would make their request for each new model year, and we would deny a request for future production if there are indications that some engines covered by previous requests are not being used solely for competition. Competition engines are produced and sold in very small quantities, so manufacturers should be able to identify which engines qualify for this exemption. We are also proposing to apply the same criteria to outboard and personal watercraft engines and vessels. We request comment on this approach to qualifying for a competition exemption.

We are proposing a new exemption to address individuals who manufacture recreational marine vessels for personal use (see § 1045.630). Under the proposed exemption, these vessels and their engines could be exempt from standards, subject to certain limitations. For example, an individual may produce one such vessel over a ten-year period, the vessel may not be used for commercial purposes, and any exempt engines may not be sold for at least five years. The vessel must generally be built from unassembled components, rather than simply completing assembly of a vessel that is otherwise similar to one that will be certified to meet emission standards. This proposal addresses the concern that hobbyists who make their own vessels could otherwise be a manufacturer subject to the full set of emission standards by introducing these vessels into commerce. We expect this exemption to involve a very small number of vessels.

C. Proposed Exhaust Emission Standards

We are proposing technology-based exhaust emission standards for new SD/I engines. These standards are similar to the exhaust emission standards that California ARB recently adopted (see Section I). This section describes the proposed requirements for SD/I engines for controlling exhaust emissions. See

Section V for a description of the proposed requirements related to evaporative emissions.

(1) Standards and Dates

We are proposing exhaust emission standards of 5 g/kW-hr $HC+NO_X$ and 75 g/kW-hr CO for SD/I engines, starting with the 2009 model year (see § 1045.105). On average, this represents about a 70 percent reduction in $HC+NO_X$ and a 50 percent reduction in CO from baseline engine configurations. Due to the challenges of controlling CO emissions at high load, the expected reduction in CO emissions from low to mid-power operation is expected to be more than 80 percent. We are proposing additional lead time for small businesses as discussed in Section III.F.2. The proposed standards would be based on the same duty cycle that currently is in place for outboard and personal watercraft engines, as described in Section III.D. Section III.F discusses the technological feasibility of these standards in more detail. We request comment on the feasibility and appropriateness of the proposed standards.

The proposed standards are largely based on the use of small catalytic converters that can be packaged in the water-cooled exhaust systems typical for these applications. California ARB also adopted an $HC+NO_X$ standard of 5 g/kW-hr, but they did not adopt a standard for CO emissions. We believe the type of catalyst used to achieve the $HC+NO_X$ standard will also be effective in reducing CO emissions enough to meet the proposed standard, so no additional technology will be needed to control CO emissions.

Manufacturers have expressed concern that the proposed implementation dates may be difficult to meet, for certain engines, due to anticipated changes in engine block designs produced by General Motors. As described in the Draft RIA and in the docket, the vast majority of SD/I engines are based on automotive engine blocks sold by General Motors.[75] There are five basic engine blocks used, and recently GM has announced that it will discontinue production of the 4.3L and 8.1L engine blocks in 2009. GM anticipates that it will offer a 4.1L engine block and a 6.0L supercharged engine block to the marine industry as replacements. Full run production of these new blocks is anticipated in mid to late 2009. SD/I engine manufacturers have expressed concern that they will not be able to begin the engineering processes related to marinizing these engines, including the development of catalyst-equipped exhaust manifolds, until mid-2007, when they are expecting to see the first prototypes of the two replacement engine models. In addition, they are concerned that they do not have enough remaining years of sales of the 4.3L and 8.1L engines to justify the cost of developing catalyst-equipped exhaust manifolds for these engines and amortizing the costs of the required tooling while also developing the two new engine models.

The SD/I requirements begin in earnest in California in the 2008 model year. Manufacturers have indicated that they plan to use catalysts to meet the California standards in 2008 for three or four of the five engine models used in SD/I applications but to potentially have limited availability of the 4.3L or 8.1L engines until the catalyst-equipped versions of the two new engine models (4.1L and 6.0L) have been marinized and meet the new California emission standards. At this point, the manufacturers project that the two new engine models would be available for sale in California in 2010. Some 4.3L and 8.1L engines may be available in California during the phase-out based on the possibility of some use of catalyst for one or both of these displacements and the use of transitional flexibilities.

These are unique circumstances because the SD/I engine manufacturers' plans and products depend on the manufacture of the base engine by a company not directly involved in marine engine manufacturing. The SD/I sales represent only a small fraction of total engine sales and thus did not weigh heavily in GM's decision to replace the existing engine blocks with two comparable versions during the timeframe when the SD/I manufacturers are facing new emission standards. SD/I manufacturers have stated that alternative engine blocks that meet their are not available in the interim, and that it would be cost-prohibitive for them to produce their own engine blocks.

EPA is proposing that the Federal SD/I standards take effect for the 2009 model year, one year after the same standards apply in California. We believe a requirement to extend the California standards nationwide after a one-year delay allows manufacturers adequate time to incorporate catalysts across their product lines as they are doing in California. Once the technology is developed for use in California, it would be available for use nationwide soon thereafter. In fact, one company currently certified to the California standards is already offering catalyst-equipped SD/I engines nationwide. However, we request comment on whether an additional year of lead time would be appropriate for engines not using catalysts in California in 2008. This is potentially the 4.3L or 8.1L SD/I engines. Under this alternative, engines based on the three engine blocks not being changed would be required to meet the standards in 2009. Also, engines built from the 4.3L and/or the 8.1L GM blocks would be required to meet the EPA standards if sold in California in 2008 or 2009. Otherwise the new standards for these engines could be delayed for an additional model year (until 2010). Assuming product plans follow through as projected, the two new engine blocks would be required to meet the standards in the 2010 model year.

Another possibility would be to address this issue through the combination of the flexibilities provided through an ABT program and a phase-in of the standards over two model years (2009/2010) instead of implementation in one model year (2009). Under this approach, manufacturers could certify and sell the 4.3L and 8.1L engines in the 2009 model year without catalysts or with limited use of catalysts through emissions averaging. This approach would have the advantage of giving manufacturers flexibility in how they choose to phase in their catalyst-equipped engines. However, engine manufacturers have expressed concern that, even though they will be offering limited configurations of catalyzed engines in California in 2008, that the lead time is short and they will not have the ability to fully catalyze their entire line of engines for 2009. Thus, if the rule is structured in a manner to permit it, marine engine manufacturers would sell a mix of catalyzed and non-catalyzed engines in 2009. Since boat builders can determine which engines are purchased and can choose either catalyzed or non-catalyzed versions of the engines if available, manufacturers are concerned that it would be difficult for SD/I engine manufacturers to ensure compliance with standards based on sales and horsepower weightings. Engine manufacturers, not boat builders, are subject to exhaust emission standards. Thus, a phase-in approach, which would be based on a projection that a certain number of catalyzed engines would be sold, may not be a feasible approach for this industry. The industry would thus prefer a mandatory implementation date as discussed below without a phase-in that uses averaging. The industry's concerns notwithstanding, there are benefits to

[75] "GM Product Changes Affecting SD/I Engine Marinizers," memo from Mike Samulski, EPA, to Docket EPA–HQ–QAR–2004–0008–0528.

this approach. Therefore, we are requesting comment on phasing in the proposed standards over the 2009–2010 timeframe. Under this approach, the standards would be 10 g/kW-hr $HC+NO_X$ and 100 g/kW-hr CO in 2009. The proposed standards would then go into effect in 2010. During the phase-in period, the proposed family emission limit (FEL) caps (see Section III.C.3) would still apply.

A third alternative, preferred by the two large SD/I manufacturers, would be full compliance with the 5 g/kW-hr standard in 2010 except for the 4.1L engine and the 6.0L supercharged engine and requiring those engines to comply with the standards in 2011. Manufacturers have expressed the view that there is value in limiting production volumes of catalyst-equipped engines only to California for two years to gain in-use experience before selling these engines nationwide. Under this approach, any technical issues that may arise with catalyst designs or in-use performance would affect only a small portion of the fleet, which would help minimize in-use concerns and costs associated with warranty claims. This approach would also provide additional lead time for those configurations not modified for California and the two new engine displacements. In addition, as discussed above, manufacturers stated that an averaging-based phase-in program that required the introduction of catalyst-equipped engines outside of California before 2010 is problematic because of marketplace and competitive issues as discussed above. For these reasons, we request comment on whether the proposed standards for SD/I engines should be delayed to 2010 for the three engine models that are not being modified and with an additional model year (2011) for the 4.1L and 6.0L supercharged engines.

Under stoichiometric or lean conditions, catalysts are effective at oxidizing CO in the exhaust. However, under very rich conditions, catalysts are not effective for reducing CO emissions. In contrast, NO_X emissions are effectively reduced under rich conditions. SD/I engines often run at high power modes for extended periods of time. Under high-power operation, engine marinizers must calibrate the engine to run rich as an engine-protection strategy. If the engine were calibrated for a stoichiometric air-fuel ratio at high power, high temperatures could lead to failures in exhaust valves and engine heads. In developing the proposed CO standard for SD/I engines, we considered an approach where test Mode 1 (full power) would be excluded from the weighted CO test level and the other four test modes would be re-weighted accordingly. Under this approach, the measured CO emissions from catalyst-equipped engines were observed to be 65–85 percent lower without Mode 1, even though the weighting factor for Mode 1 is only 6 percent of the total cycle weighting. These test results are presented in Chapter 4 of the Draft RIA. We request comment on finalizing a CO standard of 25 g/kW-hr based on a four-mode duty cycle that excludes Mode 1 instead of the proposed CO standard. Under this approach, we also request comment on CO cap, such as 350 g/kW-hr, specific to Mode 1. Manufacturers would still measure CO emissions at Mode 1 to demonstrate compliance with this cap.

Controlling CO emissions at high power may be a more significant issue with supercharged 6.0L engines due to uncertainty with regard to the air fuel ratio of the engine at high power. Engine manufacturers have not yet received prototype engines; however, they have expressed concern that these engines may need to be operated with a rich air-fuel ratio even at Mode 2 as an engine-protection strategy.[76] This concern is based on previous experience with other supercharged engines. If this is the case, it may affect the potential CO emission reductions from these engines. To address the uncertainties related to the two new SD/I engines (4.1L and 6.0L supercharged) we are asking for comment on a CO averaging standard with a maximum family emission limit to cap high CO emissions. Specifically, we request comment on averaging standard of 25 g/kW-hr CO based on a four-mode test, as discussed above, with a maximum family emission limit for the four-mode test of 75 g/kW-hr.

Engines used on jet boats may have been classified under the existing definitions as personal watercraft engines. As described above, engines used in jet boats or personal watercraft-like vessels 4 meters or longer would be classified as SD/I engines under the proposed definitions. Such engines subject to part 91 today would therefore need to continue meeting EPA emission standards as personal watercraft engines through the 2008 model year under part 91, after which they would need to meet the new SD/I standards under the proposed part 1045. This is another situation where the transition period discussed above may be helpful. In contrast, as discussed above, air boats have been classified as SD/I engines under EPA's discretionary authority and are not required to comply with part 91.

As described above, engines used solely for competition would not be subject to the proposed regulations, but many SD/I high-performance engines are sold for recreational use. High-performance SD/I engines have very high power outputs, large exhaust gas flow rates, and relatively high concentrations of hydrocarbons and carbon monoxide in the exhaust gases. From a conceptual perspective, the application of catalytic converter technology to these engines is feasible. As is the case in similar heavy-duty highway gasoline engines, these catalytic converters would have to be quite large in volume, perhaps on the order of the same volume as the engine displacement, and would involve significant heat rejection issues. Highway heavy-duty gasoline engine certification information from the late 1970s and early 1980s suggests that it is possible to achieve HC and CO emission reductions around 20 to 40 percent by adding an air pump to increase the level of oxygen in the exhaust stream. This would be a relatively low-cost and durable method of oxidizing HC and CO when the exhaust gases are hot enough to support further oxidation reactions. California ARB has implemented the same $HC+NO_X$ standards we are proposing but is expecting manufacturers to rely on emissions averaging within the SD/I class. This is not viable for small business manufacturers who do not have other products with which to average.

Even if manufacturers use catalysts to control $HC+NO_X$ emissions from high-performance engines, controlling CO emissions continues to present a technological challenge. Since these engines generally operate with fuel-rich combustion, there is little or no oxygen in the exhaust stream. As a result, any oxidation of hydrocarbon compounds in the catalyst would likely increase CO levels, rather than oxidizing all the way to CO_2. We are therefore proposing a CO standard for high-performance engines of 350 g/kW-hr. We believe this is achievable with more careful control of fueling under idle conditions. Control of air-fuel ratios at idle should result in improved emission control even after multiple rebuilds. Basing standards on non-catalyst hardware such as an air pump could enable lower CO levels.

We are proposing a variety of provisions to simplify the requirements for exhaust emission certification and compliance for these engines, as described in Section IV.F. We are also proposing not to apply the not-to-exceed

[76] 80 percent of maximum engine test speed and 71.6 percent of maximum torque at maximum test speed.

emission standards to high-performance SD/I marine engines.

We also request comment on two alternative approaches to define emission standards for high-performance engines. First, we could set the $HC+NO_X$ standard at 5 g/kW-hr and allow for emission credits as described above, but allow small-volume manufacturers of high-performance engines to meet a $HC+NO_X$ emission standard in the range of 15 to 22 g/kW-hr. See Section III.F.2 for our proposed definition of small-volume SD/I engine manufacturers. We would also need to adopt an FEL cap of 22 g/kW-hr for $HC+NO_X$ for all manufacturers under this approach to avoid the situation where only small-volume manufacturers of high-performance engines need to make design changes to reduce these emissions. Our concern is that a large manufacturer would otherwise be able to use emission credits to avoid making design changes to their high-performance engines. This emission level is consistent with measured $HC+NO_X$ emission values from these engines showing a range of emission levels with different types of fuel systems and different calibrations, as shown in the Draft RIA. Treating small-volume manufacturers of high-performance engines differently may be appropriate because they have little or no access to emission credits.

Second, we could alternatively set the high-performance engine $HC+NO_X$ standard in the range of 15 to 22 g/kW-hr for all companies and disallow the use of emission credits for meeting this standard. This would require all companies to redesign their engines, rather than use emission credits, to reduce emissions to a standard that is tailored to high-performance engines.

We request comment on the primary approach as well as the two alternatives for high-performance engine standards. Comment is requested on the costs and general positives and negatives of each approach. Comment is also requested on the technology required if a level above the proposed standards is supported, as well as information on safety and energy implications of the alternative emission standards. If a commenter supports either of the two alternative approaches, information and data are requested to assist EPA in setting the appropriate $HC+NO_X$ and CO emission standards within the 15 to 22 g/kW-hr range.

We are also aware that there may be some very small sterndrive or inboard engines. In particular, sailboats may have small propulsion engines for backup power. These engines would fall under the proposed definition of sterndrive/inboard engines, even though they are much smaller and may experience very different in-use operation. These engines may have more in common with marine auxiliary engines that are subject to land-based standards. Nevertheless, these engines share some important characteristics with bigger SD/I engines, such as reliance on four-stroke technology and access to water-based cooling. It is also true that emission standards are based on specific emission levels expected from engines of comparable sizes, so the standards adjust automatically with the size of the engine to require a relatively constant level of stringency. These engines are not like the very small outboard engines that are subject to less stringent standards because of their technical limitations in controlling emissions. Accordingly, we believe these engines can incorporate the same technologies as the bigger marine propulsion engines and meet the same emission standards. However, we request comment on the need for adjusting the emission standards for these engines to accommodate any technology constraints related to their unique designs. Specifically, we request comment on allowing manufacturers the option of certifying small SD/I engines to the proposed standards for auxiliary marine engines discussed in Section V.C.1. We also request comment on the possibility that some other small engines may inappropriately fall into the category of sterndrive/inboard engines. We request comment on the engine size for which any special accommodations must be made. Such comments should also address any issues that may exist for these engines with regard to meeting the proposed standards, or identify any other appropriate way of differentiating these engines from conventional sterndrive/inboard engines.

(2) Not-To-Exceed Standards

We are proposing emission standards for an NTE zone representing a multiplier times the duty cycle standard for $HC+NO_X$ and for CO (see § 1045.105). Section III.D.2 describes the proposed NTE test procedures and gives an overview of the proposed NTE provisions. In addition, Section III.D.2 presents the specific multipliers for the proposed NTE standards.

The NTE approach is consistent with the concept of a weighted modal emission test such as the steady-state tests included in this rule. The proposed duty cycle standard itself is intended to represent the average emissions under steady-state conditions. Because it is an average, manufacturers design their engines with emission levels at individual points varying as needed to maintain maximum engine performance and still meet the engine standard. The NTE limit would be an additional requirement. It is intended to ensure that emission controls function with relative consistency across the full range of expected operating conditions.

(3) Emission Credit Programs

(a) Averaging, Banking, and Trading

We are proposing averaging, banking, and trading of emission credits for sterndrive and inboard marine engines for meeting $HC+NO_X$ and CO standards (see § 1045.105 and part 1045, subpart H). See Section VII.C.5 for a description of general provisions related to averaging, banking, and trading programs. Emission credit calculations would be based on the maximum engine power for an engine family, as described in Section IV.F.

As with previous emission control programs, we are also proposing not to allow an emission family to earn credits for one pollutant if it is using credits to meet the standard for another pollutant. In other words, an engine family that does not meet the CO standard would not be able to earn $HC+NO_X$ emission credits, or vice versa. This should rarely be an issue for SD/I engines, because the same catalyst technology is effective for controlling $HC+NO_X$ and CO emissions. In addition, as with previous emission control programs, we are proposing that engines sold in California would not be included in this ABT program because they are already subject to California $HC+NO_X$ requirements.

Credit generation and use is calculated based on the family emission limit (FEL) of the engine family and the standard. We are proposing FEL caps to prevent the sale of very-high emitting engines. For $HC+NO_X$, the proposed FEL cap is 16 g/kW-hr for $HC+NO_X$ emissions from engines below 373 kW; this emission level is equal to the first phase of the California SD/I standards. We are proposing an FEL cap of 150 g/kW-hr for CO emissions from engines below 373 kW. These FEL caps represent the average baseline emission levels of SD/I engines, based on data described in the Draft RIA. The analogous figures for high-performance engines are 30 g/kW-hr for $HC+NO_X$ and 350 g/kW-hr for CO, as described in Section III.C.(d).

Except as specified below for jet boat engines, we are proposing to keep OB/PWC engines and SD/I engines in separate averaging sets. This means that credits earned by SD/I and OB/PWC engines are counted separately and may not be exchanged to demonstrate compliance with emission standards. Most of the engine manufacturers building SD/I engines do not also build OB/PWC engines. The exception to this is the largest manufacturer in both categories. We are concerned that allowing averaging, banking, or trading between OB/PWC engines and SD/I engines would not provide the greatest achievable reductions, because the level of the standard we are proposing is premised on the use of aftertreatment technology in SD/I engines, and is based on what is feasible for SD/I engines. We did not set the SD/I level based on the reductions achievable between OB/PWC and SD/I, but instead based on what is achievable by SD/I engines alone. The proposed limitation on ABT credits is consistent with this approach to setting the level of the SD/I standard. In addition, allowing such credit usage could provide an incentive to avoid the use of aftertreatment technologies in SD/I engines. This could create a competitive disadvantage for the many small manufacturers of SD/I engines that do not also produce OB/PWC engines.

We propose that emission credits for SD/I engines have an unlimited credit life with no discounting. We consider these emission credits to be part of the overall program for complying with the proposed standards. Given that we may consider further reductions beyond these standards in the future, we believe it will be important to assess the ABT credit situation that exists at the time any further standards are considered. We would need to set such future emission standards based on the statutory direction that emission standards must represent the greatest degree of emission control achievable, considering cost, safety, lead time, and other factors. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards. If we were to allow the use of credits generated under this proposed program for future, more stringent, standards, we may, depending on the level of emission credit banks, need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued or limited use of existing emission credits. Alternatively, we could adopt future standards without allowing the use of existing emission credits.

We are requesting comment on one particular issue regarding credit life. As proposed, credits earned under the exhaust ABT program would have an unlimited lifetime. This could result in a situation where credits generated by an engine sold in a model year are not used until many years later when the engines generating the credits have been scrapped and are no longer part of the fleet. EPA believes there may be value to limiting the use of credits to the period that the credit-generating engines exist in the fleet. For this reason, EPA requests comment on limiting the lifetime of the credits to five years or, alternatively, to the regulatory useful life of the engine.

(b) Early-Credit Approaches

We are proposing an early-credit program in which a manufacturer could earn emission credits before 2009 with early introduction of emission controls designed to meet the proposed standards (see § 1045.145). For engines produced by small-volume SD/I manufacturers that are eligible for the proposed two-year delay described in Section III.F.2, early credits could be earned before 2011. While we believe adequate lead time is provided to meet the proposed standards, we recognize that flexibility in timing could help some manufacturers—particularly small manufacturers—to meet the new standards. Other manufacturers that are able to comply early on certain models would be better able to transition their full product line to the new standards by spreading out the transition over two years or more. Under this approach, we anticipate that manufacturers would generate credits through the use of catalysts.

Manufacturers would generate these credits based on the difference between the measured emission level of the clean engines and an assigned baseline level (16 g/kW-hr $HC+NO_X$ and 150 g/kW-hr CO). These assigned baseline levels are based on data presented in Chapter 4 of the Draft RIA representing the average level observed for uncontrolled engines. We are also proposing to provide bonus credits to any manufacturer that certifies early to the proposed standard to provide a further incentive for introducing catalysts in SD/I engines. The bonus credits would take the form of a multiplier times the earned credits. The proposed multipliers are 1.25 for one year early, 1.5 for two years early, and 2.0 for three years early. For example, a small-volume manufacturer certifying an engine to 5.0 g/kW-hr $HC+NO_X$ in 2009 (2 years early) would get a bonus multiplier of 1.5. Therefore, early $HC+NO_X$ credits would be calculated using the following equation: credits [grams] = $(16 - 5) \times$ Power [kW] $\times$ Useful Life [hours] $\times$ Load Factor $\times$ 1.5. We are proposing to use a load factor of 0.207, that is currently used in the OB/PWC calculations.

To earn these credits, the engine would have to meet both the proposed $HC+NO_X$ and CO standards. These early credits would be treated the same as emission credits generated after the emission standards start to apply. This approach would provide an incentive for manufacturers to pull ahead significantly cleaner technologies. We believe such an incentive would lead to early introduction of catalysts on SD/I and help promote earlier market acceptance of this technology. Because of the proposed credit life, these credits would only be able to be used during the transition period to the new standards. We believe this proposed early credit program will allow manufactures to comply to the proposed standards in an earlier time frame than they would otherwise because it allows them to spread out their development resources over multiple years. To ensure that manufacturers do not generate credits for already required activities, no credits would be generated for the proposed federal program for engines that are produced for sale in California. We request comment on this approach.

Alternatively, we request comment on the alternative of an early ‘‘family banking’’ approach. Under this approach, we would allow manufacturers to certify an engine family early to the proposed standards. For each year of certifying engines early, the manufacturer would be able to delay certification of a comparable number of engines by one year, taking into account the relative power ratings of the different engine families. This would be based on the actual sales and would require no calculation or accounting of emission credits. This approach would not provide the same degree of precision as the early-credit program described above, but it may be an effective way of helping manufacturers make the transition to new emission standards. See 40 CFR 1048.145(a) for an example of regulations that implement such a family banking program.

We request comment on the above early-credit approaches or any other approach that would help manufacturers bring the product lines into compliance with the proposed standards without compromising overall emission reductions. Any allowance for high-emitting or late-compliant engines should be offset by emission controls that achieve emission reductions beyond that required by the new standards. We request comment on the merits of the various approaches noted above and others that commenters may wish to suggest. We request that commenters provide detailed comments on how the approaches described above should be set up, enhanced, or constrained to ensure that they serve their purpose without diminishing the overall effectiveness of the standards.

(c) Jet Boats

Sterndrive and inboard vessels are typically propelled by traditional SD/I engines based on automotive engine blocks. As explained in Section IV, we are proposing to amend the definition of personal watercraft engine to ensure that engines used on jet boats would no longer be classified as personal watercraft engines but instead as SD/I engines because jet boats are more comparable to SD/I vessels. However, manufacturers in some cases make these jet boats by installing an engine also used in outboard or personal watercraft applications (less than 4 meters in length) and coupling the engine to a jet drive for propelling the jet boat. Thus, manufacturers of outboard or personal watercraft engines may also manufacture the same or similar engine for use on what we would propose here to be considered a jet boat (whose engine we would therefore proposed to be subject to SD/I standards).

We are proposing to allow some flexibility in meeting new emission standards for jet boat engines because they are currently designed to use engines derived from OB/PWC applications and because of their relatively low sales volumes. We are also proposing to allow manufacturers to use emission credits generated from outboard and personal watercraft engines to demonstrate that their jet boat engines meet the proposed $HC+NO_X$ and CO standards for SD/I engines (see § 1045.660 and § 1045.701). We further propose that such engine manufacturers may only use this provision if the engines are certified as outboard or personal watercraft engines, and if the majority of units sold in the United States from those related engine families are sold for use as outboard or personal watercraft engines. We would decide whether a majority of engine units are sold for use as outboard or personal watercraft engines based on projected sales volumes from the application for certification. Manufacturers would need to group SD/I engines used for jet boats in a separate engine family from the outboard or personal watercraft engine to ensure proper labeling and calculation of emission credits, but manufacturers could rely on emission data from the same prototype engine for certifying both engine families. Finally, we propose that manufacturers of jet boat engines subject to SD/I standards and using credits from outboard or personal watercraft engines must certify these jet boat engines to an FEL that meets or exceed the standards for outboard and personal watercraft engines. This limits the degree to which manufacturers may take advantage of emission credits to produce engines that are emitting at higher levels than competitive engines. As such, the FELs for these engines must therefore be at or below the proposed emission standards for outboard and personal watercraft engines.

(d) SD/I High-Performance Engines

We are proposing that the ABT program described above (III.C.3(a) through (c)) would also include SD/I high-performance engines. Manufacturers would be able to use emission credits from conventional SD/I engines to offset credit deficits from higher-emitting SD/I high-performance engines. Although SD/I high-performance engines represent fewer than 1 percent of total SD/I engine sales, there are many more companies producing SD/I high-performance engines than conventional SD/I engines. Because of the relatively small sales of these engines, a large manufacturer with a broad product line could readily offset a potential credit deficit by using credits from high-volume SD/I engines. In contrast, most manufacturers of SD/I high-performance engines are small businesses that do not also produce conventional SD/I engines. Section III.F discusses special provisions intended to reduce the burden for small businesses to meet the proposed standards. We request comment on whether this ABT program would create a competitive disadvantage for small businesses.

We are proposing an approach in which manufacturers can use default emission factor of 30 g/kW-hr for $HC+NO_X$ emissions and 350 g/kW-hr for CO emissions in lieu of testing for certification. For purposes of this ABT program these default emission factors, if used in lieu of testing, would be used for certification to an FEL at these levels. Thus, the emission credits needed would be the difference between the default levels and the applicable standard (see § 1045.240). These default emission levels represent the highest emission rates observed on uncontrolled engines. Manufacturers would always have the option of conducting tests to establish a measured emission rate to reduce or eliminate the need to use emission credits. While this testing may require additional setup and preparation, we believe it would be possible even for the most high-powered engines. To avoid the possibility of manufacturers selectively taking advantage of the default values, we would require them to rely on measured values for both $HC+NO_X$ and CO emissions if they do testing.

For the purposes of the credit calculations, we are proposing to use an hours term longer than the proposed useful life for these engines. The proposed useful life for traditional SD/I engines is intended to reflect the full useable life of the engine. For high-performance engines the proposed useful life is intended to reflect the expected time until the engine is rebuilt. High-performance engines are typically rebuilt several times. In fact, manufacturers have indicated that it is common for the boat owner to own two pairs of engines so that they can use one pair while the other is being rebuilt. Therefore, the proposed useful life does not reflect the full life of the engine, including rebuilds, over which emission credits would be used (or generated). We are proposing, for purposes of the credit calculations, that a life of 480 hours would be used for high-performance SD/I engines at or below 485 kW and 250 hours for engines above 485 kW. We request comment on the number of times that high-performance engines are typically rebuilt and how the number of rebuilds should be addressed in the credit calculations.

(4) Crankcase Emissions

Due to blowby of combustion gases and the reciprocating action of the piston, exhaust emissions can accumulate in the crankcase. Uncontrolled engine designs route these vapors directly to the atmosphere. Closed crankcases have become standard technology for automotive engines and for outboard and personal watercraft engines. Manufacturers generally do this by routing crankcase vapors through a valve into the engine's air intake system. We propose to require manufacturers to prevent crankcase emissions from SD/I marine engines (see § 1045.115). Because automotive engine blocks are already tooled for closed crankcases, the cost of adding a valve for positive crankcase ventilation is small for SD/I engines. Even with non-automotive blocks, the tooling changes necessary for closing the crankcase are straight-forward.

(5) Durability Provisions

We rely on pre-production certification, and other programs, to ensure that engines control emissions throughout their intended lifetime of operation. Section VII describes how we are proposing to require manufacturers to incorporate laboratory aging in the certification process, how we limit the extent of maintenance that manufacturers may specify to keep engines operating as designed, and other general provisions related to certification. The following sections describe additional provisions that are specific to SD/I engines.

(a) Useful Life

We are proposing to specify a useful life period of 480 hours or ten years, whichever comes first. The engines would be subject to the emission standards during this useful life period. This is consistent with the requirements adopted by California ARB (see § 1045.105). We are further proposing that the 480-hour useful life period is a baseline value, which may be extended if data show that the average service life for engines in the family is longer. For example, we may require that the manufacturer certify the engine over a longer useful life period that more accurately represents the engines' expected operating life if we find that in-use engines are typically operating substantially more than 480 hours. This approach is similar to what we adopted for recreational vehicles.

For high-performance SD/I engines (at or above 373 kW), we are proposing a useful life of 150 hours or 3 years for engines at or below 485 kW and a useful life of 50 hours or 1 year for engines above 485 kW. Due to the high power and high speed of these engines, mechanical parts are often expected to wear out quickly. For instance, one manufacturer indicated that some engines above 485 kW have scheduled head rebuilds between 50 and 75 hours of operation. These proposed useful life values are consistent with the California ARB regulations for high-performance SD/I engines. We request comment on the proposed useful life requirements for high performance marine engines.

Some SD/I engines below 373 kW may be designed for high power output even though they do not reach the power threshold to qualify as SD/I high-performance engines. Because they do not qualify for the shorter useful life that applies to SD/I high-performance engines, they would be subject to the default value of 480 hours for other SD/I engines. However, to address the limited operating life for engines that are designed for especially high power output, we are proposing to allow manufacturers to request a shorter useful life for such an engine family based on information showing that engines in the family rarely operate beyond the requested shorter period. For example, if engines designed for extremely high performance are typically rebuilt after 250 hours of operation, this would form the basis for establishing a shorter useful life period for those engines. See the proposed regulations for additional detail in establishing a shorter useful life.

(b) Warranty Periods

We are proposing that manufacturers must provide an emission-related warranty during the first 3 years or 480 hours of engine operation, whichever comes first (see § 1045.120). This warranty period would apply equally to emission-related electronic components on SD/I high-performance engines. However, we are proposing shorter warranty periods for emission-related mechanical components on SD/I high-performance engines because these parts are expected to wear out more rapidly than comparable parts on traditional SD/I engines. Specifically, we are proposing a warranty period for emission-related mechanical components of 3 years or 150 hours for engines between 373 and 485 kW, and 1 year or 50 hours for engines above 485 kW. These proposed warranty periods are the same as those adopted by the California ARB.

If the manufacturer offers a longer warranty for the engine or any of its components at no additional charge, we propose that the emission-related warranty for the respective engine or component must be extended by the same amount. The emission-related warranty includes components related to controlling exhaust, evaporative, and crankcase emissions from the engine. This approach to setting warranty requirements is consistent with provisions that apply in most other programs for nonroad engines.

(6) Engine Diagnostics

We are proposing to require that manufacturers design their SD/I engines to diagnose malfunctioning emission control systems starting with the introduction of the proposed standards (see § 1045.110). As discussed in the Draft RIA, three-way catalyst systems with closed-loop fueling control work well only when the air-fuel ratios are controlled to stay within a narrow range around stoichiometry. Worn or broken components or drifting calibrations over time can prevent an engine from operating within the specified range. This increases emissions and can lead to significantly increased fuel consumption and engine wear. The operator may or may not notice the change in the way the engine operates. We are not proposing to require similar diagnostic controls for OB/PWC or Small SI engines because the anticipated emission control technologies for these other applications are generally less susceptible to drift and gradual deterioration. We have adopted similar diagnostic requirements for Large SI engines operating in forklifts and other industrial equipment that also use three-way catalysts to meet emission standards.

This diagnostic requirement focuses solely on maintaining stoichiometric control of air-fuel ratios. This kind of design detects problems such as broken oxygen sensors, leaking exhaust pipes, fuel deposits, and other things that require maintenance to keep the engine at the proper air-fuel ratio.

Diagnostic monitoring provides a mechanism to help keep engines tuned to operate properly, with benefits for both controlling emissions and maintaining optimal performance. There are currently no inspection and maintenance programs for marine engines, so the most important variable in making the emission control and diagnostic systems effective is in getting operators to repair the engine when the diagnostic light comes on. This calls for a relatively simple design to avoid signaling false failures as much as possible. The diagnostic requirements in this rule therefore focus on detecting inappropriate air-fuel ratios, which is the most likely failure mode for three-way catalyst systems. The malfunction indicator light must go on when an engine runs for a full minute under closed-loop operation without reaching a stoichiometric air-fuel ratio.

California ARB has adopted diagnostic requirements for SD/I engines that involve a more extensive system for monitoring catalyst performance and other parameters. We would accept a California-approved system as meeting EPA requirements. However, we believe the simpler system described above is better matched to the level of emission control involved, and is more appropriate in the context of recreational boating by consumers who are not subject to any systematic requirements for inspecting or maintaining their engines.

The proposed regulations direct manufacturers to follow standard practices defined in documents adopted by the International Organization for Standardization (ISO) that establish protocols for automotive systems. The proposed regulations also state that we may approve variations from these industry standards, because individual manufacturers may have systems with unique operating parameters that warrant a deviation from the automotive approach. Also, if a new voluntary consensus standard is adopted to define appropriate practices for marine engines, we would expect to incorporate that new standard into our regulations. See § 1045.110 of the draft regulations for more information.

D. Test Procedures for Certification

(1) General Provisions

The proposed test procedures are generally the same for both SD/I and OB/PWC engines. This involves laboratory measurement of emissions while the engine operates on the ISO E4 duty cycle. This is a five-mode steady-state duty cycle including an idle mode and four modes lying on a propeller curve with an exponent of 2.5, as shown in Appendix II to part 1045 of the draft regulations. The International Organization for Standardization (ISO) intended for this cycle to be used for recreational spark-ignition marine engines installed in vessels up to 24 m in length. Because most or all vessels over 24 m have diesel engines, we believe the E4 duty cycle is most appropriate for SD/I engines covered by this rule. There may be some spark-ignition engines installed in vessels somewhat longer than 24 m, but we believe the E4 duty cycle is no less appropriate in these cases. See Section IV.D for a discussion of adjustments to the test procedures related to the migration to 40 CFR part 1065, testing with a ramped-modal cycle, determining maximum test speed for denormalizing the duty cycle, and testing at higher altitudes.

The E4 duty cycle is gives a weighting of 40 percent for idle. High-performance engine manufacturers have expressed their belief that the E4 duty cycle overstates the idle fraction of operation of high-performance engines. They stated that these engines are rarely operated at idle and are therefore primarily designed for mid-range and high-power operation at the expense of rough idle operation. We request comment on whether the modes for the proposed duty cycle should be reweighted toward higher power for high-performance engines. Commenters should support their assertions with data on high-performance engine use. If constructive data are forthcoming, we may finalize an alternative cycle weighting for high-performance engines based on this data.

(2) Not-to-Exceed Test Procedures and Standards

We are proposing not-to-exceed (NTE) requirements similar to those established for marine diesel engines. Engines would be required to meet the NTE standards during normal in-use operation. We request comment on applying the proposed NTE requirements to spark-ignition marine engines and on the application of the requirements to these engines.

(a) Concept

Our goal is to achieve control of emissions over a wide range of ambient conditions and over the broad range of in-use speed and load combinations that can occur on a marine engine. This would ensure real-world emission control, rather than just controlling emissions under certain laboratory conditions. An important tool for achieving this goal is an in-use testing program with an objective standard and an easily implemented test procedure. Our traditional approach has been to set a numerical standard on a specified test procedure and rely on the additional prohibition of defeat devices to ensure in-use control over a broad range of operation not included in the test procedure.

We are proposing to apply the same prohibition on defeat devices for OB/PWC and SD/I engines (see § 1045.115).

No single test procedure or test cycle can cover all real-world applications, operations, or conditions. Yet to ensure that emission standards are providing the intended benefits in use, we must have a reasonable expectation that emissions under real-world conditions reflect those measured on the test procedure. The defeat device prohibition is designed to ensure that emission controls are employed during real-world operation, not just under laboratory testing conditions. However, the defeat device prohibition is not a quantified standard and does not have an associated test procedure, so it does not have the clear objectivity and ready enforceability of a numerical standard and test procedure. We believe using the traditional approach, *i.e.*, using only a standardized laboratory test procedure and test cycle, makes it difficult to ensure that engines will operate with the same level of control in use as in the laboratory.

Because the proposed duty cycle uses only five modes on an average propeller curve to characterize marine engine operation, we are concerned that an engine designed to the proposed duty cycle would not necessarily perform the same way over the range of speed and load combinations seen on a boat. This proposed duty cycle is based on an average propeller curve, but a marine propulsion engine may never be fitted with an ''average propeller.'' For instance, an engine fit to a specific boat may operate differently based on how heavily the boat is loaded.

To ensure that engines control emissions over the full range of speed and load combinations seen on boats, we propose to establish a zone under the engine's power curve where the engine may not exceed a specified emission limit (see § 1045.105 and § 1045.515). This limit would apply to all regulated pollutants during steady-state operation. In addition, we propose that a wide range of real ambient conditions be included in testing with this NTE zone. The NTE zone, limit, and ambient conditions are described below.

We believe there are significant advantages to establishing NTE standards. The proposed NTE test procedure is flexible, so it can represent the majority of in-use engine operation and ambient conditions. The NTE approach thus takes all the benefits of a numerical standard and test procedure and expands it to cover a broad range of conditions. Also, laboratory testing makes it harder to perform in-use testing because either the engines would have to be removed from the vessel or care would have to be taken to achieve laboratory-type conditions on the vessel. With the NTE approach, in-use testing and compliance become much easier since emissions may be sampled during normal boating. By establishing an objective measurement, this approach makes enforcement of defeat device provisions easier and provides more certainty to the industry.

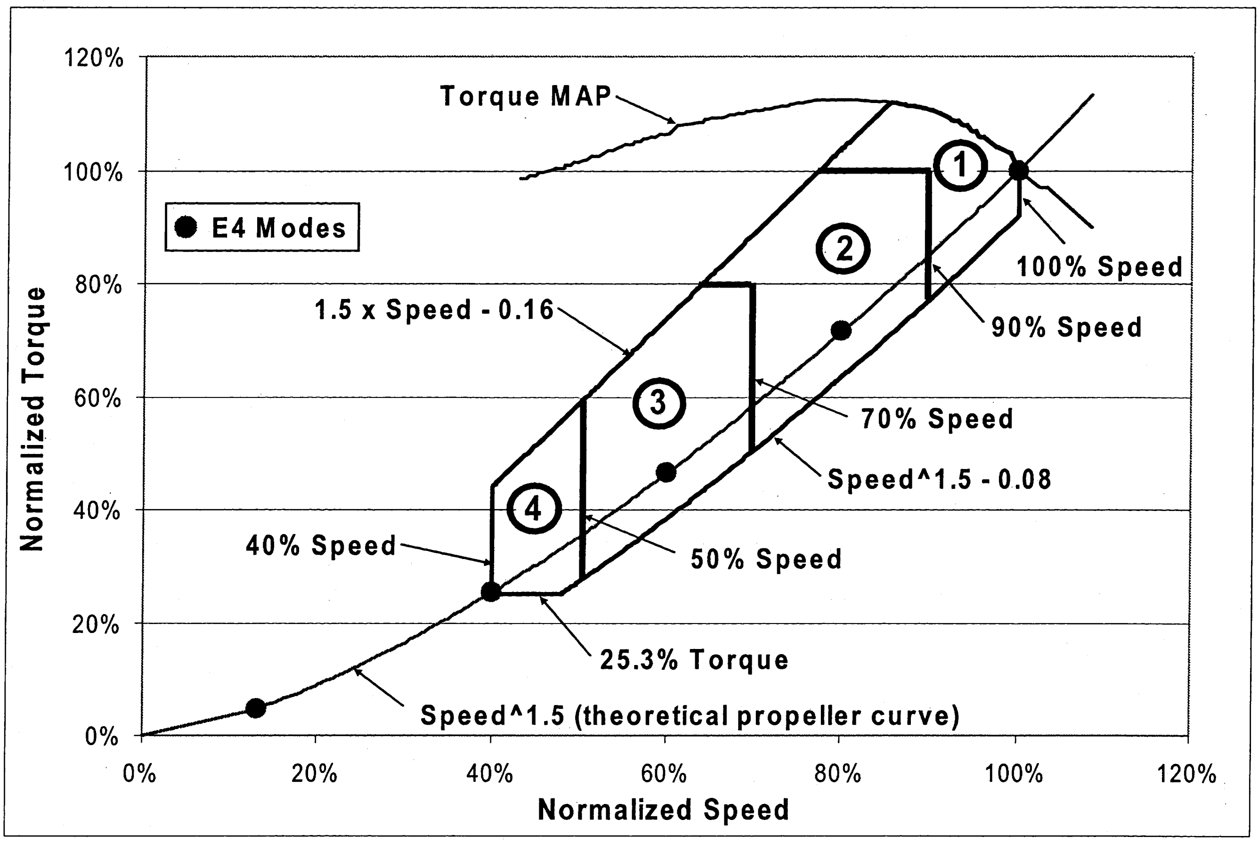
Even with the NTE requirements, we believe it is still appropriate to retain standards based on the steady-state duty cycle. This is the standard that we expect the certified marine engines to meet on average in use. The NTE testing is focused more on maximum emissions for segments of operation and, in most cases, would not require additional technology beyond what is used to meet the proposed standards. In some cases, the calibration of the engine may need to be adjusted. We believe that basing the emission standards on a distinct cycle and using the NTE zone to ensure in-use control creates a comprehensive program.

We believe the technology used to meet the standards over the five-mode duty cycle will meet the caps that apply across the NTE zone. We therefore do not expect the proposed NTE standards to cause manufacturers to need additional technology. We believe the NTE standard will not result in a large amount of additional testing, because these engines should be designed to perform as well in use as they do over the five-mode test. However, our cost analysis in the Draft RIA accounts for some additional testing, especially in the early years, to provide manufacturers with assurance that their engines would meet the proposed NTE requirements.

(b) Shape of NTE Zone

Figure III–1 illustrates our proposed NTE zone for SD/I engines. We developed this zone based on the range of conditions that these engines typically see in use. Manufacturers collected data on several engines installed on vessels and operated under light and heavy load. Chapter 4 of the Draft RIA presents this data and describes the development of the boundaries and conditions associated with the proposed NTE zone. Although significant in-use engine operation occurs at low speeds, we are excluding operation below 40 percent of maximum test speed because brake-specific emissions increase dramatically as power approaches zero. An NTE limit for low-speed or low-power operation would be very hard for manufacturers and EPA to implement in a meaningful way. We are proposing NTE limits for the subzones shown in Figure III–1, as described below. We request comment on the proposed NTE zone and subzones.

Figure III-1: NTE Zone and Subzones



We propose to allow manufacturers to request approval for adjustments to the size and shape of the NTE zone for certain engines, if they can show that the engine will not see operation outside of the revised NTE zone in use (see § 1045.515). We would not want manufacturers to go to extra lengths to design and test their engines to control emissions for operation that will not occur in use. However, manufacturers would still be responsible for all operation of an engine on a vessel that would reasonably be expected to be seen in use, and they would be responsible for ensuring that their specified operation is indicative of real-world operation. In addition, if a manufacturer designs an engine for operation at speeds and loads outside of the proposed NTE zone, the manufacturer would be responsible for notifying us so the NTE zone can be modified appropriately to include this operation for that engine family.

(c) Excluded Operation

As with marine diesel engines, we are proposing that only steady-state operation be included for NTE testing (see § 1045.515). Steady-state operation would generally mean setting the throttle (or speed control) in a fixed position. We believe most operation with Marine SI engines involves nominally steady-state operator demand. It is true that boats often experience rapid accelerations, such as with water skiing. However, boats are typically designed for planing operation at relatively high speeds. This limits the degree to which we would expect engines to experience frequent accelerations during extended operation. Also, because most of the transient events involve acceleration from idle to reach a planing condition, most transient engine operation is outside the NTE zone and would therefore not be covered by NTE testing anyway. Moreover, we believe OB/PWC and SD/I engines designed to comply with steady-state NTE requirements will be using technologies that also work effectively under the changing speed and load conditions that may occur. If we find there is substantial transient operation within the NTE zone that causes significantly increased emissions from installed engines, we will revisit this provision in the future. We request comment on the appropriateness of excluding transient operation from NTE requirements.

We are aware that SD/I engines may not be able to meet emission standards under all conditions, such as times when emission control must be compromised for startability or safety. We are proposing to specify that NTE testing excludes engine starting and warm-up. We would allow manufacturers to design their engines to utilize engine protection strategies that would not be covered by defeat device provisions or NTE standards. This is analogous to the tampering exemptions incorporated into 40 CFR 1068.101(b)(1) to address emergencies. We believe it is appropriate to allow manufacturers to design their engines with ''limp-home'' capabilities to prevent a scenario where an engine fails to function, leaving an operator on the water without any means of propulsion.

(d) NTE Emission Limits

We are proposing NTE limits for the subzones shown in Figure III–1 above based on data collected from several SD/I engines equipped with catalysts. These data and our analysis are presented in Chapter 4 of the Draft RIA. See Section IV.C for a discussion of NTE limits for OB/PWC engines.

Because the proposed NTE zone does not include the idle point, which is weighted at 40 percent of the certification duty cycle, brake-specific emissions throughout most of the proposed NTE zone are less than the weighted average from the steady-state testing. For most of the NTE zone, we are therefore proposing a limit equal to the duty cycle standard (*i.e.*, NTE multiplier = 1.0). However, data on low-emission engines show that brake-specific emissions increase for engine speeds below 50 percent of maximum test speed (Subzone 4). We are therefore proposing an $HC+NO_X$ cap of 1.5 times the certification level in Subzone 4. Emission data on catalyst-equipped engines also show higher emissions near full-power operation. We understand that richer air-fuel ratios are needed under high-power operation to protect the engines from overheating. We are therefore proposing higher NTE limits for engine speeds at or above 90 percent of rated test speed and at or above 100 percent of peak torque measured at the rated test speed (Subzone 1). Specifically, we are proposing an $HC+NO_X$ cap of 1.5 times the duty cycle standard and a CO cap of 3.5 times the duty cycle standard for Subzone 1. We request comment on the proposed NTE limits for SD/I engines. These limits are summarized in Table III–1.

TABLE III–1.—PROPOSED NTE LIMITS BY SUBZONE FOR SD/I ENGINES

Pollutant	Subzone 1	Subzone 2	Subzone 3	Subzone 4
$HC+NO_X$	1.5	1.0	1.0	1.5
CO	3.5	1.0	1.0	1.0

SD/I engine manufacturers have begun developing prototype engines with catalysts, and one manufacturer is currently selling SD/I engines equipped with catalysts. These manufacturers have indicated that they begin moving to richer air-fuel ratio calibrations at torque values greater than 80 percent of maximum. These richer air-fuel ratios give more power but because more fuel is burned also lead to higher hydrocarbon and carbon monoxide emission rates. Part of the manufacturers' rationale in selecting the appropriate air-fuel ratio in this type of operation is to protect the engine by minimizing excess air, which would lead to greater engine temperatures as increased combustion of fuel and exhaust gases. To avoid the adverse effects of this potential for overheating, we request comment on whether subzone 1 should be expanded to accommodate the engine-protection strategies needed for SD/I engines at high power. In addition, we request comment on the proposed NTE limits in subzone 1 with respect to open-loop engine operation, especially for carbon monoxide.

Marine engine manufacturers have suggested alternative approaches to setting NTE limits for marine engines, which are discussed in Section IV.C.2. Largely, these suggestions have been made to address the emission variability between test modes seen in direct-injection two-stroke outboard and PWC engines. However, we request comment on alternative approaches for SD/I engines as well.

(e) Ambient Conditions

Variations in ambient conditions can affect emissions. Such conditions include air temperature, water temperature, and barometric pressure, and humidity. We are proposing to apply the comparable ranges for these variables as for marine diesel engines (see § 1045.515). Within the ranges, there is no calculation to correct measured emissions to standard conditions. Outside of the ranges, emissions could be corrected back to the nearest end of the range using good engineering practice. The proposed ranges are 13 to 35 °C (55 to 95 °F) for ambient air temperature, 5 to 27 °C (41 to 80 °F) for ambient water temperature, and 94.0 to 103.325 kPa for atmospheric pressure. We do not specify a range of humidity values, but propose only to require that laboratory testing be conducted at humidity levels representing in-use conditions.

(f) Measurement Methods

While it may be easier to test outboard engines in the laboratory, there is a strong advantage to using portable measurement equipment to test SD/I engines and personal watercraft without removing the engine from the vessel. Field testing would also provide a much better means of measuring emissions to establish compliance with the NTE standards, because it is intended to ensure control of emissions during normal in-use operation that may not occur during laboratory testing over the specified duty cycle. We propose to apply the field testing provisions for all SD/I engines. These field-testing procedures are described further in Section IV.E.2.d. We request comment on any ways the field testing procedures should be modified to address the unique operating characteristics of marine engines.

A parameter to consider is the minimum sampling time for field testing. A longer period allows for greater accuracy, due mainly to the smoothing effect of measuring over several transient events. On the other hand, an overly long sampling period can mask areas of engine operation with poor emission control characteristics. To balance these concerns, we are applying a minimum sampling period of 30 seconds. This is consistent with the requirement for marine diesel engines. Spark-ignition engines generally don't have turbochargers and they control emissions largely by maintaining air-fuel ratio. Spark-ignition engines are therefore much less prone to consistent emission spikes from off-cycle or unusual engine operation. We believe the minimum 30 second sampling time will ensure sufficient measurement accuracy and will allow for meaningful measurements.

We do not specify a maximum sampling time. We expect manufacturers testing in-use engines to select an approximate sampling time before measuring emissions; however, the standards apply for any sampling time that meets the minimum.

(g) Certification

We propose to require that manufacturers state in their application for certification that their engines will comply with the NTE standards under any nominally steady-state combination of speeds and loads within the proposed NTE zone (see § 1045.205). The manufacturer would also provide a detailed description of all testing, engineering analysis, and other information that forms the basis for the statement. This statement would be based on testing and, if applicable, other research that supports such a statement, consistent with good engineering judgment. We would be able to review the basis for this statement during the certification process. For marine diesel engines, we have provided guidance that manufacturers may demonstrate compliance with NTE standards by testing their engines at a number of standard points throughout the NTE zone. In addition, manufacturers must test at a few random points chosen by EPA prior to the testing. We request comment on this approach for Marine SI engines.

E. Additional Certification and Compliance Provisions

(1) Production Line Testing

We are proposing to require that manufacturers routinely test engines at the point of production to ensure that production variability does not affect the engine family's compliance with emission standards (see part 1045, subpart D). These proposed testing requirements are the same as we are proposing for outboard and personal watercraft engines and are very similar to those already in place in part 91. See Section VII.C.7 and the draft regulations for a detailed description of these requirements. We may also require manufacturers to perform production line testing under the selective enforcement auditing provisions described in Section VIII.E.

(2) In-Use Testing

Manufacturers of OB/PWC engines have been required to test in-use engines to show that they continue to meet emission standards. We contemplated a similar requirement for SD/I engines, but have decided not to propose a requirement for a manufacturer-run in-use testing program at this time. Manufacturers have pointed out that it would be very difficult to identify a commercial fleet of boats that could be set up to operate for hundreds of hours, because it is very uncommon for commercial operators to have significant numbers of SD/I vessels. Where there are commercial fleets of vessels that may be conducive to accelerated in-use service accumulation, these vessels generally use outboard engines. Manufacturers could instead hire drivers to operate the boats, but this may be cost-prohibitive. We request comment on any other alternative approaches that might be available for accumulating operating hours with SD/I engines. For example, to the extent that boat builders maintain a fleet of boats for product development or employees' recreational use, those engines may be available for emission testing after in-use operation.

There is also a question about access to the engines for testing. If engines need to be removed from vessels for testing in the laboratory, it is unlikely that owners would cooperate. However, we are proposing test procedures with specified portable equipment that would potentially allow for testing engines that remain installed in boats. This is described in Section IV.E.2.d.

While we are not proposing a program to require manufacturers to routinely test in-use engines, the Clean Air Act allows us to perform our own testing at any time with in-use engines to evaluate whether they continue to meet emission standards throughout the useful life. This may involve either laboratory testing or in-field testing with portable measurement equipment. For laboratory tests, we could evaluate compliance with either the duty cycle standards or the not-to-exceed standards. For testing with engines that remain installed on marine vessels, we would evaluate compliance with the not-to-exceed standards. In addition, we may require the manufacturer to conduct a reasonable degree of testing under Clean Air Act section 208 if we have reason to believe that an engine family does not conform to the regulations. This testing may take the form of a Selective Enforcement Audit, or we may require the manufacturer to test in-use engines.

(3) Certification Fees

Under our current certification program, manufacturers pay a fee to cover the costs for various certification and other compliance activities associated with implementing the emission standards. As explained below, we are proposing to assess EPA's compliance costs associated with SD/I engines based on EPA's existing fees regulation. Section VI describes our proposal to establish a new fees category, based on the cost study methodology used in establishing EPA's existing fees regulation, for costs related to the proposed evaporative emission standards for both vessels and equipment that would be subject to standards under this proposal.

EPA established a fee structure by grouping together various manufacturers and industries into fee categories, with an explanation that separation of industries into groups was appropriate to tailor the applicable fee to the level of effort expected for EPA to oversee the range of certification and compliance responsibilities (69 FR 26222, May 11, 2004). As part of this process, EPA conducted a cost analysis to determine the various compliance activities associated with each fee category and EPA's associated annual cost burden. Once the total EPA costs were determined for each fee category, the total number of certificates involved within a fee category was added together and divided into the total costs to determine the appropriate assessment for each anticipated certificate.[77] One of the fee categories created was for ''Other Engines and Vehicles,'' which includes marine engines (both compression-ignition and spark-ignition), nonroad spark-ignition engines (above and below 19 kW), locomotive engines, recreational vehicles, heavy-duty evaporative systems, and heavy-duty engines certified only for sale in California. These engine and vehicle types were grouped together because EPA planned a more basic certification review than, for example, light-duty vehicles.

EPA determined in the final fees rulemaking that it would be premature to assess fees for the SD/I engines since they were not yet subject to emission standards. The fee calculation nevertheless includes a projection that there will eventually be 25 certificates of conformity annually for SD/I engines. We are proposing to now formally include SD/I engines in the ''Other Engines and Vehicles'' category and

[77] See Cost Analysis Document at p. 21 associated with the proposed fees rule (*http://www.epa.gov/otaq/fees.htm*).

assess a fee of $839 for each certificate of conformity in 2006. Note that we will continue to update assessed fees each year, so the actual fee in 2009 and later model years will depend on these annual calculations (see § 1027.105).

(4) Special Provisions Related to Partially Complete Engines

It is common practice for Marine SI engines for one company to produce the base engine for a second company to modify for the final application. Since our regulations prohibit the sale of uncertified engines, we are proposing provisions to clarify the status of these engines and defining a path by which these engines can be handled without violating the regulations. See Section XI for more information.

(5) Use of Engines Already Certified to Other Programs

In some cases, manufacturers may want to use engines already certified under our other programs. Engines certified to the emission standards for highway applications in part 86 or Large SI applications in part 1048 are meeting more stringent standards. We are therefore proposing to allow the pre-existing certification to be valid for engines used in marine applications, on the condition that the engine is not changed from its certified configuration in any way (see § 1045.605). Manufacturers would need to demonstrate that fewer than five percent of the total sales of the engine model are for marine applications. There are also a few minor notification and labeling requirements to allow for EPA oversight of this provision.

(6) Import-Specific Information at Certification

We are proposing to require additional information to improve our ability to oversee compliance related to imported engines (see § 1045.205). In the application for certification, we are proposing to require the following additional information: (1) The port or ports at which the manufacturer will import the engines, (2) the names and addresses of the agents the manufacturer has authorized to import the engines, and (3) the location of the test facilities in the United States where the manufacturer will test the engines if we select them for testing under a selective enforcement audit.

F. Small-Business Provisions

(1) Small Business Advocacy Review Panel

On June 7, 1999, we convened a Small Business Advocacy Review Panel under section 609(b) of the Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act of 1996. The purpose of the Panel was to collect the advice and recommendations of representatives of small entities that could be affected by this proposed rule and to report on those comments and the Panel's findings and recommendations as to issues related to the key elements of the Initial Regulatory Flexibility Analysis under section 603 of the Regulatory Flexibility Act. We convened a Panel again on August 17, 2006 to update our review for this new proposal. The Panel reports have been placed in the rulemaking record for this proposal. Section 609(b) of the Regulatory Flexibility Act directs the review Panel to report on the comments of small entity representatives and make findings as to issues related to identified elements of an initial regulatory flexibility analysis (IRFA) under RFA section 603. Those elements of an IRFA are:

- A description of, and where feasible, an estimate of the number of small entities to which the proposed rule will apply;
- A description of projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirements and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap, or conflict with the proposed rule; and
- A description of any significant alternative to the proposed rule that accomplishes the stated objectives of applicable statutes and that minimizes any significant economic impact of the proposed rule on small entities.

In addition to the EPA's Small Business Advocacy Chairperson, the Panel consisted of the Director of the Assessment and Standards Division of the Office of Transportation and Air Quality, the Administrator of the Office of Information and Regulatory Affairs within the Office of Management and Budget, and the Chief Counsel for Advocacy of the Small Business Administration.

Using definitions provided by the Small Business Administration (SBA), companies that manufacture internal-combustion engines and that employ fewer than 1000 employees are considered small businesses for a Small Business Advocacy Review (SBAR) Panel. Equipment manufacturers, boat builders, and fuel system component manufacturers that employ fewer than 500 people are considered small businesses for the SBAR Panel. Based on this information, we asked 25 companies that met the SBA small business thresholds to serve as small entity representatives for the duration of the Panel process. Of these 25 companies, 13 were involved in the marine industry. These companies represented a cross-section of SD/I engine manufacturers, boat builders, and fuel system component manufacturers.

With input from small entity representatives, the Panel reports provide findings and recommendations on how to reduce potential burden on small businesses that may occur as a result of this proposed rule. The Panel reports are included in the rulemaking record for this proposal. In light of the Panel reports, and where appropriate, the agency has made changes to the provisions anticipated for the proposed rule. The proposed options recommended to us by the Panel are described below.

(2) Proposed Burden Reduction Approaches for Small-Volume SD/I Engine Manufacturers

We are proposing several options for small-volume SD/I engine manufacturers. For purposes of determining which engine manufacturers are eligible for the small business provisions described below for SD/I engine manufacturers, we are proposing criteria based on a production cut-off of 5,000 SD/I engines per year. Under this approach, we would allow engine manufacturers that exceed the production cut-off level noted above to request treatment as a small business if they have fewer than the number of employees specified above. In such a case, the manufacturer would provide information to EPA demonstrating the number of employees in their employ. The proposed options would be used at the manufacturers' discretion. We request comment on the appropriateness of these options, which are described in detail below.

(a) Additional Lead Time

One small business marine engine manufacturer is already using catalytic converters on some of its production SD/I marine engines below 373 kW. These engines have been certified to meet standards adopted by California ARB that are equivalent to the proposed standards. However, other small businesses producing SD/I engines have stated that they are not as far along in their catalyst development efforts. These manufacturers support the concept of receiving additional time for compliance, beyond the implementation date for large manufacturers.

High-performance SD/I engine manufacturers are typically smaller businesses than other SD/I engine manufacturers. The majority of high-performance engine manufacturers produce fewer than 100 engines per year for sale in the United States, and some produce only a few engines per year. Due to these very low sales volumes, additional lead time may be useful to the manufacturers to help spread out the compliance efforts and costs.

As recommended in the SBAR Panel report, EPA is proposing an implementation date of 2011 for SD/I engines below 373 kW produced by small business marine engine manufacturers and a date of 2013 for small business manufacturers of high-performance (at or above 373 kW) marine engines (see § 1045.145). As discussed earlier, we have requested comment on alternative non-catalyst based standard of 22 g/kW-hr for high-performance SD/I marine engines. In the case of an alternative non-catalyst based standard, less lead time may be necessary. EPA requests comments on the proposed additional lead time in the implementation of the proposed SD/I exhaust emission standards for small businesses.

(b) Exhaust Emission ABT

As discussed above, we are proposing an averaging, banking, and trading (ABT) credit program for exhaust emissions from SD/I marine engines (see part 1045, subpart H). Small businesses expressed some concern that ABT could give a competitive advantage to large businesses. Specifically, there was an equity concern that if credits generated by SD/I engines below 373 kW could be used for high-performance SD/I engines, that one large manufacturer could use these credits to meet the high-performance SD/I engine standards without making any changes to their engines. EPA requests comment on the desirability of credit trading between high-performance and other SD/I marine engines and the impact it could have on small businesses.

(c) Early Credit Generation for ABT

The SBAR Panel recommended an early banking program and expressed belief that bonus credits will provide greater incentive for more small business engine manufacturers to introduce advanced technology earlier across the nation than would otherwise occur. As discussed above, we are proposing an early banking program in which bonus credits could be earned for certifying early (see § 1045.145). This program, combined with the additional lead time for small businesses, would give small-volume SD/I engine manufacturers ample opportunity to bank emission credits prior to the proposed implementation date of the standards.

(d) Assigned Emission Rates for High-Performance SD/I Engines

Small businesses commented that certification may be too costly to amortize effectively over the small sales volumes for high-performance SD/I engines. One significant part of certification costs is engine testing. This includes testing for emissions over the specified duty cycle, deterioration testing, and not to exceed (NTE) zone testing. Even in the case where an engine manufacturer is using emission credits to comply with the standard, the manufacturer would still need to test engines to calculate how many emission credits are needed. One way of minimizing this testing burden would be to allow manufacturers to use assigned baseline emission rates for certification based on previously generated emission data. As discussed earlier in this preamble, we are proposing assigned baseline $HC+NO_X$ and CO emission rates for all high-performance SD/I engines. These assigned emission rates are based on test data presented in Chapter 4 of the Draft RIA.

(e) Alternative Standards for High-Performance SD/I Engines

Small businesses expressed concern that catalysts have not been demonstrated on high-performance engines and that they may not be practicable for this application. In addition, the concern was expressed that emission credits may not be available at a reasonable price. As discussed earlier, we are requesting comment on the need for and level of alternative standards for high-performance marine engines.

The proposed NTE standards discussed above would likely require additional certification and development testing. The SBAR Panel recommended that NTE standards not apply to any high-performance SD/I engines, as it would minimize the costs of compliance testing for small businesses. For these reasons, we are not proposing to apply NTE standards to high-performance SD/I engines (See § 1045.105).

(f) Broad Engine Families for High-Performance SD/I Engines

Testing burden could be reduced by using broader definitions of engine families. Typically in EPA engine and equipment programs, manufacturers are able to group their engine lines into engine families for certification to the standards. Engines in a given family must have many similar characteristics including the combustion cycle, cooling system, fuel system, air aspiration, fuel type, aftertreatment design, number of cylinders and cylinder bore sizes. A manufacturer would then perform emission tests only on the engine in that family that would be most likely to exceed an emission standard. We are proposing to allow small businesses to group all of their high performance SD/I engines into a single engine family for certification, subject to good engineering judgment (see § 1045.230).

(g) Simplified Test Procedures for High-Performance SD/I Engines

Existing testing requirements include detailed specifications for the calibration and maintenance of testing equipment and tolerances for performing the actual tests. For laboratory equipment and testing, these specifications and tolerances are intended to achieve the most repeatable results feasible given testing hardware capabilities. For in-use testing, EPA allows for different equipment than is specified for the laboratory and with arguably less restrictive specifications and tolerances. The purpose of separate requirements for in-use testing is to account for the variability inherent in testing outside of the laboratory. These less restrictive specifications allow for lower cost emission measurement devices, such as portable emission measurement units. For high performance SD/I engines, it may be difficult to hold the engine at idle or high power within the tolerances currently specified by EPA in the laboratory test procedure. Therefore, we are proposing less restrictive specifications and tolerances, for testing high performance SD/I engines, which would allow the use of portable emission measurement equipment (see § 1065.901(b)). This would facilitate less expensive testing for these small businesses without having a negative effect on the environment.

(h) Reduced Testing Requirements

We are proposing that small-volume engine manufacturers may rely on an assigned deterioration factor to demonstrate compliance with the standards for the purposes of certification rather than doing service accumulation and additional testing to measure deteriorated emission levels at the end of the regulatory useful life (see § 1045.240). EPA is not proposing actual levels for the assigned deterioration factors with this proposal. EPA intends to analyze available emission deterioration information to determine appropriate deterioration factors for SD/I engines. The data will likely include durability information from engines certified to California ARB's standards and may also include engines certified early to EPA's standards. Prior to the implementation date for the SD/I standards, EPA will provide guidance to engine manufacturers specifying the levels of the assigned deterioration factors for small-volume engine manufacturers.

We are also proposing that small-volume engine manufacturers would be exempt from the production-line testing requirements (see § 1045.301). While we are proposing to exempt small-volume engine manufacturers from production line testing, we believe requiring limited production-line testing could be beneficial to implement the ongoing obligation to ensure that production engines are complying with the standards. Therefore, we request comment on the alternative of applying limited production-line testing to small-volume engine manufacturers with a requirement to test one production engine per year.

(i) Hardship Provisions

We are proposing two types of hardship provisions for SD/I engine manufacturers consistent with the Panel recommendations. The first type of hardship is an unusual circumstances hardship, which would be available to all businesses regardless of size. The second type of hardship is an economic hardship provision, which would be available to small businesses only. Sections VIII.C.8 and VIII.C.9 provide a description of the proposed hardship provisions that would apply to SD/I engine manufacturers.

Because boat builders in many cases will depend on engine manufacturers to supply certified engines in time to produce complying boats, we are also proposing a hardship provision for all boat builders, regardless of size, that would allow the builder to request more time if they are unable to obtain a certified engine and they are not at fault and would face serious economic hardship without an extension (see § 1068.255). Section VIII.C.10 provides a description of the proposed hardship provisions that would apply to boat builders.

G. Technological Feasibility

(1) Level of Standards

Over the past few years, developmental programs have demonstrated the capabilities of achieving significant reductions in exhaust emissions from SD/I engines. California ARB has acted on this information to set an $HC+NO_X$ emission standard of 5 g/kW-hr for SD/I engines, starting in 2008. Chapter 4 of the Draft RIA presents data from several SD/I engines with catalysts packaged within water-cooled exhaust manifolds. Four of these engines were operated with catalysts in vessels for 480 hours. The remaining engines were tested with catalysts that had been subjected to a rapid-aging cycle in the laboratory. Data from these catalyst-equipped engines generally show emission levels below the proposed standards.

(2) Implementation Dates

We anticipate that manufacturers will use the same catalyst designs to meet the proposed standards that they will use to meet the California ARB standards for SD/I engines in 2008. We believe a requirement to extend the California standards nationwide after a one-year delay allows manufacturers adequate time to incorporate catalysts across their product lines. Once the technology is developed for use in California, it would be available for use nationwide. In fact, one company currently certified to the California standards is already offering catalyst-equipped SD/I engines nationwide. As discussed above, we request comment on the effect that anticipated product changes for specific General Motors engine blocks may have on the proposed implementation dates.

(3) Technological Approaches

Engine manufacturers can adapt readily available technologies to control emissions from SD/I engines. Electronically controlled fuel injection gives manufacturers more precise control of the air/fuel ratio in each cylinder, thereby giving them greater flexibility in how they calibrate their engines. With the addition of an oxygen sensor, electronic controls give manufacturers the ability to use closed-loop control, which is especially valuable when using a catalyst. In addition, manufacturers can achieve $HC+NO_X$ reductions through the use of exhaust gas recirculation. However, the most effective technology for controlling emissions is a three-way catalyst in the exhaust stream.

In SD/I engines, the exhaust manifolds are water-jacketed and the water mixes with the exhaust stream before exiting the vessel. Manufacturers add a water jacket to the exhaust manifold to meet temperature-safety protocol. They route this cooling water into the exhaust to protect the exhaust couplings and to reduce engine noise. Catalysts must therefore be placed upstream of the point where the exhaust and water mix—this ensures the effectiveness and durability of the catalyst. Because the catalyst must be small enough to fit in the exhaust manifold, potential emission reductions are not likely to exceed 90 percent, as is common in land-based applications. However, as discussed in Chapter 4 of the Draft RIA, demonstration programs have shown that emissions may be reduced by 70 to 80 percent for $HC+NO_X$ and 30 to 50 percent for CO over the proposed test cycle. Larger reductions, especially for CO, have been achieved at lower-speed operation.

There have been concerns that aspects of the marine environment could result in unique durability problems for catalysts. The primary aspects that could affect catalyst durability are sustained operation at high load, saltwater effects on catalyst efficiency, and thermal shock from cold water coming into contact with a hot catalyst. Modern catalysts perform well at temperatures up to 1100° C, which is much higher than would be seen in a marine exhaust manifold. These catalysts have also been shown to withstand the thermal shock of being immersed in water. More detail on catalyst durability is presented in the Draft RIA. In addition, use of catalysts in automotive, motorcycle, and handheld equipment has shown that catalysts can be packaged to withstand vibration in the exhaust manifold.

Manufacturers already strive to design their exhaust systems to prevent water from reaching the exhaust ports. If too much water reaches the exhaust ports, significant durability problems would result from corrosion or hydraulic lock. As discussed in the Draft RIA, industry and government worked on a number of cooperative test programs in which several SD/I engines were equipped with catalysts and installed in vessels to prove out the technology. Early in the development work, a study was performed on an SD/I engine operating in a boat to see if water was entering the part of the manifold where catalysts would be installed. Although some water was collected in the exhaust manifold, it was found that this water came from water vapor that condensed out of the combustion products. This was easily corrected using a thermostat to prevent overcooling from the water jacket.

Four SD/I engines equipped with catalysts were operated in vessels for 480 hours on fresh water. This time period was intended to represent the full expected operating life of a typical SD/I engine. No significant deterioration was observed on any of these catalysts, nor was there any evidence of water reaching the catalysts. In addition, the catalysts were packaged such that the exhaust system met industry standards for maximum surface temperatures.

Testing has been performed on one engine in a vessel on both fresh water and saltwater over a test protocol designed by industry to simulate the worst-case operation for water reversion. No evidence was found of water reaching the catalysts. After the testing, the engine had emission rates below the proposed $HC+NO_X$ standard. We later engaged in a test program to evaluate three additional engines with catalysts in vessels operating on saltwater for extended periods. Early in the program, two of the three manifolds experienced corrosion in the salt-water environment resulting in water leaks and damage to the catalyst. These manifolds were rebuilt with guidance from experts in the marine industry and additional hours have been accumulated on the boats. Although the accumulated hours are well below the 480 hours performed on fresh water, the operation completed has shown no visible evidence of water reversion or damage to the catalysts.

One SD/I engine manufacturer began selling engines equipped with catalysts in Summer 2006. They have certified their engines to the California ARB standards, and are selling their catalyst-equipped engines nationwide. This manufacturer indicated that they have successfully completed durability testing, including extended in-use testing on saltwater. Other manufacturers have indicated that they will have catalyst-equipped SD/I engines for sale in California by the end of this year.

(4) Regulatory Alternatives

In developing the proposed emission standards, we considered both what was achievable without catalysts and what could be achieved with larger, more efficient catalysts than those used in our test programs. Chapter 4 of the Draft RIA presents data on SD/I engines equipped with exhaust gas recirculation (EGR). $HC+NO_X$ emission levels below 10 g/kW-hr were achieved for each of the engines. CO emissions ranged from 25 to 185 g/kW-hr. We believe EGR would be a technologically feasible and cost-effective approach to reducing emissions from SD/I marine engines. However, we believe greater reductions could be achieved through the use of catalysts. We considered basing an interim standard on EGR, but were concerned that this would divert manufacturers' resources away from catalyst development and could have the effect of delaying emission reductions from this sector.

Several of the marine engines with catalysts that were tested as part of the development of the proposed standards had $HC+NO_X$ emission rates in the 3–4 g/kW-hr range, even with consideration of expected in-use emissions deterioration associated with catalyst aging. However, we believe a standard of 5 g/kW-hr is still appropriate given the potential variability in in-use performance and in test data. The test programs described in Chapter 4 of the Draft RIA did not investigate larger catalysts for SD/I applications. The goal of the testing was to demonstrate catalysts that would work within the packaging constraints associated with water jacketing the exhaust and fitting the engines into engine compartments on boats. However, we did perform testing on engines equipped with both catalysts and EGR. These engines showed emission results in the 2–3 g/kW-hr range. We expect that these same reductions could be achieved more simply through the use of larger catalysts or catalysts with higher precious metal loading. Past experience indicates that most manufacturers will strive to achieve emission reductions well below the proposed standards to give them certainty that they will pass the standards in-use, especially as catalysts on SD/I engines are a new technology. Therefore, we do not believe it is necessary at this time to set a lower standard for these engines.

(5) Our Conclusions

We believe the proposed 2009 exhaust emission standards for SD/I engines represent the greatest degree of emission reduction feasible in this time frame. Manufacturers could meet the proposed standards through the use of three-way catalysts packaged in the exhaust systems upstream of where the water and exhaust mix. One manufacture is already selling engines with this technology and by 2009 many other manufacturers will have experience in producing engines with catalysts for sale in California.

As discussed in Section X, we do not believe the proposed standards would have negative effects on energy, noise, or safety and may lead to some positive effects.

IV. Outboard and Personal Watercraft Engines

A. Overview

This section applies to spark-ignition outboard and personal watercraft (OB/PWC) marine engines and vessels. OB/PWC engines are currently required to meet the $HC+NO_X$ exhaust emissions and other related requirements under 40 CFR part 91. As a result of these standards, manufacturers have spent the last several years developing new technologies to replace traditional, carbureted, two-stroke engine designs. Many of these technologies are capable of emission levels well below the current standards. We are proposing new $HC+NO_X$ and CO exhaust emission standards for OB/PWC marine engines.

For outboard and personal watercraft engines, the current emission standards regulate only $HC+NO_X$ emissions. As described in Section II, we are proposing in this notice to make the finding under Clean Air Act section 213(a)(3) that Marine SI engines cause or contribute to CO nonattainment in two or more areas of the United States.

We believe manufacturers can use readily available technological approaches to design their engines to meet the proposed standards. In fact, as discussed in Chapter 4 of the Draft RIA, manufacturers are already producing several models of four-stroke engines and direction-injection two-stroke engines that meet the proposed standards. The most important compliance step for the proposed standards will be to retire high-emitting designs that are still available and replace them with these cleaner engines. We are not proposing standards based on the use of catalytic converters in OB/PWC engines. While this may be an attractive technology in the future, we do not believe there has been sufficient development work on the application of catalysts to OB/PWC engines to use as a basis for standards at this time.

Note that we are proposing to migrate the regulatory requirements for marine spark-ignition engines from 40 CFR part 91 to 40 CFR part 1045. This gives us the opportunity to update the details of our certification and compliance program to be consistent with the comparable provisions that apply to other engine categories and describe regulatory requirements in plain language. Most of the change in regulatory text provides improved clarity without substantially changing procedures or compliance obligations. Where there is a change that warrants further attention, we describe the need for the change below.

B. Engines Covered by This Rule

(1) Definition of Outboard and Personal Watercraft Engines and Vessels

The proposed standards are intended to apply to outboard marine engines and engines used to propel personal watercraft. We are proposing to change the existing definitions of outboard and personal watercraft to reflect this intent. The existing definitions of outboard engine and personal watercraft marine engine are presented below:

- *Outboard engine* is a Marine SI engine that, when properly mounted on a marine vessel in the position to operate, houses the engine and drive unit external to the hull of the marine vessel.
- *Personal watercraft engine (PWC)* is a Marine SI engine that does not meet the definition of outboard engine, inboard engine, or sterndrive engine, except that the Administrator in his or her discretion may classify a PWC as an inboard or sterndrive engine if it is comparable in technology and emissions to an inboard or sterndrive engine.

With the proposed implementation of catalyst-based standards for sterndrive and inboard marine engines, we believe the above definitions could be problematic. Certain applications using SD/I engines and able to apply catalyst control would not be categorized as SD/I under the existing definitions in at least two cases. First, an airboat engine, which is often mounted well above the hull of the engine and used to drive an aircraft-like propeller could be misconstrued as an outboard engine. However, like traditional sterndrive and inboard engines, airboat engines are typically derived from automotive-based engines without substantial modifications for marine application. Airboat engines can use the same technologies that are available to sterndrive and inboard engines, so we believe they should be subject to the same standards. To address the concerns about classifying airboats, we are proposing to change the outboard definition to specify that the engine and drive unit be a single, self-contained unit that is designed to be lifted out of the water. This clarifies that air boats are not outboard engines; air boats do not have engines and drive units that are designed to be lifted out of the water. We are proposing the following definition:

- *Outboard engine* means an assembly of a spark-ignition engine and drive unit used to propel a marine vessel from a properly mounted position external to the hull of the marine vessel. An outboard drive unit is partially submerged during operation and can be tilted out of the water when not in use.

Second, engines used on jet boats (with an open bay for passengers) have size, power, and usage characteristics that are very similar to sterndrive and inboard applications, but these engines may be the same as OB/PWC engines, rather than the marinized automotive engines traditionally used on sterndrive vessels. We believe classifying such engines as personal watercraft engines is inappropriate because it would subject the jet boats to less stringent emission standards than other boats with similar size and power characteristics. This different approach could lead to increased use of high-emitting engines in these vessels. Under the current regulations, engines powering jet boats could be treated as SD/I engines at the discretion of the Agency, because they are comparable in technology to conventional SD/I engines. We are proposing definitions that would explicitly exclude jet boats and their engines from being treated as personal watercraft engines or vessels. Instead, we are proposing to classify jet boat engines as SD/I.

The proposed definitions conform to the existing definition of personal watercraft established by the International Organization for Standardization (ISO 13590). This ISO standard excludes open-bay vessels and specifies a maximum vessel length of 4 meters. The ISO standard therefore excludes personal watercraft-like vessels 4 meters or greater and jet boats. Thus, engines powering such vessels would be classified as sterndrive/inboard engines. We believe this definition effectively serves to differentiate vessels in a way that groups propulsion engines into categories that are appropriate for meeting different emission standards. This approach is shown below with the corresponding proposed definition of personal watercraft engine. We are proposing one change to the ISO definition for domestic regulatory purposes; we propose to remove the word ''inboard'' to prevent confusion between PWC and inboard engines and state specifically that a vessel powered by an outboard marine engine is not a PWC. We are proposing the following definition:

- *Personal watercraft* means a vessel less than 4.0 meters (13 feet) in length that uses an installed internal combustion engine powering a water jet pump as its primary source of propulsion and is designed with no open load carrying area that would retain water. The vessel is designed to be operated by a person or persons positioned on, rather than within, the confines of the hull. A vessel using an outboard engine as its primary source of propulsion is not a personal watercraft.
- *Personal watercraft engine* means a spark-ignition engine used to propel a personal watercraft.

Section III.C.2 describes special provisions that would allow manufacturers extra flexibility with emission credits if they want to continue using outboard or personal watercraft engines in jet boats. These engines would need to meet the standards for sterndrive/inboard engines, but we believe it is appropriate for them to make this demonstration using emission credits generated by other outboard and personal watercraft engines because these vessels are currently using these engine types. We request comment on this approach to defining personal watercraft, especially as it relates to vessels 4 meters or longer and jet boats.

(2) Exclusions and Exemptions

We are proposing to maintain the existing exemptions for OB/PWC engines. These include the testing exemption, the manufacturer-owned exemption, the display exemption, and the national-security exemption. If the conditions for an exemption are met, the engine is not subject to the exhaust emission standards. These exemptions are described in more detail under Section VIII.

The Clean Air Act provides for different treatment of engines used solely for competition. In the initial rulemaking to set standards for OB/PWC engines, we adopted the conventional definitions that excluded engines from the regulations if they had features that would be difficult to remove and that would make it unsafe, impractical, or unlikely to be used for noncompetitive purposes. We have taken the approach in other programs of more carefully differentiating competition and noncompetition models, and are proposing these kinds of changes in this rule. The proposed changes to the existing provisions relating to competition engines would apply equally to all types of Marine SI engines. See Section III and § 1045.620 of the regulations for a full discussion of the proposed approach.

We are proposing a new exemption to address individuals who manufacture recreational marine vessels for personal use (see § 1045.630). Under the proposed exemption, these vessels and their engines could be exempt from standards, subject to certain limitations. For example, an individual may produce one such vessel over a ten-year period, the vessel may not be used for commercial purposes, and any exempt engines may not be sold for at least five years. The vessel must generally be built from unassembled components, rather than simply completing assembly of a vessel that is otherwise similar to one that will be certified to meet emission standards. This proposal addresses the concern that hobbyists who make their own vessels would otherwise be manufacturers subject to the full set of emission standards by introducing these vessels into commerce. We expect this exemption to involve a very small number of vessels.

In the rulemaking for recreational vehicles, we chose not to apply standards to hobby products by exempting all reduced-scale models of vehicles that are not capable of transporting a person (67 FR 68242, November 8, 2002). We are proposing to extend that same provision to OB/PWC marine engines (see § 1045.5).

C. Proposed Exhaust Emission Standards

We are proposing more stringent exhaust emission standards for new OB/PWC marine engines. These proposed standards can be met through the expanded reliance on four-stroke engines and two-stroke direct-injection engines. This section describes the proposed requirements for OB/PWC engines for controlling exhaust emissions. See Section V for a description of the proposed requirements related to evaporative emissions.

(1) Standards and Dates

We are proposing new $HC+NO_X$ standards for OB/PWC engines starting in model year 2009 that would achieve more than a 60 percent reduction from the existing 2006 standards. We are also proposing new CO emission standards. These proposed standards would result in meaningful CO reductions from many engines and prevent CO from increasing from engines that already use technologies with lower CO emissions. The proposed emission standards are largely based on certification data from cleaner-burning Marine SI engines, such as four-stroke engines and two-stroke direct-injection engines. Section IV.F discusses the technological feasibility of these standards in more detail. Table IV–1 presents the proposed exhaust emission standards for OB/PWC. We are also proposing to apply not-to-exceed emission standards over a range of engine operating conditions, as described in Section IV.C.2. (See § 1045.103.)

TABLE IV–1—PROPOSED OB/PWC EXHAUST EMISSION STANDARDS [G/KW-HR] FOR 2009 MODEL YEAR

Pollutant	P[a] ≤ 40 kW	P[a] > 40 kW
$HC+NO_X$	28–0.3 × P	16
CO	500–5.0 × P	300

[a] P = maximum engine power in kilowatts (kW).

The proposed emission standards for $HC+NO_X$ are similar in stringency to the 2008 model year standards adopted in California, and we expect that the same technology anticipated to be used in California can be used to meet these proposed standards. However, we are proposing to simplify the form of the standards. The existing EPA 2006 and California ARB 2008 requirements use a functional relationship to set the emission standard for each engine family depending on the power rating—the numerical value of the standard increases with decreasing power ratings, especially for the smallest engines. However, as described in Chapter 4 of the Draft RIA, certification data show that brake-specific emission rates (in g/kW-hr) are relatively constant for engines with maximum engine power above 40 kW. We are therefore proposing a single standard for engines with maximum engine power above 40 kW. For smaller engines, the relationship between brake-specific emissions and maximum engine power is pronounced. We are proposing a simple linear function for the standards for these engines, as shown in Table IV–1. While this approach differs slightly from the California ARB standards, we believe it provides a good match for establishing a comparable level of stringency while simplifying the form of the regulatory standard.

The proposed implementation date gives an additional year beyond the implementation date of the California standards of similar stringency. Manufacturers generally sell their lower-emission engines, which are already meeting the 2008 California standards, nationwide. However, the additional year would give manufacturers time to address any models that may not meet the upcoming California standards or are not generally sold in California. We request comment on additional regulatory flexibility that manufacturers may need to transition to the proposed standards. For instance, a modest phase-in of the standards may be useful to manufacturers to complete an orderly turnover of high-emitting engines. This phase-in could take the form of giving an extra year for compliance with the proposed standards for a small percentage of engines (*e.g.*, 10 percent of projected sales) or phasing-in the level of the standard (*e.g.*, 20–25 g/kW-hr $HC+NO_X$). Any comments on proposed transitional flexibility should give details that fully describe the recommended program.

The proposed standards include the same general provisions that apply today. For example, engines must control crankcase emissions. The regulations also require compliance over the full range of adjustable parameters and prohibit the use of defeat devices. (See § 1045.115.)

(2) Not-to-Exceed Standards

Section III.D.2 describes NTE standards for sterndrive and inboard engines. We are proposing to apply the same NTE testing provisions to OB/PWC engines, including the same NTE zone and subzones and ambient conditions (see § 1045.515). However, data presented in Chapter 4 of the Draft RIA suggest that different emission limits would be appropriate for OB/PWC engines. For instance, we are proposing higher limits at full power for SD/I engines equipped with catalysts because the engines must operate rich at this mode to protect catalysts and exhaust valves. Because we are not anticipating the use of catalysts on OB/PWC to meet the exhaust emission standards, we believe it is not necessary to adopt such high limits for OB/PWC engines.

The Draft RIA describes the available emission data that allow us to specify appropriate modal caps for OB/PWC engines based on four-stroke engine technology. The available data for direct-injection two-stroke engines showed two different distinct patterns in modal emission rates. We are therefore proposing two alternative sets of NTE limits—manufacturers could use either set of NTE limits for their OB/PWC engines. To offset the relaxed limits for certain subzones, we are proposing more stringent limits for other subzones for these alternative approaches. Table IV–2 presents the proposed sets of NTE limits for the subzones described in Section III.D.2. We request comment on the proposed NTE limits for OB/PWC engines.

TABLE IV–2—PROPOSED NTE LIMITS BY SUBZONE FOR OB/PWC ENGINES

Approach	Pollutant	Subzone 4	Subzone 3	Subzone 2	Subzone 1
Primary	$HC+NO_X$	1.6	1.2	1.2	1.2
	CO	1.5	1.5	1.5	1.5
Alternative 1	$HC+NO_X$	2.0	0.8	0.8	2.0
	CO	1.0	1.0	1.5	3.0
Alternative 2	$HC+NO_X$	3.0	1.0	1.0	1.0
	CO	2.0	1.0	1.0	1.5

Marine engine manufacturers indicated that they are concerned that the differences in engine designs, especially for direct-injection two-stroke engines, may result in emission variation that would make it difficult to meet a fixed set of NTE limits for all engines. To address this variability, they have suggested two alternative approaches to setting NTE limits for marine engines. The first approach would be to base the NTE limits on the modal test results from the certification test rather than fixed values that would apply to all engines. NTE limits would then be linearly interpolated between the modes as a function of speed and load. For example, if the modal results were 2.0 g/kW-hr at Mode 3 and 4.0 g/kW-hr at Mode 4, the interpolated value half way between these modal test points would be 3 g/kW-hr. A multiplier would then be applied to this interpolated value to create the NTE limit. This multiplier would be intended to account for testing and production variability. The multiplier would not likely need to be as large as the proposed general multipliers for the subzones presented above because it would be applied to a surface generated from each manufacturer's actual modal data. Because the NTE cap would be calculated from the individual test modes in the steady-state test, it may be necessary for the manufacturers to assign family emission limits for each of the test modes in the proposed NTE zone.

The second conceptual approach would be to use a weighted average approach to the NTE limit rather than to have individual NTE limits for each subzone. Under this approach, an emission measurement would be made in each of the subzones plus idle. These measurements could be made at any operation point within each subzone. The measured emissions would then be combined using the weighting factors for the modal test. This weighted average emission level would be required to be below the standard (or family emission limit) times a multiplier (under this approach, only a single multiplier would be needed). The purpose of the multiplier would be to allow for some variability within each subzone. Because the weighted average emissions from the subzones would have the tendency of approaching the steady-state test value, this multiplier would not be expected to be much higher than 1.0. However, one drawback to this approach is that there is no specific cap for each mode and a weighted average approach may not be as effective in capping modal emissions as would be specific limits for each subzone. More detail on this concept is available in the docket.[78]

We request comment on the two alternative NTE limit approaches described above. Specifically, commenters should provide detail on what advantages (and disadvantages) these alternatives may provide and what effect they may have on in-use emissions and the potential for improving the manufacturer in-use testing program. In addition, commenters should describe what emission limits or multipliers would be appropriate for the alternative approaches and provide test data supporting these conclusions.

(3) Emission Credit Programs

Engine manufacturers may use emission credits to meet OB/PWC standards under part 91. See Section VII.C.5 for a description of general provisions related to averaging, banking, and trading programs.

We propose to adopt an ABT program for the new $HC+NO_X$ emission standards that is similar to the existing program (see part 1045, subpart H). Credits may be used interchangeably between outboard and personal watercraft engine families. Credits earned under the current program may also be used to comply with the new OB/PWC standards as described below.

We are proposing an unlimited life for emission credits earned under the proposed new standards for OB/PWC engines. We consider these emission credits to be part of the overall program for complying with proposed standards. Given that we may consider further reductions beyond the proposed standards in the future, we believe it will be important to assess the ABT credit situation that exists at the time any future standards are considered. We would need to set such future emission standards based on the statutory direction that emission standards must represent the greatest degree of emission control achievable, considering cost, safety, lead time, and other factors. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards. If we were to allow the use of existing emission credits for meeting future standards, we may, depending on the level of emission credit banks, need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued or limited use of existing emission credits. Alternatively, we could adopt future standards without allowing the use existing credits. The proposal described in this notice describes a middle path in which we allow the use of existing credits to meet the proposed new standards, with provisions that limit the use of these credits based on a three-year credit life.

We are requesting comment on one particular issue regarding credit life. As proposed, credits earned under the new exhaust ABT program would have an unlimited lifetime. This could result in a situation where credits generated by an engine sold in a model year are not used until many years later when the engines generating the credits have been scrapped and are no longer part of the fleet. EPA believes there may be value to limiting the use of credits to the period that the credit-generating engines

[78] ''Marine NTE Zones,'' Presentation to EPA by BRP on October 26, 2006, Docket EPA–HQ–OAR–2004–0008–0508.

exist in the fleet. For this reason, EPA requests comment on limiting the lifetime of the credits generated under the proposed exhaust ABT program to five years or, alternatively, to the regulatory useful life of the engine.

We are interested in using a common emission credit calculation methodology across our programs. Therefore, we are proposing to use the same emission credit equation for OB/PWC engines that is common in many of our other programs. This equation results in a simpler calculation than is currently used for OB/PWC engines. The primary difference is that the regulatory useful life would be used in the credit calculation rather than a discounted useful life function based on engine type and power rating. In addition, the emission credits would be reported in units of kilograms rather than grams. We anticipate that this change in the credit calculation would directionally increase the relative value of emission credits generated under the existing ABT program. However, due to the proposed limit on credit life and the proposed FEL cap for OB/PWC engines, we do not believe that this increase in relative value will significantly hamper the introduction of clean engine technology. We request comment on the new credit calculation and on whether credits generated under the existing OB/PWC standards should be adjusted to be more equivalent to credits generated under the proposed ABT program.

We are proposing an averaging program for CO emissions. Under this program, manufacturers could generate credits with engine families that have FELs below the CO emission standard to be used for engine families in their product line in the same model year that are above the CO standard. However, we are proposing to disallow banking for CO emissions. We are concerned that a banking program could result in a large accumulation of credits based on a given company's mix of engine technologies. If banking were allowed, the proposed CO standard would need to be substantially more stringent to reflect the capability for industry-wide average CO emission levels. We generally allow trading only with banked credits, so we are also proposing to disallow trading of CO emission credits.

As with previous emission control programs, we are also proposing not to allow manufacturers to earn credits for one pollutant for an emission family that is using credits to meet the standard for another pollutant. In other words, an engine family that does not meet the CO standard would not be able to earn $HC+NO_X$ emission credits, or vice versa. In addition, as with the current standards, we are proposing that engines sold in California would not be included in this ABT program because they are already subject to California requirements.

Under the existing standards, no cap is set on FELs for certifying engine families. This was intended to allow manufacturers to sell old-technology two-stroke engines by making up the emissions deficit with credits under the ABT program. For engines subject to the new emission standards, we are proposing FEL caps to prevent the sale of very high-emitting engines. For $HC+NO_X$, the proposed FEL cap is based on the existing 2006 standards. For CO, the proposed FEL cap is 150 g/kW-hr above the proposed standard. We believe this will still allow a great deal of flexibility for manufacturers using credits, but will require manufacturers to stop producing engines that emit pollutants at essentially uncontrolled levels.

Except as specified in Section III.C.2 for jet boats, we are proposing to specify that OB/PWC engines and SD/I engines are in separate averaging sets. This means that credits earned by OB/PWC engines may be used only to offset higher emissions from other OB/PWC engines, and credits earned by SD/I engines may be used only to offset higher emissions from other SD/I engines. We are allowing jet boats to use OB/PWC credits because there are currently small sales of these engines currently using OB/PWC engines. Most of the engine manufacturers building SD/I engines do not also build OB/PWC engines. The exception to this is the largest manufacturer in both categories. We are concerned that allowing averaging, banking, and trading between OB/PWC engines and SD/I engines would not provide the greatest achievable reductions, because the level of the standard we are proposing is premised on the technology used in OB/PWC engines, and is based on what is feasible for these engines. We did not set the OB/PWC level based on the reductions achievable between OB/PWC and SD/I, but instead based on what is achievable by OB/PWC itself. The proposed limitation on ABT credits is consistent with this approach to setting the level of the OB/PWC standards. We are also concerned that allowing trading between OB/PWC and SD/I could create a competitive disadvantage for the many small manufacturers of SD/I engines that do not also produce OB/PWC engines. In addition, we are proposing SD/I emission standards that would likely require the use of aftertreatment. We would not want to provide an incentive to use credits from the OB/PWC marine sector to avoid the use of aftertreatment technologies in SD/I engines.

We request comment on the structure of the proposed ABT program, including the new provisions related to CO emissions. For any commenters suggesting that we include banking or trading for CO emissions, we solicit further comment on what the appropriate CO standard should be to account for the greater regulatory flexibility and therefore greater degree of control achievable using emissions credits. We also request comment on the use and level of the proposed FEL caps and on the approach to defining averaging sets.

(4) Durability Provisions

We are proposing to keep the existing useful life periods from 40 CFR part 91. The specified useful life for outboard engines is 10 years or 350 hours of operation, whichever comes first. The useful life for personal watercraft engines is 5 years or 350 hours of operation, whichever comes first. (See § 1045.103.)

We are proposing to update the specified emissions warranty periods for outboard and personal watercraft engines to align with our other emission control programs (see § 1045.120). Most nonroad engines have emissions warranty periods that are half of the total useful life period. As a result, we are proposing a warranty period for outboard engines of five years or 175 hours of operation, whichever comes first. The proposed warranty period for personal watercraft engines is 30 months or 175 hours, whichever comes first. This contrasts somewhat with the currently specified warranty period of 200 hours or two years (or three years for specified major emission control components). The proposed approach would slightly decrease the warranty period in terms of hours, but would somewhat increase the period in terms of calendar years (or months). We request comment on this revised approach to defining warranty periods.

If the manufacturer offers a longer mechanical warranty for the engine or any of its components at no additional charge, we propose that the emission-related warranty for the respective engine or component must be extended by the same amount. The emission-related warranty includes components related to controlling exhaust, evaporative, and crankcase emissions from the engine. This approach to setting warranty requirements is consistent with provisions that apply in most other programs for nonroad engines.

We are proposing to keep the existing requirements related to demonstrating the durability of emission controls for purposes of certification (see § 1045.235, § 1045.240, and § 1045.245). Manufacturers must run engines long enough to develop and justify full-life deterioration factors. This allows manufacturers to generate a deterioration factor that helps ensure that the engines will continue to control emissions over a lifetime of operation. The new requirement to generate deterioration factors for CO emissions is the same as that for HC+NO_X emissions. For the HC+NO_X standard, we propose to specify that manufacturers use a single deterioration factor for the sum of HC and NO_X emissions. However, if manufacturers get our approval to establish a deterioration factor on an engine that is tested with service accumulation representing less than the full useful life for any reason, we would require separate deterioration factors for HC and NO_X emissions. The advantage of a combined deterioration factor is that it can account for an improvement in emission levels with aging. However, for engines that have service accumulation representing less than the full useful life, we believe it is not appropriate to extrapolate measured values indicating that emission levels for a particular pollutant will decrease.

Under the current regulations, emission-related maintenance is not allowed during service accumulation to establish deterioration factors. The only maintenance that may be done must be (1) Regularly scheduled, (2) unrelated to emissions, and (3) technologically necessary. This typically includes changing engine oil, oil filter, fuel filter, and air filter. In addition, we are proposing to specify that manufacturers may not schedule critical emission-related maintenance during the useful life period (see § 1045.125). This would prevent manufacturers from designing engines with emission controls that depend on scheduled maintenance that is not likely to occur with in-use engines. We request comment on all aspects of our provisions related to manufacturers' prescribed maintenance.

D. Changes to Existing OB/PWC Test Procedures

We are proposing a number of minor changes to the test procedures for OB/PWC to make them more consistent with the test procedures for other nonroad spark-ignition engines. These test provisions would apply to SD/I marine engines as well.

(1) Duty Cycle

A duty cycle is the set of modes (engine speed and load) over which an engine is operated during a test. For purposes of exhaust emission testing, we are proposing to keep the existing duty cycle specified for OB/PWC engines, with two adjustments (see § 1045.505). First, we are proposing that manufacturers may choose to run the specified duty cycle as a ramped-modal cycle, as described in Section IX.B. Second, we are proposing to change the low-power test mode from a specified 25 percent load condition to 25.3 percent load, which would complete the intended alignment with the E4 duty cycle adopted by the International Organization for Standardization.

We request comment on the appropriateness of changing part 91 to include the correction to the duty cycle described above. We request comment regarding whether a change in the specification for the current standards may cause some existing test data to be considered invalid. For example, testing from an earlier model year may have involved measurements that were slightly below 25 percent load, but within the specified tolerance for testing. These measurements may be used for carryover engine families today, but increasing the load point in the regulation could cause some measurements to be outside the tolerance once it shifts to a nominal value of 25.3 percent.

(2) Maximum Test Speed

The definition of maximum test speed, where speed is the angular velocity of an engine's crankshaft (usually expressed in revolutions per minute, or rpm), is an important aspect of the duty cycles for testing. Engine manufacturers currently declare the rated speeds for their engines and then used the rated speed as the maximum speed for testing. However, we have established an objective procedure for measuring this engine parameter to have a clearer reference point for an engine's maximum test speed. This is important to ensure that engines are tested at operating points that correspond with in-use operation. This also helps ensure that the NTE zone is appropriately matched to in-use operating conditions.

We propose to define the maximum test speed for any engine to be the single point on an engine's maximum-power versus speed curve that lies farthest away from the zero-power, zero-speed point on a normalized maximum-power versus speed plot. In other words, consider straight lines drawn between the origin (speed = 0, load = 0) and each point on an engine's normalized maximum-power versus speed curve. Maximum test speed is defined at that point where the length of this line reaches its maximum value. This change would apply to testing of OB/PWC engines as well as SD/I engines. We request comment on the use and definition of maximum test speed.

(3) 40 CFR Part 1065

We are proposing to specify that OB/PWC engines certified to the proposed exhaust emission standards use the test procedures in 40 CFR part 1065 instead of those in 40 CFR part 91.[79] We are proposing that the new procedures would apply starting with the introduction of proposed exhaust standards, though we allow manufacturers to start using these new procedures earlier as an alternative procedure. The procedures in part 1065 include updated provisions to account for newer measurement technologies and improved calculation and corrections procedures. Part 1065 also specifies more detailed provisions related to alternate procedures, including a requirement to conduct testing representative of in-use operation. In many cases, we allow carryover of emission test data from one year to another. After the implementation of the proposed standards, we are proposing to allow carryover of any test data generated prior to 2009 under the test procedures in 40 CFR part 91.

(4) Altitude

EPA emission standards generally apply at a wide range of altitudes, as reflected in the range of barometric pressures in the specified test procedures. For marine spark-ignition engines, it is clear that the large majority of operation is at sea level or at inland lakes that are not at high altitude. We are therefore proposing a specific range of barometric pressures from 94.0 to 103.325 kPa, which corresponds to all altitudes up to about 2,000 feet (see § 1045.501). Manufacturers are expected to design emission control systems that continue to function effectively at lower barometric pressures (i.e., higher altitudes), but we would not require that engines meet emission standards when tested at altitudes more than 2,000 feet above sea level.

(5) Engine Break-in

Testing new engines requires a period of engine operation to stabilize emission

[79] See our previous rulemakings related to 40 CFR part 1065 for more information about the changes in test provisions (70 FR 40420, July 13, 2005 and 67 FR 68242, November 8, 2002).

levels. The regulations specify two separate figures for break-in periods. First, for certification, we establish a limit on how much an engine may operate and still be considered a ''low-hour'' engine. The results of testing with the low-hour engine are compared with a deteriorated value after some degree of service accumulation to establish a deterioration factor. For Large SI engines, we require that low-hour test engines have no more than 300 hours of engine operation. However, given the shorter useful life for marine engines, this would not make for a meaningful process for establishing deterioration factors, even if there is a degree of commonality between the two types of engines. We are proposing for all marine spark-ignition engines that low-hour engines generally have no more than 30 hours of engine operation (see § 1045.801). This allows some substantial time for break-in, stabilization, and running multiple tests, without approaching a significant fraction of the useful life. The current regulation in part 91 specifies that manufacturers perform the low-hour measurement after no more than 12 hours of engine operation (see § 91.408(a)(1)). The proposed approach, 30 hours of engine operation, is consistent with what we have done for recreational vehicles and would give manufacturers more time to complete a valid low-hour test.

For production-line testing there is also a concern about how long an engine should operate to reach a stabilized emission level. We are proposing to keep the provision in part 91 that allows for a presumed stabilization period of 12 hours (see § 90.117(a)). We believe 12 hours is sufficient to stabilize the emissions from the engine.

We request comment on these specified values for stabilizing new engines for emission measurements.

E. Additional Certification and Compliance Provisions

(1) Production-Line Testing

We are proposing to continue to require that manufacturers routinely test engines at the point of production to ensure that production variability does not affect the engine family's compliance with emission standards. This is largely based on the existing test requirements, but includes a variety of changes. See Section VII.C.7 for a detailed description of these requirements. We may also require manufacturers to perform production line testing under the selective enforcement auditing provisions described in Section VIII.E.

(2) In-Use Testing

We are also proposing to continue the requirements related to the manufacturer-run in-use testing program. Under this program, manufacturers test field-aged engines to determine whether they continue to meet emission standards (see part 1045, subpart E). We are proposing to make a variety of changes and clarifications to the existing requirements, as described in the following sections.

(a) Adjustments Related to Engine Selection

Both EPA and manufacturers have gained insights from implementing the current program. Manufacturers have expressed a concern that engine families are selected rather late in the model year, which makes it harder to prepare a test fleet for fulfilling testing obligations. On the other hand, we have seen that manufacturers certify some of their engine families well into the model year. By making selections early in the model year, we would generally be foregoing the opportunity to select engine families for which manufacturers don't apply for certification until after the selections occur.

To address these competing interests, we are proposing an approach that allows for early selection of engine families, while preserving the potential to require testing for engines that are certified later in the model year. For applications we receive by December 31 of a given calendar year for the following model year, we would expect to select engine families for testing by the end of February of the following year. If we have not made a complete selection of engine families by the end of February, manufacturers would have the option of making their own selections for in-use testing. The proposed regulations include criteria to serve as guidance for manufacturers to make appropriate selections. For example, we would expect manufacturers to most strongly consider those engine families with the highest projected sales volume and the smallest compliance margins. Manufacturers may also take into account past experience with engine families if they have already passed an in-use testing regimen and have not undergone significant design changes since that time.

We propose to treat engine families differently for in-use testing if we receive the application after December 31. This would apply, for example, if manufacturers send an application for a 2009 engine family in February 2009. In these cases, we are proposing that all these engine families are automatically subject to in-use testing, without regard to the 25 percent limitation that would otherwise dictate our selections. This may appear to increase the potential test burden, but the clear majority of applications for certification are completed before the end of the calendar year for the following model year. This proposed provision would eliminate the manufacturers' ability to game the testing system by delaying a family of potential concern until the next calendar year. We would expect to receive few new applications after the end of the calendar year. This would be consistent with the manufacturers' interest in early family selections, without jeopardizing EPA's interest in being able to select from a manufacturer's full product lineup.

We request comment on the approach to selecting engine families for in-use testing.

(b) Crankcase Emissions

Because the crankcase requirements are based on a design specification rather than emission measurements, the anticipated crankcase technologies are best evaluated simply by checking whether or not they continue to function as designed. As a result, we intend for an inspection of in-use engines to show whether these systems continue to function properly throughout the useful life, but are not proposing to require manufacturers to include crankcase measurements as part of the in-use testing program described in this section. This is consistent with the approach we have taken in other programs.

(c) In-Use Emission Credits

Clean Air Act section 213 requires engines to comply with emission standards throughout their regulatory useful lives, and section 207 requires a manufacturer to remedy in-use nonconformity when we determine that a substantial number of properly maintained and used engines fail to conform with the applicable emission standards (42 U.S.C. 7541). As described in the original rulemaking, manufacturers could use a calculation of emission credits generated under the in-use testing program to avoid a recall determination if an engine family's in-use testing results exceeded emission standards (61 FR 52095, October 4, 1996).

We are proposing a more general approach to addressing potential noncompliance under the in-use testing program than is specified in 40 CFR part 91. The proposed regulations do not specify how manufacturers would generate emission credits to offset a nonconforming engine family. The proposed approach is preferred for two primary reasons. First, manufacturers will be able to use emission data generated from field testing to characterize an engine family's average emission level. This becomes necessarily more subjective, but allows us to consider a wider range of information in evaluating the degree to which manufacturers are complying with emission standards across their product line. Second, this approach makes clearer the role of the emission credits in our consideration to recall failing engines. We plan to consider, among other information, average emission levels from multiple engine families in deciding whether to recall engines from a failing engine family. We therefore believe it is not appropriate to have a detailed emission credit program defining precisely how and when to calculate, generate, and use credits that do not necessarily have value elsewhere.

Not specifying how manufacturers generate emission credits under the in-use testing program gives us the ability to consider any appropriate test data in deciding what action to take. In generating this kind of information, some general guidelines would apply. For example, we would expect manufacturers to share test data from all engines and all engine families tested under the in-use testing program, including nonstandard tests that might be used to screen engines for later measurement. This allows us to understand the manufacturers' overall level of performance in controlling emissions to meet emission standards. Average emission levels should be calculated over a running three-year period to include a broad range of testing without skewing the results based on old designs. Emission values from engines certified to different tiers of emission standards or tested using different measurement procedures should not be combined to calculate a single average emission level. Average emission levels should be calculated according to the following equation, rounding the results to 0.1 g/kW-hr:

$$\text{Average EL} = \Sigma_i[(\text{STD}-\text{CL})_i \times (\text{UL})_i \times (\text{Sales})_i \times \text{Power}_i \times \text{LF}_i] \div \Sigma_i [(\text{UL})_i \times (\text{Sales})_i \times \text{Power}_i \times \text{LF}_i]$$

Where:

Average EL = Average emission level in g/kW-hr.

Sales_i = The number of eligible sales, tracked to the point of first retail sale in the U.S., for the given engine family during the model year.

$(\text{STD}-\text{CL})_i$ = The difference between the emission standard (or Family Emission Limit) and the average emission level for an in-use testing family in g/kW-hr.

UL_i = Useful life in hours.

Power_i = The sales-weighted average maximum engine power for an engine family in kW.

LF_i = Load factor or fraction of maximum engine power utilized in use; use 0.50 for engine families used only in constant-speed applications and 0.32 for all other engine families.

We have adopted this same approach for the in-use testing program that applies for Large SI engines in 40 CFR part 1048.

(3) Optional Procedures for Field Testing

Outboard engines are inherently portable, so it may be easier to test them in the laboratory than in the field. However, there is a strong advantage to using portable measurement equipment to test personal watercraft and SD/I engines while the engine remains installed to avoid the effort of taking the engine out and setting it up in a laboratory. Field testing would also provide a much better means of measuring emissions to establish compliance with the NTE standards, because it is intended to ensure control of emissions during normal in-use operation that may not occur during laboratory testing over the specified duty cycle. We propose to apply the field testing provisions described below as an option for all OB/PWC and SD/I engines. We request comment on any ways the field testing procedures should be modified to address the unique operating characteristics of OB/PWC or SD/I engines.

The regulations at 40 CFR part 1065, subpart J, specify how to measure emissions using portable measurement equipment. To test engines while they remain installed, analyzers are connected to the engine's exhaust to detect emission concentrations during normal operation. Exhaust volumetric flow rate and continuous power output are also needed to convert the analyzer responses to units of g/kW-hr for comparing to emission standards. These values can be calculated from measurements of the engine intake flow rate, the exhaust air-fuel ratio and the engine speed, and from torque information.

Available small analyzers and other equipment may be adapted for measuring emissions from field equipment. A portable flame ionization detector can measure total hydrocarbon concentrations. A portable analyzer based on zirconia technology can measure NO_X emissions. A nondispersive infrared (NDIR) unit can measure CO. We are proposing to require manufacturers to specify how they would allow for drawing emission samples from in-use engines for testing installed engines. For example, emission samples can be drawn from the exhaust flow directly upstream of the point at which water is mixed into the exhaust flow. This should minimize collection of water in the extracted sample, though a water separator may be needed to maintain a sufficiently dry sample. Mass flow rates also factor into the torque calculation; this may be measured either in the intake or exhaust manifold.

Calculating brake-specific emissions depends on determining instantaneous engine speed and torque levels. We propose to require that manufacturers must therefore design their engines to be able to continuously monitor engine speed and torque. We have already adopted this requirement for other mobile source programs where electronic engine control is used. Monitoring speed values is straightforward. For torque, the onboard computer needs to convert measured engine parameters into useful units. Manufacturers generally will need to monitor a surrogate value such as intake manifold pressure or throttle position (or both), then rely on a look-up table programmed into the onboard computer to convert these torque indicators into Newton-meters. Manufacturers may also want to program the look-up tables for torque conversion into a remote scan tool. Part 1065 specifies the performance requirements for accuracy, repeatability, and noise related to speed and torque measurements. These tolerances are taken into account in the selection of the proposed NTE standards.

(4) Other Changes for In-use Testing

A question has been raised regarding the extent of liability if an engine family is found to be noncompliant during in-use testing. Because it can take up to two years to complete the in-use testing regimen for an engine family, we want to clarify the status of engines produced under that engine family's certificate, and under the certificates of earlier and later engine families that were effectively of the same design. For example, manufacturers in many cases use carryover data to continue certifying new engine families for a subsequent model year; this avoids the need to produce new test data for engines whose design does not change from year to year. For these cases, absent any contrary information from the manufacturer, we will maintain the discretion to include other applicable engine families in the scope of any eventual recall, as allowed by the Act.

There are a variety of smaller changes to the in-use testing provisions as a result of updating the regulatory language to reflect the language changes that we adopted for similar testing with Large SI engines. First, we are proposing to remove the requirement to select engines that have had service accumulation representing less than 75 percent of the useful life. This will allow manufacturers the flexibility to test somewhat older engines if they want to. Second, we are proposing to slightly adjust the description of the timing of the test program, specifying that the manufacturer must submit a test plan within 12 months of EPA selecting the family for testing, with a requirement to complete all testing within 24 months. This contrasts with the current requirement to complete testing within 12 months after the start of testing, which in turn must occur within 12 months of family selection. We believe the modified approach allows additional flexibility without delaying the conclusion of testing. Third, we are proposing to require that manufacturers explain why they excluded any particular engines from testing. Finally, we are proposing to require manufacturers to report any noncompliance within 15 days after completion of testing for a family, rather than 15 days after an individual engine fails. This has the advantage for manufacturers and the Agency of a more unified reporting after testing is complete, rather than piecemeal reporting before conclusions can be drawn.

(5) Use of Engines Already Certified to Other Programs

In some cases, manufacturers may want to use engines already certified under our other programs. Engines certified to the emission standards for highway applications in part 86 or Large SI applications in part 1048 are meeting more stringent standards. We are therefore proposing to allow the pre-existing certification to be valid for engines used in marine applications, on the condition that the engine is not changed from its certified configuration in any way (see § 1045.605). For outboard and personal watercraft engines, we are also proposing to allow this for engines certified to the Phase 3 emission standards for Small SI engines. Manufacturers would need to demonstrate that fewer than five percent of the total sales of the engine model are for marine applications. There are also a few minor notification and labeling requirements to allow for EPA oversight of this provision.

(6) Import-Specific Information at Certification

We are proposing to require additional information to improve our ability to oversee compliance related to imported engines (see § 1045.205). In the application for certification, we are proposing to require the following additional information: (1) The port or ports at which the manufacturer will import the engines, (2) the names and addresses of the agents the manufacturer has authorized to import the engines, and (3) the location of the test facilities in the United States where the manufacturer will test the engines if we select them for testing under a selective enforcement audit.

F. Other Adjustments to Regulatory Provisions

We are proposing to migrate the regulatory requirements for marine spark-ignition engines from 40 CFR part 91 to 40 CFR part 1045. This gives us the opportunity to update the details of our certification and compliance program to be consistent with the comparable provisions that apply to other engine categories. The following paragraphs highlight some of the changes in the new language that may involve noteworthy changes from the existing regulations. All these provisions apply equally to SD/I engines, except that they are not subject to the current requirements in 40 CFR part 91.

We are proposing some adjustments to the criteria for defining engine families (see § 1045.230). The fundamental principle behind engine families is to group together engines that will have similar emission characteristics over the useful life. We are proposing that engines within an engine family must have the same approximate bore diameter and all use the same method of air aspiration (for example, naturally aspirated vs. turbocharged). Under the current regulation, manufacturers may consider bore and stroke dimensions and aspiration method if they want to subdivide engine families beyond what would be required under the primary criteria specified in § 91.115. We believe engines with substantially different bore diameters will have combustion and operating characteristics that must be taken into account with unique engineering. Similarly, adding a turbocharger or supercharger to an engine changes the engine's combustion and emission control in important ways. Finally, we are proposing that all the engines in an engine family use the same type of fuel. This may have been a simple oversight in the current regulations, since all OB/PWC engines operate on gasoline. However, if a manufacturer would produce an engine model that runs on natural gas or another alternative fuel, that engine model should be in its own engine family.

The proposed regulatory language related to engine labels remains largely unchanged (see § 1045.135). However, we are including a provision to allow manufacturers to print labels that have a different company's trademark. Some manufacturers in other programs have requested this flexibility for marketing purposes.

The proposed warranty provisions are described above. We are proposing to add an administrative requirement to describe the provisions of the emission-related warranty in the owners manual (see § 1045.120). We expect that many manufacturers already do this, but believe it is appropriate to require this as a routine practice.

Certification procedures depend on establishing deterioration factors to predict the degradation in emission controls that occurs over the course of an engine's useful life. This typically involves service accumulation in the laboratory to simulate in-use operation. Since manufacturers do in-use testing to further characterize this deterioration rate, we are proposing to specify that deterioration factors for certification must take into account any available data from in-use testing with similar engines. This provision applies in most of our emission control programs that involve in-use testing. To the extent that this information is available, it should be factored into the certification process. For example, if in-use testing shows that emission deterioration is substantially higher than that characterized by the deterioration factor, we would expect the manufacturer to factor the in-use data into a new deterioration factor, or to revise durability testing procedures to better represent the observed in-use degradation.

Maximum engine power for an engine family is an important parameter. For engines below 40 kW, the maximum engine power determines the applicable standard. For bigger engines, emission credits are calculated based on total power output. As a result, we are proposing to specify that manufacturers determine their engines' maximum engine power as the point of maximum engine power on the engine map the manufacturers establish with their test engines (see Section VII.C.6 and

§ 1045.140). This value would be based on the measured maximum engine power, without correction to some standard ambient conditions.

The proposed requirements related to the application for certification would involve some new information, most of which is described above, such as installation instructions and a description of how engines comply with not-to-exceed standards (see § 1045.205). In addition, we are proposing to require that manufacturers submit projected sales volumes for each family, rather than requiring that manufacturers keep these records and make them available upon request. Manufacturers already do this routinely and it is helpful to have ready access to this information to maintain compliance oversight of the program for Marine SI engines for such things as emission credit calculations. We are also proposing that each manufacturer identify an agent for service in the United States. For companies based outside the United States, this ensures that we will be able to maintain contact regarding any official communication that may be required. We have adopted these same requirements for other nonroad programs.

We are proposing to require that manufacturers use good engineering judgment in all aspects of their effort to comply with regulatory requirements. The regulations at § 1068.5 describe how we would apply this provision and what we would require of manufacturers where we disagree with a manufacturer's judgment.

We are also proposing new defect-reporting requirements. These are requirements are described in Section VIII.

It is common practice for Marine SI engines for one company to produce the base engine for a second company to modify for the final application. Since our regulations prohibit the sale of uncertified engines, we are proposing provisions to clarify the status of these engines and defining a path by which these engines can be handled without violating the regulations. See Section XI for more information.

We request comment on all these changes to the regulations. Where there is an objection to any of the proposed provisions, we request comment on alternative provisions that would best address the concern on which the proposed provisions are based. Also, aside from the items described in this section, there are many minor adjustments in the regulatory text. While most of these changes are intended to improve the clarity of the regulations without imposing new requirements, we request comment on any of these changes that may be inappropriate. We also request comment on any additional changes that may be helpful in making the regulations clear or addressing the administration or implementation of the regulatory requirements.

G. Small-Business Provisions

The OB/PWC market has traditionally been made up of large businesses. In addition, we anticipate that the OB/PWC standards will be met through the expanded use of existing cleaner engine technologies. Small businesses certifying to standards today are already using technologies that could be used to meet the proposed standards. As a result, we are proposing only three small business regulatory relief provisions for small business manufacturers of OB/PWC engines. We are proposing to allow small business OB/PWC engine manufacturers to be exempt from PLT testing and to use assigned deterioration factors for certification. (EPA will provide guidance to engine manufacturers on the assigned deterioration factors prior to implementation of the new OB/PWC standards.) We are also proposing to extend the economic hardship relief for small businesses described in Section VIII.C.9 to small-business OB/PWC engine manufacturers (see § 1068.250). We are proposing small business eligibility criteria for OB/PWC engine manufacturers based on a production cut-off of 5,000 OB/PWC engines per year. We would also allow OB/PWC engine manufacturers that exceed the production cut-off level noted above but have fewer than 1,000 employees to request treatment as a small business.

In addition to the flexibilities noted above, all OB/PWC engine manufacturers, regardless of size, would be able to apply for the unusual circumstances hardship described in Section VIII.C.8 (see § 1068.245). Finally, all OB/PWC vessel manufacturers, regardless of size, that rely on other companies to provide certified engines or fuel system components for their product would be able to apply for the hardship provisions described in Section VIII.C.10 (see § 1068.255).

H. Technological Feasibility

(1) Level of Standards

Over the past several years, manufacturers have demonstrated their ability to achieve significant $HC+NO_X$ emission reductions from outboard and personal watercraft engines. This has largely been accomplished through the introduction of two-stroke direct injection engines and conversion to four-stroke engines. Current certification data for these types of engines show that these technologies may be used to achieve emission levels significantly below the existing exhaust emission standards. In fact, California has adopted standards requiring a 65 percent reduction beyond the current federal standards beginning in 2008.

Our own analysis of recent certification data show that most four-stroke outboard engines and many two-stroke direct injection outboard engines can meet the proposed $HC+NO_X$ standard. Similarly, although PWC engines tend to have higher $HC+NO_X$ emissions, presumably due to their higher power densities, many of these engines can also meet the proposed $HC+NO_X$ standard. Although there is currently no CO standard for OB/PWC engines, OB/PWC manufacturers are required to report CO emissions from their engines (see § 91.107(d)(9)). These emissions are based on test data from new engines and do not consider deterioration or compliance margins. Based on this data, all of the two-stroke direct injection engines show emissions well below the proposed standards. In addition, the majority of four-stroke engines would meet the proposed CO standards as well.

We therefore believe the proposed $HC+NO_X$ and CO emission standards can be achieved by phasing out conventional carbureted two-stroke engines and replacing them with four-stroke engines or two-stroke direct injection engines. This has been the market-driven trend over the last five years. Chapter 4 of the Draft RIA presents charts that compare certification data to the proposed standards.

(2) Implementation Dates

We are proposing to implement the new emission standards beginning with the 2009 model year. This gives an additional year beyond the implementation date of the California standards of similar stringency. This additional year may be necessary for manufacturers that don't sell engine models in California or that sell less than their full product lineup into the California market. We believe the same technology used to meet the 2008 standards in California could be used nationwide with the additional year allowed for any engine models not sold in California. Low-emission engines sold in California are generally sold nationwide as part of manufacturer compliance strategies for the Federal 2006 standards. Manufacturers have indicated that they are calibrating their four-stroke and direct-injection two-stroke engines to meet the California requirements. To meet the proposed standards, manufacturers' efforts would primarily center on phasing out their higher-emission carbureted two-stroke engines and producing more of their lower emission engines.

(3) Technological Approaches

Conventional two-stroke engines add a fuel-oil mixture to the intake air with a carburetor, and use the crankcase to force this mixed charge air into the combustion chamber. In the two-stroke design, the exhaust gases must be purged from the cylinder while the fresh charge enters the cylinder. With traditional two-stroke designs, the fresh charge, with unburned fuel and oil, would push the exhaust gases out of the combustion chamber as the combustion event concludes. As a result, 25 percent or more of the fresh fuel-oil could pass through the engine unburned. This is known as scavenging losses. Manufacturers have phased out sales of the majority of their traditional two-stroke engines to meet the federal 2006 OB/PWC exhaust emission standards. However, many of these engines still remain in the product mix as a result of emission credits.

One approach to minimizing scavenging losses in a two-stroke engine is through the use of direct fuel injection into the combustion chamber. The primary advantage of direct injection for a two-stroke is that the exhaust gases can be scavenged with fresh air and fuel can be injected into the combustion chamber after the exhaust port closes. As a result, hydrocarbon emissions, fuel economy, and oil consumption are greatly improved. Some users prefer two-stroke direct injection engines over four-stroke engines due to the higher power-to-weight ratio. Most of the two-stroke direct injection engines currently certified to the current OB/PWC emission standards have $HC+NO_X$ emissions levels somewhat higher than certified four-stroke engines. However, these engines also typically have lower CO emissions due to the nature of a heterogeneous charge. By injecting the fuel directly into a charge of air in the combustion chamber, localized areas of lean air/fuel mixtures are created where CO is efficiently oxidized.

OB/PWC manufacturers are also achieving lower emissions through the use of four-stroke engine designs. Because the combustion cycle takes place over two revolutions of the crankshaft, the fresh fuel-air charge can enter the combustion chamber after the exhaust valve is closed. This prevents scavenging losses. Manufacturers currently offer four-stroke marine engines with maximum engine power ranging from 1.5 to 224 kW. These engines are available with carburetion, throttle-body fuel injection, or multi-point fuel injection. Based on the certification data, whether the engine is carbureted or fuel-injected does not have a significant effect on combined $HC+NO_X$ emissions. For PWC engines, the $HC+NO_X$ levels are somewhat higher, primarily due to their higher power-to-weight ratio. CO emissions from PWC engines are similar to those for four-stroke outboard engines.

One manufacturer has certified two PWC engine models with oxidation catalysts. One engine model uses the oxidation catalyst in conjunction with a carburetor while the other uses throttle-body fuel injection. In this application, the exhaust system is shaped in such a way to protect the catalyst from water. The exhaust system is relatively large compared to the size of the engine. We are not aware of any efforts to develop a three-way catalyst system for PWC engines. We are also not aware of any development efforts to package a catalyst into the exhaust system of an outboard marine engine. In current designs, water and exhaust are mixed in the exhaust system to help cool the exhaust and tune the engine. Water can work its way up through the exhaust system because the lower end is under water and varying pressures in the exhaust stream can draw water against the prevailing gas flow. As discussed in Chapter 4 of the Draft RIA, saltwater can be detrimental to catalyst performance and durability. In addition, outboard engines are designed with lower units that are designed to be as thin as possible to improve the ability to turn the engine on the back of the boat and to reduce drag on the lowest part of the unit. This raises concerns about the placement and packaging of catalysts in the exhaust stream. Certainly, the success of packaging catalysts in sterndrive and inboard boats in recent development efforts (see Section III) suggests that catalysts may be feasible for outboards with additional effort. However, this has not yet been demonstrated and significant development efforts would be necessary. We request comment on the feasibility of using catalysts on OB and PWC engines.

(4) Regulatory Alternatives

We considered a level of 10 g/kW-hr $HC+NO_X$ for OB/PWC engines above 40 kW with an equivalent percent reduction below the proposed standards for engines below 40 kW. This second tier of standards could apply in the 2012 or later time frame. Such a standard would be consistent with currently certified emission levels from a significant number of four-stroke outboard engines. We have three concerns with adopting this second tier of OB/PWC standards. First, while some four-stroke engines may be able to meet a 10 g/kW-hr standard with improved calibrations, it is not clear that all engines could meet this standard without applying catalyst technology. As described in Section IV.H.3, we believe it is not appropriate to base standards in this rule on the use of catalysts for OB/PWC engines. Second, certification data for personal watercraft engines show somewhat higher exhaust emission levels, so setting the standard at 10 g/kW-hr would likely require catalysts for many models. Third, it is not clear that two-stroke engines would be able to meet the more stringent standard, even with direct injection and catalysts. These engines operate with lean air-fuel ratios, so reducing NO_X emissions with any kind of aftertreatment is especially challenging.

Therefore, unlike the proposed standards for sterndrive and inboard engines, we are not adopting OB/PWC standards that will require the use of catalysts. Catalyst technology would be necessary for significant additional control of $HC+NO_X$ and CO emissions. While there is good potential for eventual application of catalyst technology to outboard and personal watercraft engines, we believe the technology is not adequately demonstrated at this point. Much laboratory and in-water work is needed.

(5) Our Conclusions

We believe the proposed emission standards can be achieved by phasing out conventional carbureted two-stroke engines in favor of four-stroke engines or two-stroke direct injection engines. The four-stroke engines or two-stroke direct injection engines are already widely available from marine engine manufacturers. One or both of these technologies are currently in place for the whole range of outboard and personal watercraft engines.

The proposed exhaust emission standards represent the greatest degree of emission control achievable in the contemplated time frame. While manufacturers can meet the proposed standards with their full product line in 2009, requiring full compliance with a nationwide program earlier, such as in the same year that California introduces new emission standards, would pose an unreasonable requirement. Allowing one year beyond California's requirements is necessary to allow manufacturers to certify their full product line to the new standards, not only those products they will make available in California. Also, as described above, we believe the catalyst technology that would be required to meet emission standards substantially more stringent than we are proposing has not been adequately demonstrated for outboard or personal watercraft engines. As such, we believe the proposed standards for $HC+NO_X$ and CO emissions are the most stringent possible in this rulemaking. More time to gain experience with catalysts on sterndrive and inboard engines and a substantial engineering effort to apply that learning to outboard and personal watercraft engines may allow us to pursue more stringent standards in a future rulemaking.

As discussed in Section X, we do not believe the proposed standards would have negative effects on energy, noise, or safety and may lead to some positive effects.

V. Small SI Engines

A. Overview

This section applies to new nonroad spark-ignition engines with rated power at or below 19 kW (''Small SI engines''). These engines are most often used in lawn and garden applications, typically by individual consumers; they are many times also used by commercial operators and they provide power for a wide range of other home, industrial, farm, and construction applications. The engines are typically air-cooled single-cylinder models, though Class II engines (with displacement over 225 cc) may have two or three cylinders, and premium models with higher power may be water-cooled.

We have already adopted two phases of exhaust standards for Small SI engines. The first phase of standards for nonhandheld engines generally led manufacturers to convert any two-stroke engines to four-stroke engines. These standards applied only to engines at the time of sale. The second phase of standards for nonhandheld engines generally led manufacturers to apply emission control technologies such as in-cylinder controls and improved carburetion, with the additional requirement that manufacturers needed to meet emission standards over a useful life period.

As described in Section I, this proposal is the result of a Congressional mandate that springs from the new California ARB standards. In 2003, the California ARB adopted more stringent standards for nonhandheld engines. These standards target emission reductions of approximately 35 percent below EPA's Phase 2 standards and are based on the expectation that manufacturers will use relatively low-efficiency three-way catalysts to control $HC+NO_X$ emissions. California ARB did not change the applicable CO emission standard.[80]

We are proposing to place these new regulations for Small SI engines in 40 CFR part 1054 rather than changing the current regulations in 40 CFR part 90. This gives us the opportunity for proposing updates to the details of our certification and compliance program that are consistent with the comparable provisions that apply to other engine categories and describe regulatory requirements in plain language. Most of the change in regulatory text provides improved clarity without changing procedures or compliance obligations. Where there is a change that warrants further attention, we describe the need for the change below.

B. Engines Covered by This Rule

This action includes proposed exhaust emission standards for new nonroad engines with rated power at or below 19 kW that are sold in the United States. The exhaust standards are for nonhandheld engines (Classes I and II). As described in Section I, handheld Small SI engines (Classes III, IV, and V) are also subject to standards, but we are not proposing changes to the level of exhaust emission standards for these engines. As described in Section VI, we are also proposing standards for controlling evaporative emissions from Small SI engines, including both handheld and nonhandheld engines. Certain of the provisions discussed in this Section V apply to both handheld and nonhandheld engines, as noted. Reference to both handheld and nonhandheld engines also includes marine auxiliary engines subject to the Small SI standards for that size engine.

(1) Engines Covered by Other Programs

The Small SI standards do not apply to recreational vehicles covered by EPA emission standards in 40 CFR part 1051. The regulations in part 1051 apply to off-highway motorcycles, snowmobiles, all-terrain vehicles, and high-speed offroad utility vehicles. However, if an amphibious vehicle with an engine at or below 19 kW is not subject to standards under part 1051, its engine would need to meet the Small SI standards. We also do not consider vehicles such as go karts or golf carts to be recreational vehicles because they are not intended for high-speed operation over rough terrain; these engines are also subject to Small SI standards. The Small SI standards do not apply to engines used in scooters or other vehicles that qualify as motor vehicles.

Consistent with the current regulation under 40 CFR part 90, Small SI standards apply to spark-ignition engines used as generators or for other auxiliary power on marine vessels, but not to marine propulsion engines. As described below, we are proposing more stringent exhaust emission standards that would apply uniquely to marine generator engines.

Engines with rated power above 19 kW are subject to emission standards under 40 CFR part 1048. However, we adopted a special provision under part 1048 allowing engines with total displacement at or below 1000 cc and with rated power at or below 30 kW to meet the applicable Small SI standards instead of the standards in part 1048. For any engines that are certified using this provision, any emission standards that we adopt for Class II engines and equipment in this rulemaking will also apply at the same time. Since these engines are not required to meet the Small SI standards we have not included them in the analyses associated with this proposal.

(2) Maximum Engine Power and Engine Displacement

Under the current regulations, rated power and power rating are not defined terms, which leaves manufacturers to determine their values. We are proposing to establish an objective approach to establishing ''maximum engine power'' under the regulations (see Section VII.C.6 and § 1054.140). This value has regulatory significance for Small SI engines only to establish whether or not engines are instead subject to Large SI standards. Determining maximum engine power is therefore relevant only for those engines that are approaching the line separating these two engine categories. We are proposing to require that manufacturers determine and report maximum engine power if their emission-data engine has a maximum modal power at or above 15 kW.

Similarly, the regulations depend on engine displacement to differentiate engines for the applicability of different standards. The regulations currently provide no objective direction or

[80] California ARB also adopted new fuel evaporative emission standards for equipment using handheld and nonhandheld engines. These included tank permeation standards for both types of equipment and hose permeation, running loss, and diurnal emission standards for nonhandheld equipment. See Section VI for additional information related to evaporative emissions.

restriction regarding the determinations of engine displacement. We are proposing to define displacement as the intended swept volume of the engine to the nearest cubic centimeter, where the engine's swept volume is the product of the internal cross-section area of the cylinders, the stroke length, and the number of cylinders. As described Section VII.C.6 for maximum engine power, we are proposing that the intended swept volume must be within the range of the actual swept volumes of production engines considering normal production variability. If production engines are found to have different swept volumes, this should be noted in a change to the application for certification.

(3) Exempted or Excluded Engines

Under the Clean Air Act, engines that are used in stationary applications are not nonroad engines. States are generally preempted from setting emission standards for nonroad engines but this preemption does not apply to stationary engines. EPA recently adopted emission standards for stationary compression-ignition engines sold or used in the United States (71 FR 39154, July 11, 2006). In addition, EPA has proposed emission standards for stationary spark-ignition engines in a separate action (71 FR 33804, June 12, 2006). In pursuing emission standards for stationary engines, we have attempted to maintain consistency between stationary and nonroad requirements as much as possible. As explained in the proposal for stationary spark-ignition engines, since stationary spark-ignition engines below 19 kW are almost all sold into residential applications, we believe it is not appropriate to include requirements for owners or operators that would normally be part of a program for implementing standards for stationary engines. As a result, in that proposal we indicated that it is most appropriate to set exhaust and evaporative emission standards for stationary spark-ignition engines below 19 kW as if they were nonroad engines. This would allow manufacturers to make a single product that meets all applicable EPA standards for both stationary and nonroad applications.

The Clean Air Act provides for different treatment of engines used solely for competition. Rather than relying on engine design features that serve as inherent indicators of dedicated competitive use, we have taken the approach in other programs of more carefully differentiating competition and noncompetition models in ways that reflect the nature of the particular products. In the case of Small SI engines, we do not believe there are engine design features that allow us to differentiate between engines that are used solely for competition from those with racing-type features that are not used solely for competition. We are proposing that handheld and nonhandheld equipment with engines meeting all the following criteria would be considered to be used solely for competition, except in other cases where information is available indicating that engines are not used solely for competition:

- The engine (or equipment in which the engine is installed) may not be displayed for sale in any public dealership;
- Sale of the equipment in which the engine is installed must be limited to professional competitors or other qualified competitors;
- The engine must have performance characteristics that are substantially superior to noncompetitive models;
- The engines must be intended for use only in competition events sanctioned (with applicable permits) by a state or federal government agency or other widely recognized public organization, with operation limited to competition events, performance-record attempts, and official time trials.

Engine manufacturers would make their request for each new model year and we would deny a request for future production if there are indications that some engines covered by previous requests are not being used solely for competition. Competition engines are produced and sold in very small quantities so manufacturers should be able to identify which engines qualify for this exemption. We request comment on this approach to qualifying for a competition exemption. (See § 1054.620.)

In the rulemaking for recreational vehicles, we chose not to apply standards to hobby products by exempting all reduced-scale models of vehicles that were not capable of transporting a person (67 FR 68242, November 8, 2002). We are proposing to extend that same provision to handheld and nonhandheld Small SI engines. (See § 1054.5.)

In the rulemaking to establish Phase 2 emission standards, we adopted an exemption for handheld and nonhandheld engines used in rescue equipment. The regulation does not require any request, approval, or recordkeeping related to the exemption but we discovered while conducting the SBAR Panel described in Section VI.F that some companies are producing noncompliant engines under this exemption. We are proposing to keep this exemption but add several provisions to allow us to better monitor how it is used (see § 1054.625). We are proposing to keep the requirement that equipment manufacturers use certified engines if they are available. We are proposing to update this provision by adding a requirement that equipment manufacturers use an engine that has been certified to less stringent Phase 1 or Phase 2 standards if such an engine is available. We are proposing to explicitly allow engine manufacturers to produce engines for this exemption (with permanent labels identifying the particular exemption), but only if they have a written request for each equipment model from the equipment manufacturer. We are further proposing that the equipment manufacturer notify EPA of the intent to produce emergency equipment with exempted engines. Also, to clarify the scope of this provision, we are proposing to define ''emergency rescue situations'' as firefighting or other situations in which a person is retrieved from imminent danger. Finally, we are proposing to clarify that EPA may discontinue the exemption on a case-by-case basis if we find that engines are not used solely for emergency and rescue equipment or if we find that a certified engine is available to power the equipment safely and practically. We propose to apply the provisions of this section for new equipment built on or after January 1, 2009.

The current regulations also specify an exemption allowing individuals to import up to three nonconforming handheld or nonhandheld engines one time. We are proposing to keep this exemption with three adjustments (see § 1054.630). First, we are proposing to allow this exemption only for used equipment. Allowing importation of new equipment under this exemption is not consistent with the intent of the provision, which is to allow people to move to the United States from another country and continue to use lawn and garden equipment that may already be in the person's possession. Second, we are proposing to allow such an importation once every five years but require a statement that the person importing the exempted equipment has not used this provision in the preceding five years. The current regulations allow only one importation in a person's lifetime without including any way of making that enforceable. We believe the proposed combination of provisions represents an appropriate balance between preserving the enforceability of the exemption within the normal flow of personal property for people coming into the country. Third, we are proposing to no longer require submission of the taxpayer identification number since this is not essential for ensuring compliance.

C. Proposed Requirements

A key element of the proposed new requirements for Small SI engines is the more stringent exhaust emission standards for nonhandheld engines. We are also proposing several changes to the certification program that would apply to both handheld and nonhandheld engines. For example, we are proposing to clarify the process for selecting an engine family's useful life, which defines the length of time over which manufacturers' are responsible for meeting emission standards. We are also proposing several provisions to update the program for allowing manufacturers to use emission credits to show that they meet emission standards. The following sections describe the elements of this proposed rule.

The timing for implementation of the new exhaust emission standards is described below. Unless we specify otherwise, all the additional proposed regulatory changes would apply when engines are subject to the emission standards and the other provisions under 40 CFR part 1054. This would be model year 2012 for Class I engines and model year 2011 for Class II engines. For handheld engines, we propose to require compliance with the provisions of part 1054, including the certification provisions, starting in the 2010 model year. These proposed requirements apply to handheld engines unless stated otherwise. For convenience we refer to the handheld emission standards in part 1054 as Phase 3 standards even though the numerical values remain unchanged.

(1) Emission Standards

Extensive testing and dialogue with manufacturers and other interested parties has led us to a much better understanding of the capabilities and limitations of applying emission control technologies to Small SI nonhandheld engines. As described in the Draft RIA, we have collected a wealth of information related to the feasibility, performance characteristics, and safety implications of applying catalyst technology to these engines. We have concluded within the context of Clean Air Act section 213 that it is appropriate to propose emission standards that are consistent with those adopted by California ARB. We are proposing $HC+NO_X$ emission standards of 10.0 g/kW-hr for Class I engines starting in the 2012 model year, and 8.0 g/kW-hr for Class II engines starting in the 2011 model year (see § 1054.105). For both classes of nonhandheld engines we are proposing to maintain the existing CO standard of 610 g/kW-hr.

We are proposing to eliminate the defined subclasses for the smallest sizes of nonhandheld engines starting with implementation of the Phase 3 standards. Under the current regulations in part 90, Class I–A is designated for engines with displacement below 66 cc that may be used in nonhandheld applications. To address the technological constraints of these engines, all the current requirements for these engines are the same as for handheld engines. Class I–B is similarly designated for engines with displacement between 66 and 100 cc that may be used in nonhandheld applications. These engines are currently subject to a mix of provisions that result in an overall stringency that lies between handheld and nonhandheld engines. We are proposing to revise the regulations such that engines below 80 cc are subject to the Phase 3 handheld engine standards in part 1054 starting in the 2010 model year. We are also proposing to allow engines below 80 cc to be used without restriction in nonhandheld equipment. Identifying the threshold at 80 cc aligns with the California ARB program. For nonhandheld engines at or above 80 cc, we are proposing to treat them in every way as Class I engines. Based on the fact that it is more difficult for smaller displacement engines to achieve the same g/kW-hr emission level as larger displacement engines, it will be more of a challenge for manufacturers to achieve a 10.0 g/kW-hr $HC+NO_X$ level on these smallest Class I engines. However, for those engines unable to achieve the level of the proposed standards (either with or without a catalyst), manufacturers may elect to rely on emissions averaging to comply with emission standards. We believe all manufacturers producing engines formerly included in Class I–B also have a wide enough range of engine models that they should be able to generate sufficient credits to meet standards across the full product line. (See § 1054.101 and § 1054.801.)

We are proposing another slight change to the definition of handheld engines that may affect whether an engine is subject to handheld or nonhandheld standards. The handheld definition relies on a weight threshold for certain engines. As recently as 1999, we affirmed that the regulation should allow for the fact that switching to a heavier four-stroke engine to meet emission standards might inappropriately cause an engine to no longer qualify as a handheld engine (64 FR 5252, February 3, 1999). The regulation accordingly specifies that the weight limit is 20 kilograms for one-person augers and 14 kilograms for other types of equipment, based on the weight of the engine that was in place before applying emission control technologies. We believe it is impractical to base a weight limit on product specifications that have become difficult to establish. We are therefore proposing to increase each of the specified weight limits by 1 kilogram, representing the approximate additional weight related to switching to a four-stroke engine, and applying the new weight limit to all engines and equipment (see § 1054.801). We request comment on this adjustment to the handheld engine definition.

The regulations in part 90 allow manufacturers to rely on altitude kits to comply with emission requirements at high altitude. We are proposing to continue with this approach but to clarify that all nonhandheld engines must comply with Phase 3 standards without altitude kits at barometric pressures above 94.0 kPa, which corresponds to altitudes up to about 2,000 feet above sea level (see § 1054.115). This would ensure that all areas east of the Rocky Mountains and most of the populated areas in Pacific Coast states would have compliant engines without depending on engine modifications. This becomes increasingly important as we anticipate manufacturers relying on technologies that are sensitive to controlling air-fuel ratio for reducing emissions. Engine manufacturers must identify the altitude ranges for proper engine performance and emission control that are expected with and without the altitude kit in the owners manual. The owners manual must also state that operating the engine with the wrong engine configuration at a given altitude may increase its emissions and decrease fuel efficiency and performance. See Section V.E.5 for further discussion related to the deployment of altitude kits where the manufacturers rely on them for operation at higher altitudes.

We are proposing a slightly different approach for handheld engines with respect to altitude. Since we are not adopting more stringent exhaust emission standards, we believe it is appropriate to adopt provisions that are consistent with current practice at this time. We are therefore proposing to require handheld engines to comply with the current standards without altitude kits at barometric pressures above 96.0 kPa, which would allow for testing in most weather conditions at all altitudes up to about 1,100 feet above sea level.

Spark-ignition engines used for marine auxiliary power are covered by the same regulations as land-based engines of the same size. However, the marine versions of Small SI engines are able to make use of ambient water for enhanced cooling of the engine and exhaust system. Exhaust systems for these engines are water-jacketed to maintain low surface temperatures to minimize the risk of fires on boats where the generator is often installed in small compartments within the boat. Recently, auxiliary marine engine manufacturers have developed advanced technology in an effort to improve fuel consumption and CO emission rates for marine generators. This advanced technology includes the use of electronic fuel injection and three-way catalysts. As a result, manufacturers are offering new products with more than a 99 percent reduction in CO and have expressed their intent to offer only these advanced technology engines in the near future. They have stated that these low CO engines are due to market demand. We are proposing a CO standard of 5.0 g/kW-hr CO for marine generator engines to reflect the recent trend in marine generator engine design (see § 1054.105). For other auxiliary marine engines, we are proposing the same CO emission limits as for land-based engines. We believe this cap is necessary to prevent backsliding in CO emissions that could occur if new manufacturers were to attempt to enter the market with cheaper, high-CO designs. See Section II for a discussion of air quality concerns related to CO emissions. We request comment on the appropriateness of setting a separate standard for marine auxiliary engines and on the most appropriate level of such a standard.

At this time, we are planning to continue the current regulatory approach for wintertime engines (*e.g.*, engines used exclusively to power equipment such as snowthrowers and ice augers). Under this proposal, the $HC+NO_X$ exhaust emission standards would be optional for wintertime engines. However, if a manufacturer chooses to certify its wintertime engines to such standards, those engines would be subject to all the requirements as if the optional standards were mandatory. We are adding a definition of wintertime engines to clarify which engines qualify for these special provisions. We are also proposing to require that manufacturers identify these as wintertime engines on the emission control information label to prevent someone from inappropriately installing these engines (either new or used) in equipment that would not qualify for the wintertime exemption.

All engines subject to standards must continue to control crankcase emissions.

(2) Useful Life

The Phase 2 standards for Small SI engines included the concept that manufacturers are responsible for meeting emission standards over a useful life period. The useful life defines the design target for ensuring the durability of emission controls under normal in-use operation for properly maintained engines. Given the very wide range of engine applications, from very low-cost consumer products to commercial models designed for continuous operation, we determined that a single useful life value for all products, which is typical for other engine programs, was not appropriate for Small SI engines. We proposed at that time to determine the useful life for an engine family based on specific criteria, but commenters suggested that such a requirement was overly rigid and unnecessary. The final rule instead specified three alternative useful life values, giving manufacturers the responsibility to select the useful life that was most appropriate for their engines and the corresponding types of equipment. The preamble to the final rule expressed a remaining concern that manufacturers might not select the most appropriate useful life value, both for ensuring effective in-use emission control and for maintaining the integrity of emission-credit calculations. The preamble also stated our intent to periodically review the manufacturers' decisions to determine whether modifications to these rules are appropriate.

The regulations in § 90.105 provide a benchmark for determining the appropriate useful life value for an engine family. The regulations direct manufacturers to select the useful life value that ''most closely approximates the expected useful lives of the equipment into which the engines are anticipated to be installed.'' To maintain a measure of accountability, we included a requirement that manufacturers document the basis for their selected useful life values. The suggested data included, among other things: (1) Surveys of the life spans of the equipment in which the subject engines are installed; (2) engineering evaluations of field-aged engines to ascertain when engine performance deteriorates to the point where utility and/or reliability is impacted to a degree sufficient to necessitate overhaul or replacement; and (3) failure reports from engine customers. These regulatory provisions identify the median time to retirement for in-use equipment as the marker for defining the useful life period. This allows manufacturers to consider that equipment models may fail before the engine has reached the point of failure and that engines may be installed in different types of equipment with varying usage patterns. Engines used in different types of equipment, or even engines used in the same equipment models used by different operators, may experience widely varying usage rates. The manufacturer is expected to make judgments that take this variability into account when estimating the median life of in-use engines and equipment.

Several manufacturers have made a good faith effort to select appropriate useful life values for their engine families, either by selecting only the highest value, or by selecting higher values for families that appear more likely to be used in commercial applications. At the same time, we have observed several instances in which engine models are installed in commercial equipment and marketed as long-life products but are certified to the minimum allowable useful life period. As described in the Phase 2 final rule, we are considering modifications to the regulations to address this recurring problem.

After assessing several ideas, we are proposing an approach that preserves the fundamental elements of the current provisions related to useful life but clarifies and enhances its implementation (see § 1054.107). Manufacturers will continue to select the most appropriate useful life from the same nominal values to best match the expected in-use lifetime of the equipment into which the engines in the engine family will be installed. Manufacturers must continue to document the information supporting their selected useful life. We are considering three approaches to address remaining concerns with the process of selecting useful life values.

First, for manufacturers not selecting the highest available nominal value for useful life, we would expect to routinely review the information to confirm that it complies with the regulation. Where our review indicates that the selected useful life may not be appropriate for an engine family, we may request further justification. If we determine from available information that a longer useful life is appropriate, the manufacturer must either provide additional justification or select a longer useful life for that engine family. We would encourage manufacturers to use the proposed provisions related to preliminary approval in § 1054.210 if there is any uncertainty related to the useful life selection. We would rather work to establish this together early in the certification process rather than reviewing a completed application for certification to evaluate whether the completed durability demonstration is sufficient.

Second, we believe it is appropriate to modify the regulations to allow nonhandheld engine manufacturers to select a useful life value that is longer than the three specified nominal values. Manufacturers may choose to do this for the marketing advantage of selling a long-life product or they may want to generate emission credits that correspond to an expected lifetime that is substantially longer than we would otherwise allow. We are proposing to allow manufacturers to select longer useful life values in 100-hour increments. Durability testing for certification would need to correspond to the selected useful life period. We have considered the possibility that a manufacturer might overstate an engine family's useful life to generate emission credits while knowing that engines may not operate that long. We believe the inherent testing burden and compliance liability is enough to avoid such a problem, but we are specifying maximum values corresponding with the applicable useful life for comparable diesel engines or Large SI engines. We are not proposing to allow for longer useful life values for handheld engines.

We are also proposing to require that engines and equipment be labeled to identify the applicable useful life period. The current requirement allows manufacturers to identify the useful life with code letters on the engine's emission control information label, with the numerical value of the useful life spelled out in the owners manual. We believe it is important for equipment manufacturers and consumers to be able to find an unambiguous designation showing the manufacturer's expectations about the useful life of the engine. There has also been some interest in using descriptive terms to identify the useful life on the label. We believe any terminology would communicate less effectively than the numerical value of the useful life. However, we request comment on allowing or requiring manufacturers to also include descriptive terms. We believe it would be most appropriate to characterize the three useful life values in increasing order as Residential, Premium Residential (or General Purpose), and Commercial. Any useful life values beyond the three nominal values would appropriately be identified as Heavy Commercial. Handheld engine manufacturers have suggested using the terms Light Use, Medium Use, and Heavy Use to characterize the three useful life categories applicable to handheld engines.

In all of our other engine programs, useful life is defined in terms of years of use or extent of engine operation, whichever comes first. Under the current regulations, manufacturers are responsible for meeting emission standards for any in-use engine that is properly maintained and used over the full useful life period. Since the useful life is defined in operating hours without regard to calendar years, some engines that accumulate operating hours very slowly could remain within the useful life period for ten years or more. We request comment regarding the appropriateness of revising the useful life to limit the useful life period to five years or the specified number of operating hours, whichever comes first. Adding a five-year limit on the useful life would not change the certification process.

(3) Averaging, Banking, and Trading

EPA has included averaging, banking, and trading (ABT) programs in almost all of its recent mobile source emissions control programs. EPA's existing Phase 2 regulations for Small SI engines include an exhaust ABT program (40 CFR 90.201 through 90.211). We propose to adopt an ABT program for the Phase 3 $HC+NO_X$ exhaust emission standards that is similar to the existing program (see part 1054, subpart H in the proposed regulations). The proposed exhaust ABT program is intended to enhance the ability of engine manufacturers to meet the emission standards for the proposed model years. The proposed exhaust ABT program is also structured to avoid delay of the transition to the new exhaust emission controls. As described in Section VI, we are proposing a separate evaporative ABT program for fuel tanks used in Small SI equipment (and for fuel lines used in handheld equipment). We are proposing that credits cannot be exchanged between the exhaust ABT program and the evaporative ABT program.

The exhaust ABT program has three main components. Averaging means the exchange of emission credits between engine families within a given engine manufacturer's product line for a specific model year. Engine manufacturers divide their product line into ''engine families'' that are comprised of engines expected to have similar emission characteristics throughout their useful life. Averaging allows a manufacturer to certify one or more engine families at levels above the applicable emission standard, but below a set upper limit. This level then becomes the applicable standard for all of the engines in that engine family, for purposes of certification, in-use testing, and the like. However, the increased emissions must be offset by one or more engine families within that manufacturer's product line that are certified below the same emission standard, such that the average standard from all the manufacturer's engine families, weighted by engine power, regulatory useful life, and production volume, is at or below the level of the emission standard. Banking means the retention of emission credits by the engine manufacturer for use in future model year averaging or trading. Trading means the exchange of emission credits between engine manufacturers which can then be used for averaging purposes, banked for future use, or traded to another engine manufacturer.

Because we are not proposing any change in the general equation under which emission credits are calculated, EPA is proposing to allow manufacturers to use Phase 2 credits generated under the part 90 ABT program for engines that are certified in the Phase 3 program under part 1054, within the limits described below. As with the existing exhaust ABT program for Phase 2 engines in part 90, we are proposing that engines sold in California which are subject to the California ARB standards would not be included in the proposed exhaust ABT program because they are subject to California's requirements and not EPA's requirements. Furthermore, even though we are not proposing new exhaust emission standards for handheld engines, the handheld engine regulations are migrating to part 1054. Therefore, handheld engines will be included in the proposed ABT program under part 1054 with one change in the overall program as described below.

Under an ABT program, averaging is allowed only between engine families in the same averaging set, as defined in the regulations. For the exhaust ABT program, we are proposing to separate handheld engines and nonhandheld engines into two distinct averaging sets starting with the 2011 model year. Under the proposed program, credits may generally be used interchangeably between Class I and Class II engine families, with a limited restriction on Phase 3 credits during model years 2011 and 2012 as noted below. Likewise, credits will be able to be used interchangeably between all three handheld engine classes (Classes III, IV, and V). Because the Phase 2 exhaust ABT program allowed exchange across all engine classes (*i.e.*, allowing exchanges between handheld engines and nonhandheld engines), manufacturers using credits beginning with the 2011 model year would need to show that the credits were generated within the allowed category of engines. For many companies, especially those in the handheld market, this will potentially be straightforward since they are primarily in the handheld market. For companies that have a commingled pool of emission credits generated by both handheld engines and nonhandheld engines, this will take some more careful accounting. Because manufacturers are aware of this already at the time of this proposal, keeping records to distinguish handheld credits and nonhandheld credits will be relatively straightforward for 2006 and later model years.

We are proposing two exceptions to the provision restricting credit exchanges between handheld engines and nonhandheld engines. Currently, some companies that are primarily nonhandheld engine manufacturers also sell a relatively limited number of handheld engines. Under the Phase 2 program, these engine manufacturers can use credits from nonhandheld engines to offset the higher emissions of their handheld engines. Because we are not proposing new exhaust requirements for handheld engines, we are proposing to address this existing practice by specifying that an engine manufacturer may use emission credits from their nonhandheld engines for their handheld engines under the following conditions. A manufacturer may use credits from their nonhandheld engines for their handheld engines but only where the handheld engine family is certified in 2008 and later model years without any design changes from the 2007 model year and the FEL of the handheld engine family does not increase above the level that applied in the 2007 model year unless such an increase is based on emission data from production engines. We believe this allows for engine manufacturers to continue producing these handheld engines for use in existing handheld models of low-volume equipment applications while preventing new high-emitting handheld engine families from entering the market through the use of nonhandheld engine credits. As discussed below, we are proposing to prohibit the use of Phase 2 nonhandheld engine credits after 2013 to demonstrate compliance with the Phase 3 nonhandheld engine standards. For this reason, we request comment on whether we should allow only Phase 3 nonhandheld engine credits to be used under this handheld engine credit provision after 2013 as well.

A second exception to the provision restricting credit exchanges between handheld engines and nonhandheld engines arises because of our proposed handling of engines below 80cc. Under the proposed Phase 3 program, all engines below 80cc are considered handheld engines for the purposes of the emission standards. However, a few of these engines are used in nonhandheld applications. Therefore, EPA will allow a manufacturer to generate nonhandheld ABT credits from engines below 80cc for those engines a manufacturer has determined are used in nonhandheld applications. (The credits would be generated against the applicable handheld engine standard.) These nonhandheld credits could be used within the Class I and Class II engine classes to demonstrate compliance with the Phase 3 exhaust standards (subject to applicable restrictions). The credits generated by engines below 80cc used in handheld applications could only be used for other handheld engines.

Under an ABT program, a manufacturer establishes a ''family emission limit'' (FEL) for each participating engine family. This FEL may be above or below the standard. The FEL becomes the enforceable emissions limit for all the engines in that family for purposes of compliance testing. FELs that are established above the standard may not exceed an upper limit specified in the ABT regulations. For nonhandheld engines we are proposing FEL caps to prevent the sale of very high-emitting engines. Under the proposed FEL cap, manufacturers would need to establish FELs at or below the levels of the Phase 2 $HC+NO_X$ emission standards of 16.1 g/kW-hr for Class I engines and 12.1 g/kW-hr for Class II engines. (The Phase 3 FEL cap for Class I engines with a displacement between 80 cc and 100 cc would be 40.0 g/kW-hr since these engines would have been Class I–B engines under the Phase 2 regulations and subject to this higher level.) For handheld engines, where we are not proposing new exhaust emission standards, we are maintaining the FEL caps as currently specified in the part 90 ABT regulations.

For nonhandheld engines we are proposing two special provisions related to the transition from Phase 2 to Phase 3 standards. First, we are proposing incentives for manufacturers to produce and sell engines certified at or below the Phase 3 standards before the standards are scheduled to be implemented. Second, we are proposing provisions to allow the use of Phase 2 credits for a limited period of time under specific conditions. The following discussions describes each of these provisions in more detail for Class I engines and Class II engines separately.

For Class I, engine manufacturers could generate early Phase 3 credits by producing engines with an FEL at or below 10.0 g/kW-hr prior to 2012. These early Phase 3 credits would be calculated and categorized into two distinct types of credits, Transitional Phase 3 credits and Enduring Phase 3 credits. For engines certified with an FEL at or below 10.0 g/kW-hr, the manufacturer would earn Transitional Phase 3 credits. The Transitional Phase 3 credits would be calculated based on the difference between 10.0 g/kW-hr and 15.0 g/kW-hr. (The 15.0 g/kW-hr level is the production-weighted average of Class I FEL values under the Phase 2 program.) Manufacturers could use the Transitional Phase 3 credits from Class I engines in 2012 through 2014 model years. For engines certified with an FEL below 10.0 g/kW-hr, manufacturers would earn Enduring Phase 3 credits in addition to the Transitional Phase 3 credits described above. The Enduring Phase 3 credits would be calculated based on the difference between the FEL for the engine family and 10.0 g/kW-hr (*i.e.*, the applicable Phase 3 standard). The Enduring Phase 3 credits could be used once the Phase 3 standards are implemented without the model year restriction noted above for Transitional Phase 3 credits.

For Class I, engine manufacturers may use Phase 2 credits generated by nonhandheld engines for the first two years of the Phase 3 standards (*i.e.*, model years 2012 and 2013) under certain conditions. The manufacturer must first use all of its available Phase 3 credits to demonstrate compliance with the Phase 3 standards. This would include all early Phase 3 credits (Transitional and Enduring) as well as all other Phase 3 credits, subject to the cross-class credit restriction noted below which applies prior to model year 2013. If these Phase 3 credits are sufficient to demonstrate compliance, the manufacturer may not use Phase 2 credits. If these Phase 3 credits are insufficient to demonstrate compliance, the manufacturer could use Phase 2 credits to a limited degree (under the conditions described below) to cover the remaining amount of credits needed to demonstrate compliance.

The maximum number of Phase 2 $HC+NO_X$ exhaust emission credits a manufacturer could use for their Class I engines would be calculated based on the characteristics of Class I engines produced during the 2007, 2008, and 2009 model years. For each of those years, the manufacturer would calculate a Phase 2 credit allowance using the ABT credit equation and inserting 1.6 g/kW-hr for the ''Standard—FEL'' term, and basing the rest of the values on the total production of Class I engines, the production-weighted power for all Class I engines, and production-weighted useful life value for all Class I engines produced in each of those years. Manufacturers would not include their wintertime engines in the calculations unless the engines are certified to meet the otherwise applicable $HC+NO_X$ emission standard. The maximum number of Phase 2 $HC+NO_X$ exhaust emission credits a manufacturer could use for their Class I engines (calculated in kilograms) would be the average of the three values calculated for model years 2007, 2008, and 2009. The calculation described above allows a manufacturer to use Phase 2 credits to cover a cumulative shortfall over the first two years for their Class I engines of 1.6 g/kW-hr above the Phase 3 standard.

The Phase 2 credit allowance for Class I engines could be used all in 2012, all in 2013, or partially in either or both model year's ABT compliance calculations. Because ABT compliance calculations must be done annually, the manufacturer will know its 2013 remaining allowance based on its 2012 calculation. For example, if a manufacturer uses all of its Phase 2 credit allowance in 2012, it will have no use of Phase 2 credits for 2013. Conversely, if a manufacturer doesn't use any Phase 2 credits in 2012, it will have all of its Phase 2 credit allowance available for use in 2013. And of course, if a manufacturer uses less than its calculated total credits based on the 1.6 g/kW-hr limit in 2012, the remainder would be available for use in 2013. This provision allows for some use of Phase 2 emission credits to address the possibility of unanticipated challenges in reaching the Phase 3 emission levels in some cases or selling Phase 3 compliant engines early nationwide, without creating a situation that would allow manufacturers to substantially delay the introduction of Phase 3 emission controls.

For Class II, engine manufacturers could generate early Phase 3 credits by producing engines with an FEL at or below 8.0 g/kW-hr prior to 2011. These early Phase 3 credits would be calculated and categorized as Transitional Phase 3 credits and Enduring Phase 3 credits. For engines certified with an FEL at or below 8.0 g/kW-hr, the manufacturer would earn Transitional Phase 3 credits. The Transitional Phase 3 credits would be calculated based on the difference between 8.0 g/kW-hr and 11.0 g/kW-hr. (The 11.0 g/kW-hr level is the production-weighted average of Class II FEL values under the Phase 2 program.) Manufacturers could use the Transitional Phase 3 credits from Class II engines in 2011 through 2013 model years. For engines certified with an FEL below 8.0 g/kW-hr, manufacturers would earn Enduring Phase 3 credits in addition to the Transitional Phase 3 credits described above. The Enduring Phase 3 credits would be calculated based on the difference between the FEL for the engine family and 8.0 g/kW-hr (*i.e.*, the applicable Phase 3 standard). The Enduring Phase 3 credits could be used once the Phase 3 standards are implemented without the model year restriction noted above for Transitional Phase 3 credits.

For Class II, engine manufacturers may use Phase 2 credits generated by nonhandheld engines for the first three years of the Phase 3 standards (*i.e.*, model years 2011, 2012 and 2013) under certain conditions. The manufacturer must first use all of its available Phase 3 credits to demonstrate compliance with the Phase 3 standards. This would include all early Phase 3 credits (Transitional and Enduring) as well as all other Phase 3 credits, subject to the cross-class credit restriction noted below which applies prior to model year 2013. If these credits are sufficient to demonstrate compliance, the manufacturer may not use Phase 2 credits. If these Phase 3 credits are insufficient to demonstrate compliance, the manufacturer could use Phase 2 credits to a limited degree (under the conditions described below) to cover the remaining amount of credits needed to demonstrate compliance.

The maximum number of Phase 2 $HC+NO_X$ exhaust emission credits a manufacturer could use for their Class II engines would be calculated based on the characteristics of Class II engines produced during the 2007, 2008, and 2009 model years. For each of those years, the manufacturer would calculate a Phase 2 credit allowance using the ABT credit equation and inserting 2.1 g/kW-hr for the ''Standard—FEL'' term, and basing the rest of the values on the total production of Class II engines, the production-weighted power for all Class II engines, and production-weighted useful life value for all Class II engines produced in each of those years. Manufacturers would not include their wintertime engines in the calculations unless the engines are certified to meet the otherwise applicable $HC+NO_X$ emission standard. The maximum number of Phase 2 $HC+NO_X$ exhaust emission credits a manufacturer could use for their Class II engines (calculated in kilograms) would be the average of the three values calculated for model years 2007, 2008, and 2009. The calculation described above allows a manufacturer to use Phase 2 credits to cover a cumulative shortfall over the first three years for their Class II engines of 2.1 g/kW-hr above the Phase 3 standard.

The Phase 2 credit allowance for Class II engines could be used all in 2011, all in 2012, all in 2013, or partially in any or all three model year's ABT compliance calculations. Because ABT compliance calculations must be done annually, the manufacturer will know its remaining allowance based on its previous calculations. For example, if a manufacturer uses all of its Phase 2 credit allowance in 2011, it will have no Phase 2 credits for 2012 or 2013. However, if a manufacturer uses less than its calculated total credits based on the 2.1 g/kW-hr limit in 2011, it will have the remainder of its allowance available for use in 2012 and 2013. This provision allows for some use of Phase 2 emission credits to address the possibility of unanticipated challenges in reaching the Phase 3 emission levels in some cases or selling Phase 3 engines nationwide, without creating a situation that would allow manufacturers to substantially delay the introduction of Phase 3 emission controls.

Engine manufacturers have raised concerns that despite all of their planning, they may not be able to accurately predict their use of credits at the beginning of the year. They are concerned that they may end up in a credit deficit situation if sales do not materialize as projected, potentially needing to use more Phase 2 credits than they have available to them. In order to prevent such a non-compliance situation from occurring, manufacturers have suggested that we allow manufacturers to carry a limited credit deficit during the initial years of the Phase 3 program. EPA has allowed such provisions in other rules, including deficit provisions for handheld engines in the Phase 2 regulations in which the manufacturer was required to cover the deficit in the next four model years with a penalty applied that increased over time depending how soon the deficit was repaid. EPA requests comment on providing some type of credit deficit provisions for the Phase 3 exhaust standards for nonhandheld engines including what limits and penalties would be appropriate if such provisions were adopted.

To avoid the use of credits to delay the introduction of Phase 3 technologies, we are also proposing that manufacturers may not use Phase 3 credits from Class I engines to demonstrate compliance with Class II engines in the 2011 and 2012 model years. Similarly, we are proposing that manufacturers may not use Phase 3 credits from Class II engines to demonstrate compliance with Class I engines in the 2012 model year. The 1.6 kW-hr and 2.1 g/kW-hr allowances discussed above may not be traded across engine classes or among manufacturers.

We are proposing to make two additional adjustments related to the exhaust ABT program for engines subject to the new emission standards. As with all our other emission control programs, we are proposing that engine manufacturers identify an engine's FEL on the emission control information label (see § 1054.135). This is important for readily establishing the enforceable level of emission control that applies for each engine. Recent experience has shown that this is also necessary in cases where the engine's build date is difficult to determine. We are proposing to require that lowering an FEL after the start of production may occur only if the manufacturer has emission data from production engines justifying the lower FEL (see § 1054.225). This prevents manufacturers from making FEL changes late in the model year to generate more emission credits (or use fewer emission credits) when there is little or no opportunity to verify whether the revised FEL is appropriate for the engine family. This provision is common in EPA's emission control programs for other engine categories. We are also proposing that the any revised FEL can apply only for engines produced after the FEL change. This is necessary to prevent manufacturers from recalculating emission credits in a way that leaves no way of verifying that the engines produced prior to the FEL change met the applicable requirements. It is also consistent with the proposal to require identification of the FEL on the emission control information label. Manufacturers have raised concerns that this approach sets up an inappropriate incentive to set FELs with the smallest possible compliance margin to avoid foregone emission credits in case production-line testing shows that actual emission levels were below that represented by the emission-data engine for certification. However, it is not clear why manufacturers should not perform sufficient testing early in the model year to be confident that the FEL is properly matched to the emission levels from production engines. Nevertheless, we request comment on any appropriate methods to use the results of production-line testing to revise FELs retroactively such that the past production is clearly compliant with respect to the modified FEL. An important element of our compliance program involves the responsibility to meet standards with production-line testing, not just with a backward-looking calculation, but with a real-time evaluation at the point of testing. We would therefore not consider allowing revised FELs to apply for more than the first half of the production for a given model year.

As described below in Section V.E.3., we are proposing that a limited number of Class II engines certified by engine manufacturers with a catalyst as Phase 3 engines, may be installed by equipment manufacturers in equipment without the catalyst. (This would only be allowed when the engine is shipped separately from the exhaust system under the provisions described in Section V.E.2.) Because engine manufacturers may be generating emission credits from these catalyst-equipped engines, EPA is concerned that engine manufacturers could be earning exhaust ABT credits for engines that are sold but never have the catalyst installed. In discussions with EPA, engine manufacturers expressed concern about the difficulty of tracking the eventual use of these engines by equipment manufacturers (*i.e.*, whether the catalyst-equipped exhaust system was installed or not). Therefore, instead of requiring engine manufacturers to track whether equipment manufacturers install the catalyst-equipped exhaust system into the equipment, EPA is proposing for model years 2011 through 2014 that all Class II engine families which are offered for sale under the separate shipment provisions must decrease the number of ABT credits generated by the engine family by 10 percent. This adjustment would only apply to engines generating credits because those are the engines most likely to be equipped with catalysts. We believe the 10 percent decrease from credit generating engines should provide an emission adjustment commensurate with the potential use of the equipment manufacturer flexibility provisions described in Section V.E.3. We request comment on this approach to addressing the concern related to engines involving delegated-assembly provisions. In particular, we request comment regarding the amount of the credit adjustment, and whether there might be alternative approaches that would address this concern.

For all emission credits generated by engines under the Phase 3 exhaust ABT program, we are proposing an unlimited credit life. We consider these emission credits to be part of the overall program for complying with Phase 3 standards. Given that we may consider further reductions beyond the Phase 3 standards in the future, we believe it will be important to assess the ABT credit situation that exists at the time any post-Phase 3 standards are considered. We will need to set such future emission standards based on the statutory direction that emission standards must represent the greatest degree of emission control achievable, considering cost, safety, lead time, and other factors. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards. If we were to allow the use of Phase 3 credits for meeting post-Phase 3 standards, we may, depending on the level of Phase 3 credit banks, need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued or limited use of Phase 3 credits. Alternatively, we could adopt future standards without allowing the use of Phase 3 credits. The proposal described in this notice describes a middle path in which we allow the use of Phase 2 credits to meet the Phase 3 standards, with provisions that limit the extent and timing of using these credits.

We are requesting comment on one particular issue regarding credit life. As proposed, credits earned under the Phase 3 exhaust ABT program would have an unlimited lifetime. This could result in a situation where credits generated by an engine sold in a model year are not used until many years later when the engines generating the credits have been scrapped and are no longer part of the fleet. EPA believes there may be value to limiting the use of credits to the period that the credit-generating engines exist in the fleet. For this reason, EPA requests comment on limiting the lifetime of the credits generated under the Phase 3 exhaust ABT program to five years. The five-year period is intended to be similar to the typical median life of Small SI equipment and is consistent with the contemplated specification for defining the useful life in years in addition to