The EPA Administrator signed the following final rule on September 4, 2008. It is being submitted for publication in the *Federal Register*. While EPA has taken steps to ensure the accuracy of this Internet version, it is not the official version of the rule. Please refer to the official version in a forthcoming *Federal Register* publication and on GPO's Web Site. The rule will likely be published in the *Federal Register* by October 9, 2008. You can access the *Federal Register* at: http://www.access.gpo.gov/su_docs/aces/aces140.html. When using this site, note that "text" files may be incomplete because they don't include graphics. Instead, select "Adobe Portable Document File" (PDF) files.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 9, 60, 80, 85, 86, 89, 90, 91, 92, 94, 1027, 1033, 1039, 1042, 1045, 1048, 1051, 1054, 1060, 1065, 1068, and 1074
[EPA-HQ-OAR-2004-0008; FRL-xxxx-x]
RIN 2060-AM34

Control of Emissions from Nonroad Spark-Ignition Engines and Equipment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final Rule.

SUMMARY: We are setting emission standards for new nonroad spark-ignition engines that will substantially reduce emissions from these engines. The exhaust emission standards apply starting in 2010 for new marine spark-ignition engines, including first-time EPA standards for sterndrive and inboard engines. The exhaust emission standards 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 adopting 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, this rule will result in significantly reduced pollutant emissions from regulated engine and equipment sources, including estimated annual nationwide reductions of 604,000 tons of volatile organic hydrocarbon emissions, 132,200 tons of NOx emissions, and 5,500 tons of directly-emitted 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 1,461,000 tons of carbon monoxide emissions, with the greatest reductions in areas where there have been problems with individual exposures. The requirements in this rule will substantially benefit public health and welfare and the environment. We estimate that by 2030, on an annual basis, these emission reductions will prevent 230 PM-related premature deaths, between 77 and 350 ozone-related premature deaths, approximately 1,700 hospitalizations and emergency room visits, 23,000 work days lost, 180,000 lost school days, 590,000 acute respiratory symptoms, and other quantifiable benefits every year. The total annual benefits of this rule in 2030 are estimated to be between $1.8 billion and $4.4 billion, assuming a 3% discount rate. The total annual benefits of this rule in 2030 are estimated to be between $1.6 billion and $4.3 billion, assuming a 7% discount rate. Estimated costs in 2030 are many times less at approximately $190 million.

DATES: This rule is effective on **[insert date 60 days after publication in the FEDERAL REGISTER**]. The incorporation by reference of certain publications listed in this regulation is approved by the Director of the Federal Register as of **[insert date 60 days after publication in the FEDERAL REGISTER**].

ADDRESSES: 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. The docket is located in the EPA Headquarters Library, Room Number 3334 in the EPA West Building, located at 1301 Constitution Ave., NW, Washington, DC. The EPA/DC Public Reading Room hours of operation will be 8:30 AM to 4:30 PM Eastern Standard Time (EST), Monday through Friday, excluding holidays. The telephone number for the Public Reading Room is (202) 566-1744 and the telephone number for the Docket is (202) 566-1742.

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; email 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 regulations. Note that we are adopting minor changes in the regulations that apply to a wide range of products that may not be reflected in the following table (see Section VIII). If you have questions, call the person listed in the FOR FURTHER INFORMATION CONTACT section above:

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.

Table of Contents

I. Introduction

A. Overview

This rule will reduce the mobile-source contribution to air pollution in the United States. In particular, we are adopting standards that will 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 new emission 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 rule are already regulated under existing emission standards, except sterndrive and inboard marine engines, which are 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 2030 without this final rule these engines would account for about 33 percent (1,287,000 tons) of mobile source volatile organic hydrocarbon compounds (VOC) emissions, 31 percent (15,605,000 tons) of mobile source carbon monoxide (CO) emissions, 6 percent (311,300 tons) of mobile source oxides of nitrogen (NOx) emissions, and 12 percent (44,000 tons) of mobile source particulate matter (PM2.5) emissions. The new 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 new standards will

[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.

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 environmental problems associated with Marine SI engines and Small SI engines, such as injury to vegetation and ecosystems and visibility impairment. These effects are described in more detail later in this document.

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 NOx 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 set standards for nonroad spark-ignition engines comes from section 428(b) of the 2004 Consolidated Appropriations Act, which requires EPA to adopt 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 rule implements Congress' mandate by adopting new requirements for particular nonroad engines and equipment that are regulated as part of EPA's overall nonroad emission control program.

We are adopting 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

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

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 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 adopting more stringent standards for certain types of nonroad spark-ignition engines below 50 horsepower.

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

Table I-1: Nonroad Engine Categories for EPA Emission Standards

Engine Categories	CFR Cite for Regulations Establishing Emission Standards	Cross Reference to Table I-2
1. Locomotives engines	40 CFR Part 92 and 1033	d, l
2. Marine diesel engines	40 CFR Part 94 and 1042	g, i, j, l
3. Other nonroad diesel engines	40 CFR Parts 89 and 1039	a, e, k
4. Marine SI engines[a]	40 CFR Part 91	c
5. Recreational vehicles	40 CFR Part 1051	i
6. Small SI engines[b]	40 CFR Part 90	b, f, h
7. Large SI engines[b]	40 CFR Part 1048	i

[a] 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.
[b] 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.

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 Tier3 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
l. Locomotives and commercial marine diesel < 30 liters per cylinder	73 FR 37096	June 30, 2008

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 (64 FR 15208).[4] The Phase 2 regulations included a phase-in period that has recently been completed. 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 (69 FR 1824). 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.[5] However, we believe it is appropriate to apply evaporative emission standards to handheld engines similar to the standards we are adopting for the nonhandheld engines. Manufacturers can control evaporative emissions from handheld engines in a way that has little or no impact on exhaust emissions.

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.

---

[4] 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 handheld engines (see §1054.801). Class I refers to nonhandheld engines with displacement below 225 cc; Class II refers to larger nonhandheld engines.

[5] 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.

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 for the other engine categories subject to this final rule. The Tier 2 standards also include evaporative emission standards, new transient test procedures, 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. We 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. The California Air Resources Board 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 do not increase overall stringency beyond that reflected in the federal standards. As a result, we believe it is inappropriate to adopt 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. This rule preserves this approach.

Recreational Vehicles

We adopted exhaust and evaporative emission standards for recreational vehicles in our November 8, 2002 final rule (67 FR 68242). These standards apply to all-terrain vehicles, off-highway motorcycles, and snowmobiles.[6] These exhaust emission standards were 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 included 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. Considering these new requirements for recreational vehicles in a 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.

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

All-terrain vehicles

EPA's initial round of exhaust emission standards was fully implemented starting with the 2007 model year. The regulations for all-terrain vehicles (ATV) specify testing based on a chassis-based transient procedure. However, we permit manufacturers on an interim basis to optionally use a steady-state engine-based procedure. We recently completed a change in the regulations to extend this allowance from 2009 through 2014, after which manufacturers must certify all their ATVs based on the chassis-based transient test procedure that applies for off-highway motorcycles (72 FR 20730, April 26, 2007). This change does not represent an increase in stringency, but manufacturers will be taking time to make the transition to the different test procedure. We expect that there will be a good potential to apply further emission controls on these engines. However, we do not have information at this time on possible advances in technology beyond what is required for the current standards.

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 expect to be able to better judge the potential for broadly applying new technology to achieve further emission reductions from off-highway motorcycles.

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 NOx 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 above 50 hp and there is still a fundamental need for time to pass to allow us to assess the success of four-stroke engine technology in the marketplace.[7] This is an important aspect of the assessment we need to conduct with regard to the Phase 3 emission standards. We believe it is best to address this in a separate rulemaking and we have initiated that effort to evaluate the appropriate long-term emission standards for snowmobiles.

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

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

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 recently adopted a new round of more stringent emission standards for both locomotives and marine diesel engines that will require widespread use of aftertreatment technology (73 FR 37096, June 30, 2008).

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).

D. Putting This Rule 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.

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 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 codifying these preemption changes in this rule.

The California Air Resources Board (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+NOx 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+NOx emission levels as low as 16 g/kW-hr. For sterndrive and inboard engines, California ARB has adopted a 5 g/kW-hr HC+NOx 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 ARB 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 for identifying 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 adopted exhaust emission standards and new evaporative emission standards for these engines, consistent with EPA's 2007 model year standards. Their new requirements also included an additional level of emission control for Large SI engines starting with the 2010 model year. However, their 2010 standards do not increase overall stringency beyond that reflected in the federal standards. Rather, they aim to achieve reductions in HC+NOx emissions by removing the flexibility incorporated into the federal standards allowing manufacturers to have higher HC+NOx emissions by certifying to a more stringent CO standard.

Actions in other countries

While the new 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 US 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 at or above 50 cc 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 must require that engines placed on the market meet the requirements of the Directive, whether or not they are already installed in machinery.

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 NOx 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	NOx	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 Adopting?

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 and fuel systems 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 in this rulemaking. See the later sections for a full discussion of the rule.

Marine SI engines and vessels

We are adopting a more stringent level of emission standards for outboard and personal watercraft engines starting with the 2010 model year. The HC+NOx emission standards are the same as those adopted by California ARB for 2008 and later model year engines. The CO emission standard is 300 g/kW-hr for engines with maximum engine power above 40 kW; the standard increases as a function of maximum engine power for smaller engines. We expect manufacturers to meet these standards with improved fueling systems and other in-cylinder controls. We are not pursuing catalyst-based emission standards for outboard and personal watercraft engines. As discussed below, 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 it is not straightforward to apply the fundamental engine modifications, fuel system upgrades, and other engine control modifications needed to get acceptable catalyst performance. This rule 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 four-stroke engines or 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 more stringent controls in the future.

We are adopting new exhaust emission standards for sterndrive and inboard marine engines. The standards are 5.0 g/kW-hr for HC+NOx and 75.0 g/kW-hr for CO starting with the 2010 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 will require engines to have a diagnostic system for detecting a failure in the emission control system. For sterndrive and inboard marine engines above 373 kW with high-performance characteristics (generally referred to as "SD/I high-performance engines"), we are adopting less stringent emission standards that reflect their limited ability to control emissions with catalysts. The HC+NOx standard is 16 g/kW-hr in for engines at or below 485 kW and 22 g/kW-hr for bigger engines. The CO standard for all SD/I high-performance engines is 350 g/kW-hr. Manufacturers of these engines must meet emission standards without generating or using emission credits. We also include a variety of other special provisions for these engines to reflect unique operating characteristics.

The emission standards described above relate to engine operation over a prescribed duty cycle for testing in the laboratory. We are also adopting 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 (the NTE standards do not apply to SD/I high-performance engines).

We are adopting 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 including these new regulations for Marine SI engines in 40 CFR part 1045 rather than in the current regulations in 40 CFR part 91. This new part allows 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.

Small SI engines and equipment

We are adopting HC+NOx 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 maintaining 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 adopting a more stringent Phase 3 CO emission standard of 5.0 g/kW-hr. This applies equally to all sizes of engines subject to the Small SI standards.

We are adopting 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 will also require control of running loss emissions.

We are drafting the new regulations for Small SI engines from 40 CFR part 90 rather than changing the current regulations in 40 CFR part 90. 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?

Many readers may be interested only in certain aspects of the rule since it covers a broad range of engines and equipment that vary in design and use. We have therefore attempted to organize this information 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 subject to the rule.

The next several sections describe the provisions that apply for Small SI engines and equipment and Marine SI engines and vessels. Sections III through V describe the new 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 new requirements related to evaporative emissions for all categories. Section VII discusses how we took energy, noise, and safety factors into consideration for the new standards.

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

- We are reorganizing the regulatory language related to preemption of state standards and to clarify certain provisions.
- We are incorporating new provisions related to certification fees for newly regulated products covered by this rule. This involves some restructuring of the regulatory language. We are also adopting various technical amendments, such as identifying an additional payment method, that apply broadly to our certification programs.
- We are modifying 40 CFR part 1068 to clarify when engines are subject to standards. This includes several new provisions to address special cases for partially complete engines.
- We are also modifying part 1068 to clarify how the provisions apply with respect to evaporative emission standards and we are adopting various technical amendments. These changes apply to all types of nonroad engines that are subject to the provisions of part 1068.
- We are adopting several technical amendments for other categories of nonroad engines and vehicles, largely to maintain consistency across programs for different categories of engines and vehicles.

- We are amending provisions related to delegated assembly. The new approach is to adopt a universal set of requirements in §1068.261 that applies uniformly to heavy-duty highway engines and nonroad engines.
- We are clarifying that the new exhaust and evaporative emission standards for Small SI engines also apply to the comparable stationary engines.

Section IX summarizes the projected impacts and benefits of this rule. Finally, Sections X and XI summarize the primary public comments received and describe how we satisfy our various administrative requirements.

G. Judicial Review

Under section 307(b)(1) of the Clean Air Act (CAA), judicial review of these final rules is available only by filing a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit by [INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]. Under section 307(b)(2) of the CAA, the requirements established by these final rules may not be challenged separately in any civil or criminal proceedings brought by EPA to enforce these requirements.

Section 307(d)(7)(B) of the CAA further provides that "[o]nly an objection to a rule or procedure which was raised with reasonable specificity during the period for public comment (including any public hearing) may be raised during judicial review." This section also provides a mechanism for us to convene a proceeding for reconsideration, "[i]f the person raising an objection can demonstrate to the EPA that it was impracticable to raise such objection within [the period for public comment] or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of the rule." Any person seeking to make such a demonstration to us should submit a Petition for Reconsideration to the Office of the Administrator, U.S. EPA, Room 3000, Ariel Rios Building, 1200 Pennsylvania Ave., NW., Washington, DC 20460, with a copy to both the person(s) listed in the preceding FOR FURTHER INFORMATION CONTACT section and the Associate General Counsel for the Air and Radiation Law Office, Office of General Counsel (Mail Code 2344A), U.S. EPA, 1200 Pennsylvania Ave., NW., Washington, DC 20460.

II. Public Health and Welfare Effects

The engines and fuel systems subject to this rule generate emissions of hydrocarbons (HC), nitrogen oxides (NOx), 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 and fuel systems also emit hazardous air pollutants (air toxics) that are associated with a host of adverse health effects. Emissions from these engines and fuel systems also contribute to visibility impairment and other welfare and environmental effects.

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

A. Public Health Impacts

Ozone

The Small SI engine and Marine SI engine standards finalized in this action will result in reductions of volatile organic compounds (VOC), of which HC are a subset, and NO_x emissions. VOC and NO_x contribute to the formation of ground-level ozone pollution or smog. People in many areas across the U.S. continue to be exposed to unhealthy levels of ambient ozone.

Background

Ground-level ozone pollution is typically formed by the reaction of VOC 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, power plants, chemical plants, refineries, makers of consumer and commercial products, industrial facilities, and smaller area sources.

The science of ozone formation, transport, and accumulation is complex.[8] 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 occurs on a single high-temperature day. Ozone can be transported hundreds of miles downwind of precursor emissions, resulting in elevated ozone levels even in areas with low local VOC or NOx emissions.

EPA has recently amended the ozone NAAQS (73 FR 16436, March 27, 2008). The final ozone NAAQS rule addresses revisions to the primary and secondary NAAQS for ozone to provide increased protection of public health and welfare, respectively. With regard to the primary standard for ozone, EPA has revised the level of the 8-hour standard to 0.075 parts per million (ppm), expressed to three decimal places. With regard to the secondary standard for ozone, EPA has revised the current 8-hour standard by making it identical to the revised primary standard.

Health Effects of Ozone

The health and welfare effects of ozone are well documented and are assessed in EPA's 2006 ozone Air Quality Criteria Document (ozone AQCD) and EPA Staff Paper.[9, 10] Ozone can irritate the respiratory system, causing coughing, throat irritation, and/or uncomfortable sensation

[8] U.S. EPA Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). U.S. Environmental Protection Agency, Washington, D.C., EPA 600/R-05/004aF-cF, 2006. This document is available in Docket EPA-HQ-OAR-2003-0190. This document may be accessed electronically at: http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_cr_cd.html.

[9] U.S. EPA Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). U.S. Environmental Protection Agency, Washington, D.C., EPA 600/R-05/004aF-cF, 2006. This document is available in Docket EPA-HQ-OAR-2003-0190. This document may be accessed electronically at: http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_cr_cd.html

[10] U.S. EPA (2007) Review of the National Ambient Air Quality Standards for Ozone, Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper.EPA-452/R-07-003. This document is available in Docket EPA-HQ-OAR-2003-0190. This document is available electronically at: http:www.epa.gov/ttn/naaqs/standards/ozone/s_o3_cr_sp.html.

in the chest. Ozone can reduce lung function and make it more difficult to breathe deeply; breathing may also 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 medical attention and/or the use of additional medication. In addition, there is suggestive evidence of a contribution of ozone to cardiovascular-related morbidity and highly suggestive evidence that short-term ozone exposure directly or indirectly contributes to non-accidental and cardiopulmonary-related mortality, but additional research is needed to clarify the underlying mechanisms causing these effects. In a recent report on the estimation of ozone-related premature mortality published by the National Research Council (NRC), a panel of experts and reviewers concluded that short-term exposure to ambient ozone is likely to contribute to premature deaths and that ozone-related mortality should be included in estimates of the health benefits of reducing ozone exposure.[11] Animal toxicological 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 can include children, the elderly, and individuals with respiratory disease such as asthma. Those with greater exposures to ozone, for instance due to time spent outdoors (e.g., children and outdoor workers), are also of particular 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 toxicological 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.

Plant and Ecosystem Effects of Ozone

Elevated ozone levels contribute to 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 low 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

[11] National Research Council (NRC), 2008. Estimating Mortality Risk Reduction and Economic Benefits from Controlling Ozone Air Pollution. The National Academies Press: Washington, D.C.

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 final 2006 Criteria Document presents more detailed information on ozone effects on vegetation and ecosystems.

Current and Projected Ozone Levels

Ozone concentrations exceeding the level of the 1997 8-hour ozone NAAQS occur over wide geographic areas, including most of the nation's major population centers.[12] As of March 12, 2008, there were approximately 140 million people living in 72 areas (which include all or part of 337 counties) designated as not in attainment with the 1997 8-hour ozone NAAQS.[13] These numbers do not include the people living in areas where there is a future risk of failing to maintain or attain the 8-hour ozone NAAQS. The 1997 ozone NAAQS was recently revised and the 2008 ozone NAAQS was final on March 12, 2008. Table II-1 presents the number of counties in areas currently designated as nonattainment for the 1997 ozone NAAQS as well as the number of additional counties that have design values greater than the 2008 ozone NAAQS.

Table II-1 Counties with design values greater than the 2008 Ozone NAAQS based on 2004-2006 Air Quality Data

	Number of Counties	Population[a]
1997 Ozone Standard: counties within the 72 areas currently designated as nonattainment	337	139,633,458
2008 Ozone Standard: additional counties that would not meet the 2008 NAAQS[b]	74	15,984,135
Total	**411**	**155,617,593**

Notes:
[a] Population numbers are from 2000 census data.
[b] Attainment designations for 2008 ozone NAAQS have not yet been made. Nonattainment for the 2008 Ozone NAAQS will be based on three years of air quality data from later years. Also, the county numbers in the table include only the counties with monitors violating the 2008 Ozone NAAQS. The numbers in this table may be an underestimate of the number of counties and populations that will eventually be included in areas with multiple counties designated nonattainment.

States with 8-hour ozone nonattainment areas are 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 1997 ozone NAAQS in the 2007 to 2013 time frame and then maintain the NAAQS thereafter.[14] Many of these nonattainment areas will need to adopt additional emission reduction programs and the VOC and NO_x reductions from this final action are particularly important for these states. The attainment dates associated with the potential new 2008 ozone nonattainment areas are likely to be in the 2013 to 2021 timeframe, depending on the severity of the problem.

EPA has already adopted many emission control programs that are expected to reduce ambient ozone levels. Some of these control programs are described in Section I.C.1. As a result of existing programs, the number of areas that fail to meet the ozone NAAQS in the future is expected to decrease. Based on the air quality modeling performed for this rule, which does not include any additional local controls, we estimate eight counties (where 22 million people are

[12] A listing of the 8-hour ozone nonattainment areas is included in the RIA for this rule.
[13] Population numbers are from 2000 census data.
[14] The Los Angeles South Coast Air Basin 8-hour ozone nonattainment area will have to attain before June 15, 2021.

projected to live) will exceed the 1997 8-hour ozone NAAQS in 2020.[15] An additional 37 counties (where 27 million people are projected to live) are expected to be within 10 percent of violating the 1997 8-hour ozone NAAQS in 2020.

Results from the air quality modeling conducted for this final rule indicate that the Small SI and Marine SI engine emission reductions in 2020 and 2030 will improve both the average and population-weighted average ozone concentrations for the U.S. In addition, the air quality modeling shows that on average this final rule will help bring counties closer to ozone attainment as well as assist counties whose ozone concentrations are within ten percent below the standard. For example, on a population-weighted basis, the average modeled future-year 8-hour ozone design values will decrease by 0.57 ppb in 2020 and 0.76 ppb in 2030.[16] The air quality modeling methodology and the projected reductions are discussed in more detail in Chapter 2 of the RIA.

Particulate Matter

The Small SI engine and Marine SI engine standards detailed in this action will result in reductions in emissions of VOCs and NOx which contribute to the formation of secondary $PM_{2.5}$. In addition, the standards finalized today will reduce primary (directly emitted) $PM_{2.5}$ emissions.

Background

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 aerodynamic diameter. $PM_{2.5}$ refers to fine particles, generally less than or equal to 2.5 µm in aerodynamic 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 aerodynamic diameter. Ultrafine PM refers to particles less than 100 nanometers (0.1 µm) in aerodynamic diameter. Larger particles tend to be removed by the respiratory clearance mechanisms (e.g. coughing), 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., SOx, NOx and VOC) 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 hundreds to thousands of kilometers.

The primary $PM_{2.5}$ NAAQS includes a short-term (24-hour) and a long-term (annual) standard. The 1997 $PM_{2.5}$ NAAQS established by EPA set the 24-hour standard at a level of 65µg/m^3 based on the 98th percentile concentration averaged over three years. The annual

---

[15] 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.

[16] Ozone design values are reported in parts per million (ppm) as specified in 40 CFR Part 50. Due to the scale of the design value changes in this action, results have been presented in parts per billion (ppb) format.

standard specifies an expected annual arithmetic mean not to exceed 15μg/m^3 averaged over three years.

In 2006, EPA amended the NAAQS for $PM_{2.5}$ (71 FR 61144, October 17, 2006). The final rule addressed revisions to the primary and secondary NAAQS for PM to provide increased protection of public health and welfare, respectively. The level of the 24-hour $PM_{2.5}$ NAAQS was revised from 65μg/m^3 to 35 μg/m^3 and the level of the annual $PM_{2.5}$ NAAQS was retained at 15μg/m^3. With regard to the secondary standards for $PM_{2.5}$, EPA has revised these standards to be identical in all respects to the revised primary standards.

Health Effects of $PM_{2.5}$

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), and the 2005 PM Staff Paper.[17,18] Further discussion of health effects associated with PM can also be found in the RIA for this rule.

Health effects associated with short-term exposures (hours to days) to ambient PM 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 cardiovascular and respiratory mortality.[19] In addition, a reanalysis of the American Cancer Society Study shows an association between fine particle and sulfate concentrations and lung cancer mortality.[20]

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 controls

---

[17]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-2003-0190.

[18]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-2003-0190.

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

[20] Pope, C. A., III; Burnett, R. T.; Thun, M. J.; Calle, E. E.; Krewski, D.; Ito, K.; Thurston, G. D. (2002) Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. J. Am. Med. Assoc. 287:1132-1141.

[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.

finalized in this action may help to reduce exposures, and specifically exposures near the source, to mobile source related $PM_{2.5}$.

Visibility

Visibility can be defined as the degree to which the atmosphere is transparent to visible light. Airborne particles degrade visibility by scattering and absorbing light. 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 final 2004 PM AQCD as well as the 2005 PM Staff Paper.[24,25]

EPA is pursuing a two-part strategy to address visibility. First, to address the welfare effects of PM on visibility, EPA has set secondary $PM_{2.5}$ standards which act in conjunction with the establishment of a regional haze program. In setting this secondary standard, EPA has 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. Second, section 169 of the Clean Air Act provides additional authority to address 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).[26] 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.

Current Visibility Impairment

As of March 12, 2008, over 88 million people live in nonattainment areas for the 1997 $PM_{2.5}$ NAAQS.[27] These populations, as well as large numbers of individuals who travel to these areas, are likely to experience visibility impairment. 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.[28] 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]

---

[24] 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-2003-0190.
[25] 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-2003-0190.
[26] 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.
[27] Population numbers are from 2000 census data.
[28] U.S. EPA (2002) Latest Findings on National Air Quality – 2002 Status and Trends. EPA 454/K-03-001.
[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)

Future Visibility Impairment

Air quality modeling conducted for this final rule was used to project visibility conditions in 133 mandatory class I federal areas across the US in 2020 and 2030. The results indicate that improvements in visibility will occur in the future, although all areas will continue to have annual average deciview levels above background in 2020 and 2030. Chapter 2 of the RIA contains more detail on the visibility portion of the air quality modeling.

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.[31]

Adverse impacts on water quality can occur when atmospheric contaminants deposit to the water surface or when material deposited on the land enters a water body through runoff. Potential impacts of atmospheric deposition to water bodies 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 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.[32,33,34,35,36]

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

---

[31] 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. This document is available in Docket EPA-HQ-OAR-2003-0190.

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

[33] 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.

[34] 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.

[35] 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.

[36] 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.

livestock (as in the case for dioxin deposition), reduction in crop yield, and limited use of land due to contamination.

Materials Damage and Soiling

The deposition of airborne particles can reduce the aesthetic appeal of buildings and culturally important articles through soiling, and can contribute directly (or in conjunction with other pollutants) to structural damage by means of corrosion or erosion.[37] Particles affect materials principally by promoting and accelerating the corrosion of metals, by degrading paints, and by deteriorating building materials such as concrete and limestone. Particles contribute to these effects because of their electrolytic, hygroscopic, and acidic properties, and their ability to adsorb corrosive gases (principally sulfur dioxide). The rate of metal corrosion depends on a number of factors, including the deposition rate and nature of the pollutant; the influence of the metal protective corrosion film; the amount of moisture present; variability in the electrochemical reactions; the presence and concentration of other surface electrolytes; and the orientation of the metal surface.

Current and Projected $PM_{2.5}$ Levels

$PM_{2.5}$ concentrations exceeding the level of the $PM_{2.5}$ NAAQS occur in many parts of the country.[38] In 2005 EPA designated 39 nonattainment areas for the 1997 $PM_{2.5}$ NAAQS (70 FR 943, January 5, 2005). These areas are comprised of 208 full or partial counties with a total population exceeding 88 million. The 1997 $PM_{2.5}$ NAAQS was revised and the 2006 $PM_{2.5}$ NAAQS became effective on December 18, 2006. Table II-2 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 design values greater than the 2006 $PM_{2.5}$ NAAQS.

Table II-2: Counties with design values greater than the 2006 $PM_{2.5}$ NAAQS based on 2003-2005 Air Quality Data

Nonattainment Areas/Other Violating Counties	Number of Counties	Population[a]
1997 $PM_{2.5}$ Standards: counties within the 39 areas currently designated as nonattainment	208	88,394,000
2006 $PM_{2.5}$ Standards: additional counties that would not meet the 2006 NAAQS[b]	49	18,198,676
Total	**257**	**106,595,676**

Notes:
[a] Population numbers are from 2000 census data.
[b] Attainment designations for 2006 $PM_{2.5}$ NAAQS have not yet been made. 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 table includes only the counties with monitors violating the 2006 $PM_{2.5}$ NAAQS. The numbers in this table may be an underestimate of the number of counties and populations that will eventually be included in areas with multiple counties designated nonattainment.

Areas designated as not attaining the 1997 $PM_{2.5}$ NAAQS will need to attain the 1997 standards in the 2010 to 2015 time frame, and then maintain them thereafter. The attainment

[37]U.S EPA (2005) Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper. This document is available in Docket EPA-HQ-OAR-2003-0190.
[38] A listing of the $PM_{2.5}$ nonattainment areas is included in the RIA for this rule.

dates associated with the potential new 2006 $PM_{2.5}$ nonattainment areas are likely to be in the 2014 to 2019 timeframe. The emission standards finalized in this action become effective as early as 2009 making the inventory reductions from this rulemaking useful to states in attaining or maintaining the $PM_{2.5}$ NAAQS.

EPA has already adopted many emission control programs that are expected to reduce ambient $PM_{2.5}$ levels and which will assist in reducing the number of areas that fail to achieve the $PM_{2.5}$ NAAQS. Even so, our air quality modeling for this final rule projects that in 2020, with all current controls but excluding the reductions achieved through this rule, up to 11 counties with a population of over 24 million may not attain the current annual $PM_{2.5}$ standard of 15 µg/m[3.] These numbers do not account for additional areas that have air quality measurements within 10 percent of the annual $PM_{2.5}$ standard. These areas, although not violating the standards, will also benefit from the additional reductions from this rule ensuring long term maintenance of the $PM_{2.5}$ NAAQS.

Air quality modeling performed for this final rule shows the emissions reductions will improve both the average and population-weighted average $PM_{2.5}$ concentrations for the U.S. On a population-weighted basis, the average modeled future-year annual $PM_{2.5}$ design value (DV) for all counties is expected to decrease by 0.02 $\mu g/m^3$ in 2020 and 2030. There are areas with larger decreases in their future-year annual $PM_{2.5}$ DV, for instance the Chicago region will experience a 0.08 $\mu g/m^3$ reduction by 2030. The air quality modeling methodology and the projected reductions are discussed in more detail in Chapter 2 of the RIA.

B. Air Toxics

Small SI and Marine SI emissions also contribute to ambient levels of air toxics known or suspected as human or animal carcinogens, or that have noncancer health effects. These air toxics 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 cancer risk or noncancer hazard 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 and noncancer risk from breathing outdoor air toxics. In addition, human exposure to toxics from spark-ignition engines also occurs as a result of operating these engines and from intrusion of emissions in residential garages into attached indoor spaces.[39,40] The emission reductions from Small SI and Marine SI engines that are finalized in this rulemaking will help reduce exposure to these harmful substances.

Benzene: The EPA's IRIS database lists benzene as a known human carcinogen (causing leukemia) by all routes of exposure, and concludes 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.[41,42,43] EPA states in its IRIS database that data indicate a causal

---

[39] Baldauf, R.; Fortune, C.; Weinstein, J.; Wheeler, M.; Blanchard, B. (2006) Air contaminant exposures during the operation of lawn and garden equipment. J Expos Sci Environ Epidmeiol 16: 362-370.
[40] Isbell, M.; Ricker, J.; Gordian, M.E.; Duff, L.K. (1999) Use of biomarkers in an indoor air study: lack of correlation between aromatic VOCs with respective urinary biomarkers. Sci Total Environ 241: 151-159.
[41] 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.
[42] International Agency for Research on Cancer (IARC). 1982. Monographs on the evaluation of carcinogenic risk

relationship between benzene exposure and acute lymphocytic leukemia and suggest a relationship between benzene exposure and chronic non-lymphocytic leukemia and chronic lymphocytic leukemia. The International Agency for Research on Carcinogens (IARC) has determined that benzene is a human carcinogen and the U.S. Department of Health and Human Services (DHHS) has characterized benzene as a known human carcinogen.[44,45]

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 IARC has determined that 1,3-butadiene is a human carcinogen and the U.S. DHHS has characterized 1,3-butadiene as a known human carcinogen.[56,57] There are numerous

---

of chemicals to humans, Volume 29, Some industrial chemicals and dyestuffs, World Health Organization, Lyon, France, p. 345-389.

[43] 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.

[44] International Agency for Research on Cancer (IARC). 1987. Monographs on the evaluation of carcinogenic risk of chemicals to humans, Volume 29, Supplement 7, Some industrial chemicals and dyestuffs, World Health Organization, Lyon, France.

[45] U.S. Department of Health and Human Services National Toxicology Program 11th Report on Carcinogens available at: http://ntp.niehs.nih.gov/go/16183.

[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] U.S. EPA (2002) Toxicological Review of Benzene (Noncancer Effects). Environmental Protection Agency, Integrated Risk Information System (IRIS), Research and Development, National Center for Environmental Assessment, Washington DC. This material is available electronically at 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. This document is available electronically at http://www.epa.gov/iris/supdocs/buta-sup.pdf.

[55] U.S. EPA (2002) Full IRIS Summary for 1,3-butadiene (CASRN 106-99-0). Environmental Protection Agency, Integrated Risk Information System (IRIS), Research and Development, National Center for Environmental Assessment, Washington, DC http://www.epa.gov/iris/subst/0139.htm.

[56] International Agency for Research on Cancer (IARC) (1999) Monographs on the evaluation of carcinogenic risk of chemicals to humans, Volume 71, Re-evaluation of some organic chemicals, hydrazine and hydrogen peroxide and Volume 97 (in preparation), World Health Organization, Lyon, France.

[57] U.S. Department of Health and Human Services (2005) National Toxicology Program 11th Report on

studies consistently demonstrating that 1,3-butadiene is metabolized into genotoxic metabolites by experimental animals and humans. The specific mechanisms of 1,3-butadiene-induced carcinogenesis are unknown; however, the scientific evidence strongly suggests that the carcinogenic effects are mediated by genotoxic metabolites. Animal data suggest that females may be more sensitive than males for cancer effects associated with 1,3-butadiene exposure; 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.[58]

Formaldehyde: Since 1987, EPA has classified formaldehyde as a probable human carcinogen based on evidence in humans and in rats, mice, hamsters, and monkeys.[59] EPA is currently reviewing recently published epidemiological data. For instance, 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.[60, 61] 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.[62] Extended follow-up of a cohort of British chemical workers did not find evidence of an increase in nasopharyngeal or lymphohematopoietic cancers, but a continuing statistically significant excess in lung cancers was reported.[63] Recently, the IARC re-classified formaldehyde as a human carcinogen (Group 1).[64]

Formaldehyde exposure also causes a range of noncancer health effects, including irritation of the eyes (burning and watering of the eyes), nose and throat. Effects from repeated exposure in humans include respiratory tract irritation, chronic bronchitis and nasal epithelial lesions such as metaplasia and loss of cilia. Animal studies suggest that formaldehyde may also cause airway inflammation – including eosinophil infiltration into the airways. There are several studies that suggest that formaldehyde may increase the risk of asthma – particularly in the young.[65,66]

Carcinogens available at: ntp.niehs.nih.gov/index.cfm?objectid=32BA9724-F1F6-975E-7FCE50709CB4C932.

[58] 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.

[59] 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.

[60] 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.

[61] 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.

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

[63] Coggon, D, EC Harris, J Poole, KT Palmer. 2003. Extended follow-up of a cohort of British chemical workers exposed to formaldehyde. J National Cancer Inst. 95:1608-1615.

[64] International Agency for Research on Cancer (IARC). 2006. Formaldehyde, 2-Butoxyethanol and 1-tert-Butoxypropan-2-ol. Volume 88. (in preparation), World Health Organization, Lyon, France.

[65] Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for Formaldehyde. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. http://www.atsdr.cdc.gov/toxprofiles/tp111.html

[66] WHO (2002) Concise International Chemical Assessment Document 40: Formaldehyde. Published under the joint sponsorship of the United Nations Environment Programme, the International Labour Organization, and the

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.[67] Acetaldehyde is reasonably anticipated to be a human carcinogen by the U.S. DHHS in the 11th Report on Carcinogens and is classified as possibly carcinogenic to humans (Group 2B) by the IARC.[68,69] EPA is currently conducting a reassessment of cancer risk from inhalation exposure to acetaldehyde.

The primary noncancer effects of exposure to acetaldehyde vapors include irritation of the eyes, skin, and respiratory tract.[70] In short-term (4 week) rat studies, degeneration of olfactory epithelium was observed at various concentration levels of acetaldehyde exposure.[71, 72] Data from these studies were used by EPA to develop an inhalation reference concentration. Some asthmatics have been shown to be a sensitive subpopulation to decrements in functional expiratory volume (FEV1 test) and bronchoconstriction upon acetaldehyde inhalation.[73] The agency is currently conducting a reassessment of the health hazards from inhalation exposure to acetaldehyde.

Acrolein: EPA determined in 2003 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.[74] The IARC determined in 1995 that acrolein was not classifiable as to its carcinogenicity in humans.[75]

Acrolein is extremely acrid and irritating to humans when inhaled, with acute exposure resulting in upper respiratory tract irritation, mucus hypersecretion and congestion. Levels considerably lower than 1 ppm (2.3 mg/m^3) elicit subjective complaints of eye and nasal irritation and a decrease in the respiratory rate.[76,77] Lesions to the lungs and upper respiratory

---

World Health Organization, and produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals. Geneva.

[67] U.S. EPA. 1991. Integrated Risk Information System File of Acetaldehyde. Research and Development, National Center for Environmental Assessment, Washington, DC. This material is available electronically at http://www.epa.gov/iris/subst/0290.htm.

[68] U.S. Department of Health and Human Services National Toxicology Program 11th Report on Carcinogens available at: ntp.niehs.nih.gov/index.cfm?objectid=32BA9724-F1F6-975E-7FCE50709CB4C932.

[69] International Agency for Research on Cancer (IARC). 1999. Re-evaluation of some organic chemicals, hydrazine, and hydrogen peroxide. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemical to Humans, Vol 71. Lyon, France.

[70] U.S. EPA. 1991. Integrated Risk Information System File of Acetaldehyde. This material is available electronically at http://www.epa.gov/iris/subst/0290.htm.

[71] Appleman, L. M., R. A. Woutersen, V. J. Feron, R. N. Hooftman, and W. R. F. Notten. 1986. Effects of the variable versus fixed exposure levels on the toxicity of acetaldehyde in rats. *J. Appl. Toxicol.* 6: 331-336.

[72] Appleman, L.M., R.A. Woutersen, and V.J. Feron. 1982. Inhalation toxicity of acetaldehyde in rats. I. Acute and subacute studies. *Toxicology.* 23: 293-297.

[73] Myou, S.; Fujimura, M.; Nishi K.; Ohka, T.; and Matsuda, T. 1993. Aerosolized acetaldehyde induces histamine-mediated bronchoconstriction in asthmatics. *Am. Rev. Respir.Dis.*148(4 Pt 1): 940-3.

[74] 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 at http://www.epa.gov/iris/subst/0364.htm

[75] International Agency for Research on Cancer (IARC). 1995. Monographs on the evaluation of carcinogenic risk of chemicals to humans, Volume 63, Dry cleaning, some chlorinated solvents and other industrial chemicals , World Health Organization, Lyon, France.

[76] Weber-Tschopp, A; Fischer, T; Gierer, R; et al. (1977) Experimentelle reizwirkungen von Acrolein auf den Menschen. Int Arch Occup Environ Hlth 40(2):117-130. In German

tract of rats, rabbits, and hamsters have been observed after subchronic exposure to acrolein. Based on animal data, individuals with compromised respiratory function (e.g., emphysema, asthma) are expected to be at increased risk of developing adverse responses to strong respiratory irritants such as acrolein. This was demonstrated in mice with allergic airway-disease by comparison to non-diseased mice in a study of the acute respiratory irritant effects of acrolein.[78]

EPA is currently in the process of conducting an assessment of acute exposure effects for acrolein. The intense irritancy of this carbonyl has been demonstrated during controlled tests in human subjects, who suffer intolerable eye and nasal mucosal sensory reactions within minutes of exposure.[79]

Polycyclic Organic Matter (POM): POM is generally defined as a large class of organic compounds which have multiple benzene rings and a boiling point greater than 100 degrees Celsius. Many of the compounds included in the class of compounds known as POM are classified by EPA as probable human carcinogens based on animal data. One of these compounds, naphthalene, is discussed separately below. Polycyclic aromatic hydrocarbons (PAHs) are a subset of POM that contain only hydrogen and carbon atoms. A number of PAHs are known or suspected carcinogens. Recent studies have found that maternal exposures to PAHs (a subclass of POM) 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.[80,81] EPA has not yet evaluated these recent studies.

Naphthalene: Naphthalene is found in small quantities in gasoline and diesel fuels. Naphthalene emissions have been measured in larger quantities in both gasoline and diesel exhaust compared with evaporative emissions from mobile sources, indicating it is primarily a product of combustion. EPA recently released an external review draft of a reassessment of the inhalation carcinogenicity of naphthalene based on a number of recent animal carcinogenicity studies.[82] The draft reassessment recently completed external peer review.[83] Based on external peer review comments received to date, additional analyses are being undertaken. This external review draft does not represent official agency opinion and was released solely for the purposes of external peer review and public comment. Once EPA evaluates public and peer reviewer comments, the document will be revised. The National Toxicology Program listed naphthalene as "reasonably anticipated to be a human carcinogen" in 2004 on the basis of bioassays reporting

---

[77] Sim, VM; Pattle, RE. (1957) Effect of possible smog irritants on human subjects. J Am Med Assoc 165(15):1908-1913.

[78] Morris JB, Symanowicz PT, Olsen JE, et al. 2003. Immediate sensory nerve-mediated respiratory responses to irritants in healthy and allergic airway-diseased mice. J Appl Physiol 94(4):1563-1571.

[79] Sim VM, Pattle RE. Effect of possible smog irritants on human subjects JAMA165: 1980-2010, 1957.

[80] 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.

[81] 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.

[82] 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.

[83] Oak Ridge Institute for Science and Education (2004) External Peer Review for the IRIS Reassessment of the Inhalation Carcinogenicity of Naphthalene. August 2004.
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=84403

clear evidence of carcinogenicity in rats and some evidence of carcinogenicity in mice.[84] 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.[85] Naphthalene also causes a number of chronic non-cancer effects in animals, including abnormal cell changes and growth in respiratory and nasal tissues.[86]

The standards finalized in this action will reduce air toxics emitted from these engines, vessels and equipment. These emissions reductions will help to mitigate some of the adverse health effects associated with their operation.

C. 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 previously 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 are adopting a finding, based on the information in this section and in Chapters 2 and 3 of the Final 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.[87] Additional information on CO related health effects can be found in the Carbon Monoxide Air Quality Criteria Document (CO AQCD).[88]

In addition to health effects from chronic exposure to ambient CO levels, acute exposures to higher levels are also a problem, see the Final RIA for additional information. In recent years a substantial number of CO poisonings and deaths have occurred on and around recreational

[84] National Toxicology Program (NTP). (2004). 11th Report on Carcinogens. Public Health Service, U.S. Department of Health and Human Services, Research Triangle Park, NC. Available from: http://ntp-server.niehs.nih.gov.

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

[86] 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

[87] 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.

[88] 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.

boats across the nation.[89] 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.[90] 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.[91]

As of March 12, 2008, there were approximately 850,000 people living in 4 areas (which include 5 counties) designated as nonattainment for CO.[92] The CO nonattainment areas are presented in the Final RIA.

EPA's NONROAD model indicates that Marine SI emissions 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-3.

Table II-3: CO emissions from Marine SI Engines and Vessels in Classified CO Nonattainment Areas[a]

Area	County	Category	CO (short tons in 2005)
Las Vegas, NV	Clark	Marine SI	3,016
Reno, NV	Washoe	Marine SI	3,494
El Paso, TX	El Paso	Marine SI	37

Source: U.S. EPA, NONROAD 2005 model
a This table does not include Salem, OR which is an unclassified CO nonattainment area.

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

[89] 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.
[90] 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.
[91] 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.
[92] Population numbers are from 2000 census data.

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 will undermine the broader goal of achieving the greatest degree of emission control from the full set of Marine SI engines.

We believe this 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, while an emission control program for SD/I engines will increase the price of these engines, we no longer think this will result in a market shift to higher-emitting outboard engines. The economic impact analysis performed for this final rule, summarized in Section XII, suggests that the prices will increase less than 1 percent and sales will be impacted by less than 2 percent. It is also possible that SD/I engine manufacturers may promote higher fuel efficiency and other performance advantages of compliant engines which would allow them to promote these engines as having a greater value and justifying these small expected 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 adopting 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 new 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 the new 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.

We are adopting the regulatory requirements for marine spark-ignition engines in 40 CFR part 1045. These requirements are similar to the regulations that have been in place for outboard and personal watercraft engines for several years, but include updated certification procedures, as described in Section IV.A. Engines and vessels subject to part 1045 are also subject to the general compliance provisions in 40 CFR part 1068. These include prohibited acts and penalties, exemptions and importation provisions, selective enforcement audits, defect reporting and recall, and hearing procedures. See Section VIII of the preamble to the proposed rule for further discussion of these general compliance provisions.

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 revised 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 definitions for sterndrive and inboard engines at 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 amending the above definitions for determining which exhaust emission standards apply to spark-ignition marine engines in 2010. The new definition establishes a single term to include sterndrive and inboard engines together as a single engine category. The new definition for sterndrive/inboard also is drafted to include all engines not otherwise classified as outboard or personal watercraft engines.

The new 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 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 new 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 definition in part 91 does not clearly specify how to treat specialty vessels such as airboats or hovercraft that use engines similar to those in conventional SD/I applications. The definition of personal watercraft grants EPA the discretion to classify engines as SD/I engines if the engine is comparable in technology and emissions to an inboard or sterndrive engine. EPA has used this discretion to classify 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 are adopting the following definition:

- *Sterndrive/inboard engine* means a spark-ignition engine that is used to propel a vessel, but is not an outboard engine or a personal watercraft engine. A sterndrive/inboard engine may be either a conventional sterndrive/inboard engine or a high-performance engine. Engines on propeller-driven vessels, jet boats, air boats, and hovercraft are all sterndrive/inboard engines.

SD/I high-performance 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 defining a high-performance engine as an SD/I engine with maximum power 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 extending our basic nonroad exemptions to the SD/I engines and vessels covered by this rule. 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.

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 extending 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. Starting January 1, 2009, Marine SI engines meeting all the following criteria will therefore be considered to be used solely for competition:

- 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.

We are also including a provision allowing us to approve an exemption for cases in which an engine manufacturer can provide clear and convincing evidence that an engine will be used solely for competition even though not all the above criteria apply for a given situation. This may occur, for example, if a racing association specifies a particular engine model in their competition rules, where that engine has design features that prevent it from being certified or from being used for purposes other than competition.

Engine manufacturers will make their request for each new model year. We will 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 generally produced and sold in very small quantities, so manufacturers should be able to identify which engines qualify for this exemption. We are applying the same criteria to outboard and personal watercraft engines and vessels. See §1045.620.

We are adopting a new exemption to address individuals who manufacture recreational marine vessels for personal use (see §1045.630). Under this exemption, someone may install a used engine in a new vessel where that engine is exempt from standards, subject to certain limitations. For example, an individual may produce one such vessel over a five-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 exemption does not apply for freshly manufactured engines. This exemption 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. We revised the provisions of the personal-use exemption since the proposal to allow people to build a vessel with an exempted engine once every five years instead of ten years. We believe this is more reflective of a hobbyists interest in building a boat and using it before moving on to the next building project.

C. Exhaust Emission Standards

We are adopting 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 provisions related to controlling exhaust emissions from SD/I engines. See Section VI for a description of the new requirements related to evaporative emissions.

(1) Standards and Dates

We are adopting exhaust emission standards of 5.0 g/kW-hr HC+NOx and 75 g/kW-hr CO for SD/I engines, starting with the 2010 model year (see §1045.105). On average, this represents about a 70 percent reduction in HC+NOx 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 providing additional lead time for small businesses as discussed in Section III.F.2. The new standards are 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.G discusses the technological feasibility of these standards in more detail.

The new 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+NOx standard of 5 g/kW-hr, starting with 2008 model year engines, but they did not adopt a standard for CO emissions. We believe the type of catalyst used to achieve the HC+NOx standard will also be effective in reducing CO emissions enough to meet the new standard with the proper calibrations, so no additional hardware will be needed to control CO emissions.

Manufacturers have expressed concern that the 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 Final RIA and in the docket, the vast majority of SD/I engines are based on automotive engine blocks sold by General Motors.[93] There are five basic engine blocks used, and recently GM announced that it plans to discontinue production of the 4.3L and 8.1L engine blocks. 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 around the time that manufacturers will be making the transition to meeting new EPA emission standards. 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 they 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.

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

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

marine engine manufacturing. The SD/I sales represent only a small fraction of GM's total engine sales and thus did not weigh heavily in their 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 needs are not available in the interim, and that it will be cost-prohibitive for them to produce their own engine blocks.

EPA's SD/I standards start to take effect with the 2010 model year, two years after the same standards apply in California. We believe a requirement to extend the California standards nationwide after a two-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 will 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. To address the challenge related to the transition away from the current 4.3 and 8.1 liter GM engines, we are including in the final rule a direct approval for a hardship exemption allowing manufacturers to produce these engines for one additional year without certifying them (see §1045.145). Starting in the 2011 model year, we would expect manufacturers to have worked things out such that they could certify their full product lineup to the applicable standards.

Engines used on jet boats may have been classified under the original definitions as personal watercraft engines. As described in Section IV, engines used in jet boats or personal watercraft-like vessels that are four meters or longer will be classified as SD/I engines under the new definitions. Such engines subject to part 91 today will therefore need to continue meeting EPA emission standards as personal watercraft engines through the 2009 model year under part 91, after which they will need to meet the new SD/I standards under 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, but must meet the new emission standards for SD/I engines under part 1045.

As described above, engines used solely for competition are not subject to emission standards, but many SD/I high-performance engines are sold for recreational use. SD/I high-performance engines have very high power outputs, large exhaust gas flow rates, and relatively high concentrations of hydrocarbons and carbon monoxide in the exhaust gases. As described in the Final Regulatory Impact Analysis, applying catalyst technology to these engines is not practical. California ARB initially adopted the same HC+NOx standards that apply for other SD/I engines with the expectation that manufacturers would simply rely on emission credits from other SD/I engines. We believe a credit-based solution is not viable for small business manufacturers that do not have other products with which to exchange emission credits and California ARB has modified their rule to also address this concern.

We are adopting standards for SD/I high-performance engines based on the level of control that can be expected from recalibration with electronically controlled fuel injection. These standards are phased in over a two-year transition period. In the 2010 model year, the HC+NOx emission standards are 20.0 g/kW-hr for engines at or below 485 kW and 25.0 g/kW-hr for bigger engines. In 2011 and later model years, the HC+NOx emission standards drop to 16.0 g/kW-hr for engines at or below 485 kW and 22.0 g/kW-hr for bigger engines. The CO standard is 350 g/kW-hr for all SD/I high-performance engines. We believe this is achievable with more careful control of fueling rates, especially under idle conditions. Control of air-fuel ratios should result in improved emission control even after multiple rebuilds. Note that small-volume manufacturers may delay complying with the high-performance standards until 2013. In that year, the standard will be the same as the 2011 standards for larger manufacturers.

We are adopting a variety of provisions to simplify the requirements for exhaust emission certification and compliance for SD/I high-performance engines, as described in Section IV.F. We have also chosen not to apply the Not-to-Exceed emission standards to these engines because we have very limited information on their detailed emission characteristics and we are concerned about extent of testing that would be required by the large number of affected engine manufacturers that are small businesses.

We are also aware that there are some very small sterndrive or inboard engines. In particular, sailboats may have small propulsion engines for backup power. These engines will fall under the new definition of sterndrive/inboard engines, even though they are much smaller and may experience very different in-use operation. These engines generally have more in common with marine auxiliary engines or lawn and garden engines that are subject to land-based standards. We are therefore allowing manufacturers to use engines that have been certified to current land-based emission standards for sterndrive and inboard installation, much like we are adopting for outboard and personal watercraft engines (see §1045.610).

The emission standards apply at the range of atmospheric pressures represented by the test conditions specified in part 1065. This includes operation at elevated altitudes. Since we expect most or all SD/I engines to have three-way catalysts with closed-loop fuel control, these engines should be able to include the ability to automatically compensate for varying altitude. Manufacturers may choose to use an altitude kit for demonstrating compliance with emission standards at high altitudes as described for OB/PWC engines in Section IV.C.1. Manufacturers using altitude kits would need to take a variety of steps to describe their approach and ensure that such altitude kits are in fact being used with in-use engines operating at high altitudes, as described in Section IV.E.8.

(2) Not-to-Exceed Standards

We are adopting emission standards that apply over an NTE zone. The NTE standards are in the form of a multiplier times the duty-cycle standard for HC+NOx and for CO (see §1045.105. Section III.D.2 gives an overview of the NTE standards and compliance provisions and describes the NTE test procedures.

Manufacturers commented that certification to the NTE standards requires additional testing for engine models that are already certified to the new emission standards for California. In addition, they expressed concern that they may need to recalibrate existing engine models to meet the NTE standards. Manufacturers commented that this would not be possible by the date of the duty cycle standard. For engines already certified in California, manufacturers carry over preexisting certification test data from year to year. Manufacturers commented that additional time would be necessary to retest, and potentially recalibrate, these engines for certification to the NTE standards. To address these issues regarding lead time needed to retest these engines, we are not applying the NTE standards for 2010-2012 model year engines that are certified using preexisting data (i.e., carryover engine families). For new engine models, manufacturers indicated that they will be able to perform the NTE testing and duty-cycle testing as part of their efforts to certify to the new standards. Therefore the primary implementation date of 2010 applies to these engines. Beginning in the 2013 model year, all conventional SD/I engines must be certified to meet the NTE standards.

This NTE approach complements the weighted modal emission tests included in this rule. These steady-state duty cycles and standards are intended to establish average emission levels over several discrete modes of engine operation. 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 will 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 adopting provisions for averaging, banking, and trading of emission credits for conventional SD/I engines to meet the new HC+NOx and CO standards (see §1045.105 and part 1045, subpart H). See Section VII.C.5 of the preamble to the proposed rule for a description of general provisions related to averaging, banking, and trading programs. A description of the ABT provisions for the new SD/I standards is provided in this section.

EPA proposed that manufacturers would not be able to earn credits for one pollutant while using credits to comply with the emissions standard for another pollutant. The proposed restriction was modeled on similar requirements in other ABT programs where there was concern that a manufacturer could use technologies to reduce one pollutant while increasing another pollutant. Manufacturers are expected to comply with the new SD/I standards by using a combination of improved engine designs and catalysts. This should result in reductions in both HC+NOx emissions and CO emissions compared to current designs. While the technology is expected to reduce both HC+NOx emissions and CO emissions, there could be situations where the engines are capable of meeting one of the emission standards but not the other. EPA does not want to preclude such engines from being able to certify using the provisions of the ABT program and is therefore dropping the proposed restriction from the final rule.

Credit generation and use is calculated based on the FEL of the engine family and the standard. We are adopting FEL caps to prevent the sale of very high-emitting engines. The HC+NOx FEL cap for conventional SD/I engines is 16 g/kW-hr while the CO FEL cap is 150 g/kW-hr and applies starting in 2010, except as noted below. These FEL caps represent the average baseline emission levels of SD/I engines, based on data described in the Final RIA. However, through the 2013 model year we are separately allowing small-volume engine manufacturers to certify their four-stroke conventional SD/I engines without testing by assuming an HC+NOx FEL of 22.0 g/kW-hr and a CO FEL of 150 g/kW-hr. Manufacturers using this provision would not be subject to the FEL cap for those engine families.

We are specifying that SD/I engines are in a separate averaging set from OB/PWC engines, with a limited exception for certain jet boat engines as described below. This means that credits earned by SD/I engines may be used only to offset higher emissions from other SD/I engines. Likewise, credits earned by OB/PWC engines may be used only to offset higher emissions from other OB/PWC engines (except where we allow those credits to be used for certain jet boat engines).

Emission credits earned for SD/I engines will have an indefinite credit life with no discounting. We consider these emission credits to be part of the overall program for complying with the new 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. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards, consistent with the statutory requirement to establish standards that represent the greatest degree of emission reduction achievable, considering cost, safety, lead time, and other factors. If we were to allow the use of credits generated under the standards adopted in this rule to meet more stringent standards adopted in a future rulemaking, we may need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued use of existing emission credits, depending on the level of emission credit banks. Alternatively, we may adopt future standards without allowing the use of existing emission credits.

Finally, manufacturers may include as part of their federal credit calculation the sales of engines in California as long as they don't separately account for those emission credits under the California regulations. We originally proposed to exclude engines sold in California that are subject to the California ABR standards. However, we consider California's current HC+NOx standards to be equivalent to those we are adopting in this rulemaking, so we would expect a widespread practice of producing and marketing 50-state products. Therefore, as long as a manufacturer is not generating credits under California's regulations for SD/I engines, we would allow manufacturers to count those engines when calculating credits under EPA's program. This is consistent with how EPA allows credits to be calculated in other nonroad sectors, such as recreational vehicles.

(b) Early-credit approaches

We are adopting an early-credit program in which a manufacturer could earn emission credits before 2010 with early introduction of emission controls designed to meet the new standards (see §1045.145). For engines produced by small-volume SD/I manufacturers that are eligible for the one-year delay described in Section III.F.2, early credits could be earned before 2011. As proposed, use of these early credits would be limited to the first three years that the new standards apply. While we believe adequate lead time is provided to meet the new 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 will 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 will generate credits through the use of catalysts.

Manufacturers will generate these early credits based on the difference between the measured emission level of the clean engines and an assigned baseline level (16 g/kW-hr HC+NOx and 150 g/kW-hr CO). These assigned baseline levels are based on data presented in Chapter 4 of the Final RIA representing the average level observed for uncontrolled engines. We also provide bonus credits for any small-volume SD/I engine manufacturer that certifies early to the new standards to provide a further incentive for introducing catalysts in SD/I engines. The bonus credits will take the form of a multiplier times the earned credits. The multipliers are 1.25

for being one year early, 1.5 for being two years early, and 2.0 for being three years early. For example, a small-volume manufacturer certifying an engine to 5.0 g/kW-hr HC+NOx in 2009 (two years early) will get a bonus multiplier of 1.5. Early HC+NOx credits will therefore be calculated using the following equation: credits [grams] = (16-5) × Power [kW] × Useful Life [hours] × Load Factor × 1.5. The specified load factor is 0.207, which is currently used in the OB/PWC calculations.

To earn these early credits, the engine must meet both the new HC+NOx standard and the new CO standard. These early credits will be treated the same as emission credits generated after the emission standards start to apply. This approach provides an incentive for manufacturers to pull ahead significantly cleaner technologies. We believe such an incentive will lead to early introduction of catalysts on SD/I engines and help promote earlier market acceptance of this technology. We believe this early credit program will allow manufactures to comply with the new standards in an earlier time frame because it allows them to spread out their development resources over multiple years. To ensure that manufacturers do not generate credits for meeting standards that already apply, no EPA credits will be generated for engines that are produced for sale in California.

(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 changing the definition of personal watercraft to ensure that engines used on jet boats will no longer be classified as personal watercraft engines but instead as SD/I engines because jet boats are more like SD/I vessels. However, manufacturers in many 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 a similar engine for use on what we consider to be a jet boat.

Engines used in jet boats will be subject to SD/I emission standards. However, we are providing some flexibility in meeting the 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 will allow manufacturers to use emission credits generated from OB/PWC engines to demonstrate that their jet boat engines meet the new HC+NOx and CO standards for SD/I engines if the same or similar engine is certified as an outboard or personal watercraft engine, 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 (see §1045.660 and §1045.701). Manufacturers will need to group SD/I engines used for jet boats in a separate engine family from the outboard or personal watercraft engines 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, 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 exceeds the newly adopted 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.

(d) SD/I high-performance engines

For the reasons described in Section III.C.1, the standards being adopted for SD/I high-performance engines are less stringent than originally proposed. As a result, we are not including the SD/I high-performance engines in the ABT program. Manufacturers are required to meet the emission standards for SD/I high-performance engines without using emission credits.

(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 are requiring 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 straightforward.

(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 of the preamble to the proposed rule describes how we 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 specifying a useful life period of ten years or 480 hours of engine operation, whichever comes first (see §1045.105). Manufacturers are responsible for meeting emission standards during this useful life period. This is consistent with the requirements adopted by California ARB. We are further requiring 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 SD/I high-performance engines, we are specifying 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 useful life values are consistent with the California ARB regulations for SD/I high-performance 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 will 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 allowing 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 will form the basis for establishing a shorter useful life period for those engines. See §1045.105 for additional detail in establishing a shorter useful life.

Jet boat engines that are certified in conjunction with outboard or personal watercraft engine families are subject to the shorter useful life period that applies for outboard or personal watercraft engines. This is necessary to prevent a situation where the original certification data is insufficient for certifying the jet boat engines without some further testing or analysis to show that the engines meet emission standards over a longer period.

(b) Warranty periods

We are requiring that manufacturers provide an emission-related warranty during the first three years or 480 hours of engine operation, whichever comes first (see §1045.120). This warranty period applies equally to emission-related electronic components on SD/I high-performance engines. However, we are allowing shorter warranty periods (in hours) 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 specifying a warranty period for emission-related mechanical components of 3 years or 150 hours for high-performance engines between 373 and 485 kW, and 1 year or 50 hours for high-performance engines above 485 kW. These 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 require 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. These warranty requirements are consistent with provisions that apply in most other programs for nonroad engines.

(6) Engine Diagnostics

We are requiring that manufacturers design their catalyst-equipped SD/I engines to diagnose malfunctioning emission control systems starting with the introduction of the final standards (see §1045.110). As discussed in the Final 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 requiring similar diagnostic controls for OB/PWC 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 (upstream of sensors and catalysts), 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 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 final rule, therefore, focus on detecting inappropriate air-fuel ratios, which is the most likely failure mode for three-way catalyst systems. The malfunction indicator 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 will accept a California-approved system as meeting EPA requirements. The final regulations direct manufacturers to follow standard practices defined in documents adopted recently by the Society of Automotive Engineers in SAE J1939-5. See §1045.110 for detailed information.

D. Test Procedures for Certification

(1) General Provisions

The marine engine test procedures are generally the same for both SD/I and OB/PWC engines. This involves laboratory measurement of emissions while the engine operates over 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. 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 high altitude.

The E4 duty cycle includes a weighting of 40 percent for idle. For SD/I high-performance engines, commenters suggested that these engines typically have substantial auxiliary loads and parasitic losses even when the vessel does not need propulsion power. While the specified duty cycle for SD/I high-performance engines is identical to that for other Marine SI engines, we would expect manufacturers to use the provisions of §1065.510(b)(3) to target a reference torque of 15 percent instead of zero at idle.

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

We are adopting not-to-exceed (NTE) requirements similar to those established for marine diesel engines. Engines will be required to meet the NTE standards during normal in-use operation.

(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 will ensure real-world emission control, rather than just controlling emissions under certain laboratory conditions. This allows us to evaluate an engine's compliance during in-use testing without removing the engine from the vessel because the NTE requirements establish 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 establishing 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 emission control in use as in the laboratory.

Because the duty cycle we have adopted uses only five modes on an average propeller curve to characterize marine engine operation, we are concerned that an engine designed to that duty cycle will not necessarily perform the same way over the range of speed and load combinations seen on a boat. This 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 installed in a specific boat with a particular propeller may operate differently based on the design of the boat and heavily the boat is loaded, among other factors.

To ensure that engines control emissions over a wide range of speed and load combinations normally seen on boats, we are including 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 will apply to all regulated pollutants during steady-state operation. In addition, we are requiring 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 final 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 will have to be removed from the vessel or care will 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, will not require additional technology beyond what is used to meet the final 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, when properly calibrated, will meet the caps that apply across the NTE zone. We therefore do not expect the final NTE standards to cause manufacturers to need additional hardware. 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 Final RIA accounts for some additional testing, especially in the early years, to provide manufacturers with assurance that their engines will meet the NTE requirements.

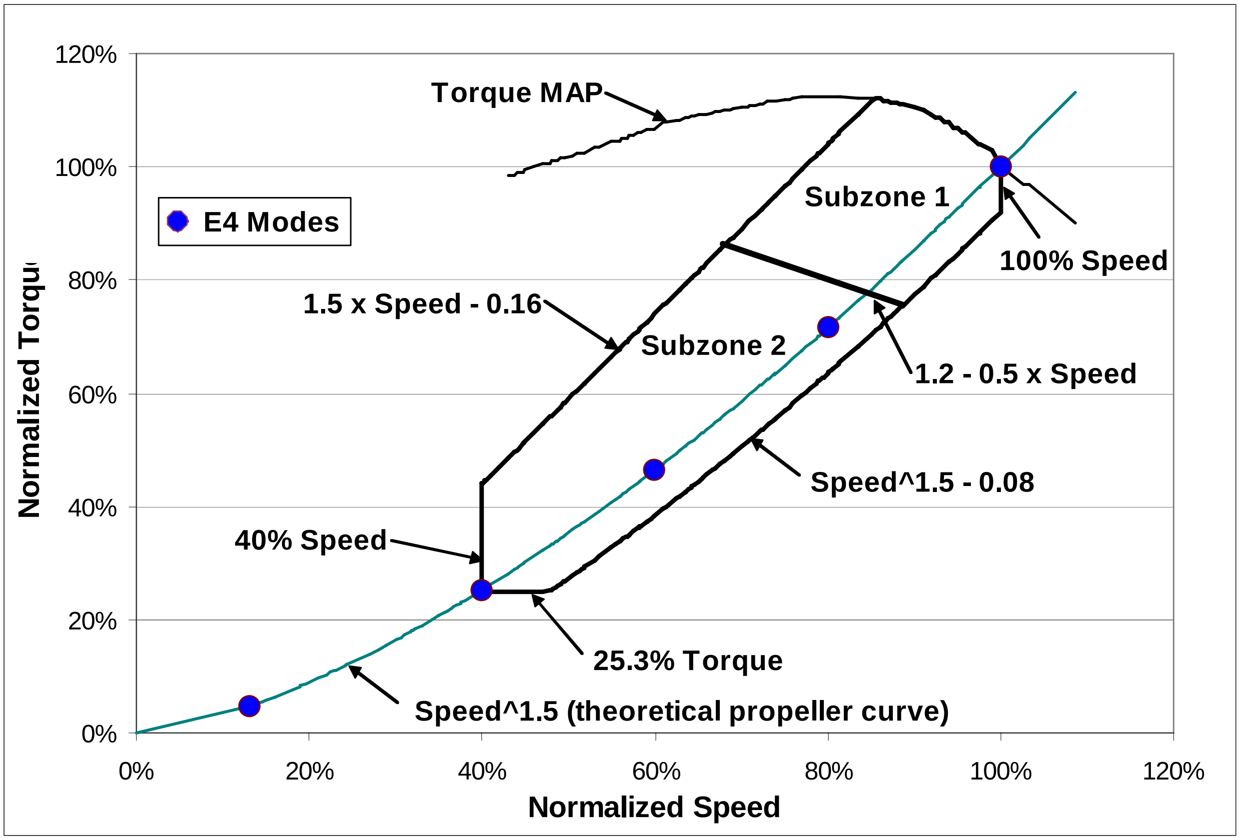
(b) Shape of NTE zone

We developed the NTE 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 Final RIA presents this data and describes the development of the boundaries and conditions associated with the 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 will be very hard for manufacturers and EPA to implement in a meaningful way.

We anticipate that most, if not all SD/I engines subject to the NTE standards will use three-way catalytic controls to meet the exhaust emission standards. For that reason, this discussion focuses on the NTE zone and subzones for catalyst-equipped engines. Catalysts are most effective when the fuel-air ratio in the exhaust is near stoichiometry, and engine manufacturers use closed-loop electronic control to monitor and maintain the proper fuel-air ratio in the exhaust for optimum catalyst efficiency. However, at high power, engine manufacturers must increase the fueling rate to reduce the exhaust temperatures. Otherwise, if the exhaust temperature becomes too high, exhaust valves and catalysts may be damaged. During rich, open-loop operation at high power, the catalyst is oxygen-limited and less effective at oxidizing HC and CO. To address the issue of open-loop catalyst efficiency, we created a high power subzone for catalyst-equipped engines. The shape of this subzone is based on data presented in the RIA on engine protection strategies.

Figure III-1 illustrates the final NTE zone for engines equipped with catalysts. Section IV.D.5 discusses the NTE test procedures and limits for non-catalyzed engines. The NTE zones and standards apply depending on whether the engine has a catalyst or not, so outboard or personal watercraft engines may be subject to the NTE approach described in this section and sterndrive/inboard engines may be subject to the NTE provisions described in Section IV.D.5. However, we expect these situations to be rather uncommon.

Figure III-1: NTE Zone and Subzones for Catalyst-Equipped Engines



The final regulations 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 normally operate outside the revised NTE zone in use (see §1045.515). We do 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 will still be responsible for all operation of an engine on a vessel that will reasonably be expected to be seen in use, and they will be responsible for ensuring that their specified operation is indicative of real-world operation. EPA testing may include any normal operation observed on in-use vessels, consistent with the applicable regulatory provisions. In addition, if a manufacturer designs an engine for operation at speeds and loads outside of the NTE zone, the manufacturer is required to notify us so the NTE zone used to comply with the applicable standards can be modified appropriately to include this operation for that engine family.

(c) NTE emission limits

We are establishing NTE limits for the individual 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 Final RIA. See Section IV.D.5 for a discussion of NTE limits for engines not equipped with catalysts.

For catalyst-equipped engines, the largest contribution of emissions over the 5-mode duty cycle comes from open-loop operation at Mode 1. In addition, the idle point (Mode 5) is weighted 40 percent in the 5-mode duty cycle, but not included in the NTE zone. For this reason, brake-specific emissions throughout most of the NTE zone are less than the weighted average from the steady-state testing. For most of the NTE zone, we are therefore establishing a limit equal to the duty-cycle standard (i.e., NTE multiplier = 1.0). This means that these engines may not have steady-state emissions at any point inside the NTE zone, except in the subzone around full-load operation, that exceed the HC+NOx or CO emission standards.

Emission data on catalyst-equipped engines also show higher emissions near full-power operation. As discussed above, this is due to the need for richer fuel-air ratios under high-power operation to protect the engines from overheating. Under rich conditions, a three-way catalyst does not effectively oxidize CO emissions. Therefore, we are not setting an NTE limit in Subzone 1 for CO. Some HC+NOx control is expected in Subzone 1 because a three-way catalyst will efficiently reduce NOx emissions under rich conditions. Similar to CO, HC emissions are not effectively oxidized in a catalyst during rich operation. We are therefore establishing a higher NTE limit of 1.5 for HC+NOx in Subzone 1. This limit is based on emission control performance during open-loop operation.

(d) Excluded operation

As with marine diesel engines, only steady-state operation is included for NTE testing (see §1045.515). Steady-state operation will 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 will 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 are aware that 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. As with outboard and personal watercraft engines, NTE testing excludes engine starting and warm-up. We are allowing manufacturers to design their engines to utilize engine protection strategies that will 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.

(e) Ambient conditions

Variations in ambient conditions can affect emissions. Such conditions include air temperature, water temperature, barometric pressure, and humidity. We are applying the comparable ranges for these variables as for marine diesel engines (see §1045.515). Within the specified ranges, there is no provision to correct emission levels to standard conditions. Outside of the specified ranges, emissions may be corrected back to the nearest end of the range using good engineering practice. The specified 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. NTE testing may take place at any humidity level, but manufacturers may correct for humidity effects as described in §1065.670.

(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 will 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 are adopting field-testing provisions for all SD/I engines. These field-testing procedures are described further in Section IV.E.2.

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, for any sampling period, each 30-second period of operation would be subject to the NTE standards. For example, manufacturers may measure emissions for ten minutes. The engine's emissions over the ten-minute period would need to meet the applicable NTE standards, but each 30-second period of operation during the ten-minute period should also be evaluated to determine that the engine complies.

(g) Certification

We are requiring 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 new NTE zone (see §1045.205). The manufacturer must also provide a detailed description of all testing, engineering analysis, and other information that forms the basis for the statement. This statement will be based on testing and, if applicable, other research that supports such a statement, consistent with good engineering judgment. We will 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.

E. Additional Certification and Compliance Provisions

(1) Production-Line Testing

There are several factors that have led us to conclude that we should not finalize production-line testing requirements for SD/I engines in this rulemaking. First, California ARB has not yet adopted production-line testing requirements for these engines. Second, the companies producing these engines are predominantly small businesses. Third, the relatively short useful life and small sales volumes limit the overall emissions effect from these engines. Fourth, we are aware that marine engines may need additional setup time for testing to simulate the marine configuration. We do not consider any of these issues to be fundamental, but we believe it is best to defer further consideration of a requirement for production-line testing until a later rulemaking. This would allow us to better understand the degree of compliance with emission standards, the effectiveness of diagnostic controls, and California ARB's interest in requiring production-line testing. However, 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.

(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 adopt 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. 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 for some reason, it is unlikely that owners will cooperate.

While we are not establishing 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 will evaluate compliance with the not-to-exceed standards. In addition, as described above for production-line testing, we may require manufacturers to perform a reasonable degree of testing. This may include testing 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 assessing EPA's compliance costs associated with SD/I engines based on EPA's existing fees regulation. Section VI describes a new fees category we are adopting, based on the cost study methodology used in establishing EPA's original fees regulation, for costs related to the final evaporative emission standards for both vessels and equipment that are subject to this final rule.

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.[94] 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, for light-duty motor vehicles.

EPA determined in the final fees rulemaking that it was premature to assess fees for 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 now formally including SD/I engines in the "Other Engines and Vehicles" category such that the baseline fee is $839 for each certificate of conformity. Note that we will continue to update assessed fees each year, so the actual fee in 2010 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 one company to produce engine blocks that a second company modifies for use as a marine engine. Since our regulations prohibit the sale of uncertified engines, we are establishing provisions to clarify the status of these engines and defining a path

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

by which these engines can be handled without violating the regulations. See Section VIII.C.1 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 allowing 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 will 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. We are adopting similar provisions for engines below 19 kW that are certified to Small SI standards as described in Section III.C.1.

(6) Import-specific information at certification

We are requiring additional information to improve our ability to oversee compliance related to imported engines (see §1045.205). In the application for certification, we require the following additional information: (1) the port or ports at which the manufacturer has imported engines over the previous 12 months, (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. See Section 1.3 of the Summary and Analysis of Comments for further discussion related to naming test facilities in the United States.

(7) Alternate fuels

See Section IV.E.7 for a discussion of requirements that apply to spark-ignition SD/I engines that operate on fuels other than gasoline.

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 (RFA). The purpose of the Panel was to collect the advice and recommendations of representatives of small entities that could be affected by the proposal 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 re-convened the Panel on August 17, 2006 to update our review for the proposal. The Panel reports have been placed in the rulemaking record for this final rule. 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 certain 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 rule will apply;
- A description of projected reporting, recordkeeping, and other compliance requirements of the 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 rule; and
- A description of any significant alternative to the rule that accomplishes the stated objectives of applicable statutes and that minimizes any significant economic impact of the 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.

EPA used the size standards provided by the Small Business Administration (SBA) at 13 CFR part 121 to identify small entities for the purposes of its regulatory flexibility analysis. Companies that manufacture internal-combustion engines and that employ fewer than 1000 employees are considered small businesses for the purpose of the RFA analysis for this rule. Equipment manufacturers, boat builders, and fuel system component manufacturers that employ fewer than 500 people are considered small businesses for the purpose of the RFA analysis for this rule. 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 the proposed rule. The Panel reports are included in the rulemaking record for this action. In light of the Panel report, and where appropriate, we proposed a number of provisions for small business SD/I engine manufacturers. With this final rule we are adopting many of the flexibility options proposed with some changes due to the different standards we are adopting for SD/I high-performance engines. In addition, we are making a change to the criteria for determining which companies are eligible for the flexibility options. The following section describes the flexibility options being adopted as part of this final rule and the criteria for determining which manufacturers are eligible.

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

We are establishing 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 adopting a 250 employee limit. EPA believes this limit will cover all the existing small business SD/I engine manufacturers (as defined by SBA), but places a reasonable limit on how large a company could grow before they are no longer eligible for EPA's flexibilities for small volume engine manufacturers.

(a) Additional lead time

As recommended in the SBAR Panel report and as proposed, EPA is establishing an implementation date of 2011 for conventional SD/I engines produced by small volume engine manufacturers. In addition, EPA is establishing an implementation date of 2013 for SD/I high-performance engines produced by small volume engine manufacturers (see §1045.145).

(b) Exhaust emission ABT

In the proposal, EPA cited concerns raised by small businesses that ABT could give a competitive advantage to large businesses and requested comment on the desirability of credit trading between high-performance and conventional SD/I marine engines. As described earlier in Section III.C.1, EPA is adopting different standards for SD/I high-performance engines than originally proposed. While we are adopting an averaging, banking, and trading (ABT) credit program for conventional SD/I marine engines (see part 1045, subpart H), SD/I high-performance engines are required to meet the new standards without an ABT program.

(c) Early credit generation for ABT

As recommended in the SBAR Panel report and as proposed, we are adopting an early banking program in which small volume engine manufacturers can earn bonus credits for certifying earlier than required (see §1045.145). This program, combined with the additional lead time for small businesses, will give small-volume SD/I engine manufacturers ample opportunity to bank emission credits prior to the implementation date of the standards and will provide greater incentive for more small business engine manufacturers to introduce advanced technology earlier across the nation than will otherwise occur. The ABT program applies only to conventional SD/I engines so the early credit provisions will not apply to SD/I high-performance engines.

(d) Assigned emission rates for SD/I high-performance engines

In the proposal, EPA noted that engine manufacturers using emission credits to comply with the standard will still need to test engines to calculate how many emission credits are needed. To minimize this testing burden, we proposed to allow manufacturers to use assigned baseline emission rates for certification based on previously generated emission data. As discussed above, we are adopting less stringent standards for SD/I high-performance engines that do not allow for the use of the ABT program for demonstrating compliance with the standards. We are not adopting baseline HC+NOx and CO emission rates for SD/I high-performance engines since the proposed levels were higher than the standards being adopted and therefore are of no use without an ABT program.

(e) Alternative standards for SD/I high-performance engines

In the proposal, EPA cited concerns raised by small businesses that catalysts had not been demonstrated on high-performance engines and that they may not be practicable for this application and therefore requested comment on the need for and level of alternative standards for SD/I high-performance engines. As described in Section III.C.1, we are adopting a less stringent set of exhaust emission standards for SD/I high-performance engines than originally proposed.

In addition, as described in Section III.C.2, we are not adopting NTE standards for SD/I high-performance engines (See §1045.105). This is consistent with the SBAR Panel recommendation that NTE standards not apply to SD/I high-performance engines.

(f) Broad engine families for SD/I high-performance engines

In the proposal, EPA noted that the testing burden could be reduced by using broader definitions of engine families. As proposed, we are adopting provisions to allow small businesses to group all their SD/I high-performance engines into a single engine family for certification (see §1045.230). A manufacturer will need to perform emission tests only on the engine in that family that is most likely to exceed an emission standard.

(g) Simplified test procedures for SD/I high-performance 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 SD/I high-performance engines, EPA is adopting a provision that allows for different equipment than is specified for the laboratory and with less restrictive specifications and tolerances more typical of in-use testing (see §1045.501(h)). These less restrictive specifications will facilitate less expensive testing for businesses, with little or no negative effect on the environment. The relaxation on these specifications is especially helpful for testing high-performance engines due to their high exhaust flow rates, temperatures, and emission concentrations. This provision is available to all SD/I high-performance engine manufacturers, regardless of business size.

(h) Reduced testing requirements for SD/I engines

We are adopting provisions to allow small-volume engine manufacturers to use an assigned deterioration factor to demonstrate compliance with the standards for 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 specifying actual levels for the assigned deterioration factors in this final rule. 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 proposed to exempt small-volume manufacturers of SD/I engines from the production-line testing requirements. However, we are dropping the production-line testing requirements for all SD/I engine manufacturers. Therefore, no production-line testing will be required of any SD/I engine manufacturer, whether large or small (see §1045.301).

(i) Hardship provisions

We are adopting two types of hardship provisions for SD/I engine manufacturers, consistent with the Panel recommendations. EPA used the SBA size standards for purposes of defining "small businesses" for its regulatory flexibility analysis. The eligibility criteria for the hardship provisions described below reflect EPA's consideration of the Panel's recommendations and a reasonable application of existing hardship provisions. As has been our experience with similar provisions already adopted, we anticipate that hardship mechanisms will be used sparingly. First, under the unusual circumstances hardship provision, any manufacturer subject to the new standards may apply for hardship relief if circumstances outside their control cause the failure to comply and if failure to sell the subject engines or equipment or fuel system component would have a major impact on the company's solvency (see §1068.245). An example of an unusual circumstance outside a manufacturer's control may be an "Act of God," a fire at the manufacturing plant, or the unforeseen shutdown of a supplier with no alternative available. The terms and time frame of the relief will depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards. This hardship provision will be available to all manufacturers of engines, equipment, boats, and fuel system components subject to the new standards, regardless of business size.

Second, an economic hardship provision allows small businesses subject to the new standards to petition EPA for limited additional lead time to comply with the standards (see §1068.250). A small business must make the case that it has taken all possible business, technical, and economic steps to comply, but the burden of compliance costs would jeopardize the company's solvency. Hardship relief could include requirements for interim emission reductions and/or the purchase and use of emission credits. The length of the hardship relief decided during review of the hardship application will be up to one year, with the potential to extend the relief as needed. We anticipate that one to two years will normally be sufficient. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards. This hardship provision will be available only to qualifying small businesses.

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

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+NOx emission standard of 5 g/kW-hr for SD/I engines, starting in 2008. At this time, three engine manufacturers have certified SD/I engines to these standards. Chapter 4 of the Final RIA presents data from these engines as well as detailed data on several developmental SD/I engines with catalysts packaged within water-cooled exhaust manifolds. Four of these developmental engines were operated with catalysts in vessels for 480 hours. The remaining developmental engines were tested with catalysts that had been subjected to a rapid-aging cycle in the laboratory. Data from these catalyst-equipped engines support the level of the standards.

SD/I high-performance engines have very high power outputs, large exhaust gas flow rates, and relatively high concentrations of hydrocarbons and carbon monoxide in the exhaust gases. As a result, we believe it is not practical to apply catalyst technology to these engines. We are therefore adopting standards for SD/I high-performance engines based on the level of control that can be expected from recalibration with electronically controlled fuel injection.

(2) Implementation Dates

We anticipate that manufacturers will use the same catalyst designs to meet the final 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 two-year delay allows manufacturers adequate time to incorporate catalysts across their product lines. Once the technology is developed for use in California, it will be available for use nationwide. In fact, several engine models currently certified to the California standards are already available with catalysts nationwide. As discussed above, we are accommodating the transition to new base engines by agreeing to one year of hardship relief for companies that would otherwise need to design and certify an engine for that one year before it becomes obsolete.

(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+NOx 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 Final RIA, data on catalyst-equipped SD/I engines show that emissions may be reduced by 70 to 80 percent for HC+NOx and 30 to 50 percent for CO over the 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 expected 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 Final 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 will result from corrosion or hydraulic lock. As discussed in the Final 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 will 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 in 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 HC+NOx 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 were accumulated on the boats. Although the accumulated hours are well below the 480 hours performed on fresh water, the operation completed showed no visible evidence of water reversion or damage to the catalysts.

Three SD/I engine manufacturers have certified SD/I engines to the California ARB standards, and some catalyst-equipped engines are available for purchase nationwide. Manufacturers have indicated that they have successfully completed durability testing, including extended in-use testing on saltwater.

(4) Regulatory Alternatives

In developing the final 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 Final RIA presents data on SD/I engines equipped with exhaust gas recirculation (EGR). HC+NOx 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 will 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 will 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 standards had HC+NOx emission rates appreciably lower that 5 g/kW-hr, 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 Final RIA did not investigate larger catalysts for SD/I applications. The goal of the testing was to demonstrate catalysts that will 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 final 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.

For SD/I high-performance engines, we originally proposed a standard based on the use of catalysts and then considered a less stringent alternative based on engine fuel system upgrades, calibration, or other minor changes such as an air injection pump rather than catalytic control. However, manufacturers commented that catalysts are not practical for these engines due to the high exhaust flow rates, high emission rates, and short time between rebuilds. In the final rule, we are establishing standards that can be met through the use of engine controls, similar to the alternative standard that was analyzed in the proposal. Because we do not consider catalyst-based standards to be feasible for high-performance engines at this time, we did not model a more stringent alternative for these engines.

(5) Our Conclusions

We believe the final 2010 exhaust emission standards for SD/I engines represent the greatest degree of emission reduction achievable in this time frame. Manufacturers of conventional SD/I engines can meet the standards through the use of three-way catalysts packaged in the exhaust systems upstream of where the water and exhaust mix. Manufacturers are already selling engines with this technology. By 2010 there will be widespread experience in applying emission controls to a large number of engine models.

As discussed in Section VII, we do not believe the final standards will 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+NOx 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 adopting new HC+NOx and CO exhaust emission standards for OB/PWC marine engines reflecting the capabilities of these new technologies.

For outboard and personal watercraft engines, the current emission standards regulate only HC+NOx emissions. As described in Section II, we are making 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 new standards. In fact, as discussed in Chapter 4 of the Final RIA, manufacturers are already producing several models of four-stroke engines and direction-injection two-stroke engines that meet the new standards. The most important compliance step for the standards will be to retire high-emitting designs that are still available and replace them with these cleaner engines. We are not establishing 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 migrating the regulatory requirements for marine spark-ignition engines from 40 CFR part 91 to 40 CFR part 1045. Manufacturers must comply with the provisions in part 1045 for an engine once the exhaust emission standards begin to apply in 2010. 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.

Engines and vessels subject to part 1045 are also subject to the general compliance provisions in 40 CFR part 1068. These include prohibited acts and penalties, exemptions and importation provisions, selective enforcement audits, defect reporting and recall, and hearing procedures. See Section VIII of the preamble to the proposed rule for further discussion of these general compliance provisions.

B. Engines Covered by This Rule

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

The final standards are intended to apply to outboard marine engines and engines used to propel personal watercraft. We are changing the definitions of outboard and personal watercraft to reflect this intent. The original definitions of outboard engine and personal watercraft marine engine adopted in 40 CFR part 91 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 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 will not be categorized as SD/I under the original 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 changing 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 adopting 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. Because jet boat engines may be the same as OB/PWC engines, the regulations classified them as OB/PWC engines unless the Agency classified them as SD/I due to comparable technology and emissions as SD/I engines. However, as explained in the proposed rule, we believe classifying such engines as personal watercraft engines is inappropriate because it will subject the jet boats to less stringent emission standards than other boats with similar size, power, and usage characteristics, and thus potentially lead to increased use of high-emitting engines in these vessels. Because the current regulations authorize engines powering jet boats to be treated as SD/I engines at the discretion of the Agency, but do not compel such classification, we are finalizing amendments to the definition to explicitly exclude jet boats and their engines from being treated as personal watercraft engines or vessels. Instead, we are classifying jet boat engines as SD/I engines.

The new definition conforms to the 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 for personal watercraft therefore excludes personal watercraft-like vessels 4 meters or greater and jet boats. Thus, engines powering such vessels will 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 definition of personal watercraft engine. We are making one change to the ISO definition for domestic regulatory purposes; we are removing 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 revising the definitions as follows:

- *Personal watercraft* means a vessel less than 4.0 meters (13 feet) in length that uses an installed spark-ignition 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.3 describes special provisions that will allow manufacturers extra flexibility with emission credits if they want to continue using outboard or personal watercraft engines in jet boats. These engines will 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.

(2) Exclusions and Exemptions

We are maintaining the current 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 in Section VIII of the preamble to the proposed rule.

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 were difficult to remove and that made it unsafe, impractical, or unlikely to be used for noncompetitive purposes. We have more recently taken the approach in other programs of more carefully differentiating competition and noncompetition models, and are adopting these kinds of changes in this rule. The changes to the provisions relating to competition engines apply equally to all types of Marine SI engines. See Section III.B and §1045.620 of the regulations for a full discussion of the new approach.

We are incorporating a new exemption to address individuals who manufacture recreational marine vessels for personal use as described in Section III.B.2.

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 extending that same provision to OB/PWC marine engines (see §1045.5).

C. Final Exhaust Emission Standards

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

(1) Standards and Dates

We are requiring new HC+NOx standards for OB/PWC engines starting in model year 2010 that will achieve more than a 60 percent reduction from the 2006 standards (see §1045.103). We are also establishing new CO emission standards. These standards will result in meaningful CO reductions from many engines and prevent CO from increasing for engines that already use technologies with lower CO emissions. The new emission standards are largely based on certification data from cleaner-burning four-stroke engines and two-stroke direct-injection engines that are certified under part 91. Section IV.H discusses the technological feasibility of these standards in more detail. Table IV-1 presents the exhaust emission standards for OB/PWC. The HC+NOx emission standards are the same as those adopted by California ARB for 2008 and later model years. We are also applying not-to-exceed emission standards over a range of engine operating conditions, as described in Section IV.C.2.

Table IV-1: OB/PWC Exhaust Emission Standards [g/kW-hr]

Pollutant	Power	Emission Standard
HC+NOx	$P \leq 4.3$ kW	30.0
	P> 4.3 kW	$2.1 + 0.09 \times (151 + 557/P^{0.9})$
CO	$P \leq 40$ kW	$500 - 5.0 \times P$
	P> 40 kW	300

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

Our implementation date allows two additional years beyond the implementation date of the same standards in California. Manufacturers generally sell their lower-emission engines, which are already meeting the 2008 California standards, nationwide. However, the additional time will give manufacturers time to address any models that may not meet the upcoming California standards or are not sold in California. This also accommodates the lead time concerns with the timing of this final rule as expressed by the commenters.

The emission standards apply at the range of atmospheric pressures represented by the test conditions specified in part 1065. This includes operation at elevated altitudes. Since not all engines have electronic engines with feedback controls to incorporate altitude compensation, we are taking the same approach here as for Small SI engines where a similar dynamic is in place. Specifically, we are requiring that all engines must comply with emission standards in the standard configuration (i.e., without an altitude kit) at barometric pressures above 94.0 kPa, which corresponds to altitudes up to about 2,000 feet above sea level (see §1045.115). This will ensure that all areas east of the Rocky Mountains and most of the populated areas in Pacific Coast states will have compliant engines without depending on engine adjustments. This becomes more important as we anticipate manufacturers increasingly relying on technologies that are sensitive to controlling air-fuel ratio for reducing emissions. For operation at higher altitudes, manufacturers may rely on an altitude kit that allows their engines to meet emission standards at higher elevations. In this case, engine manufacturers must describe the kit specifications in their application for certification and identify in the owner's manual the altitude ranges for proper engine performance and emission control that are expected with and without the altitude kit. The owner's 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. The regulations specify that owners may follow the manufacturer's instructions to modify their engines with altitude kits without violating the tampering prohibition. See Section IV.E.8 for further discussion related to the deployment of altitude kits where the manufacturers rely on them for operation at higher altitudes.

The new 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

We are adopting emission standards that apply over an NTE zone. The NTE standards are in the form of a multiplier times the duty-cycle standard for HC+NOx and for CO (see §1045.105). Section IV.D.5 gives an overview of the NTE standards and compliance provisions and describes the NTE test procedures.

Manufacturers commented that certification to the NTE standards requires additional testing even for engine models that are currently certified to emission levels below the new duty-cycle based standards. In addition, they expressed concern that they may need to recalibrate existing engine models to meet the NTE standards. Manufacturers commented that this would not be possible by 2010 because of the large number of engine models. For most engines, manufacturers carry over preexisting certification test data from year to year. Manufacturers commented that additional time would be necessary to retest, and potentially recalibrate, all these engines for certification to the NTE standards. To address these issues regarding lead time needed to retest these engines, we are not applying the NTE standards for 2010-2012 model year engines that are certified using preexisting data (i.e., carryover engine families). For new engine models, manufacturers indicated that they will be able to perform the NTE testing and duty-cycle testing as part of their efforts to certify to the new standards. Therefore the primary implementation date of 2010 applies to these engines. Beginning in the 2013 model year, all conventional OB/PWC engines must be certified to meet the NTE standards.

This NTE approach complements the weighted modal emission tests included in this rule. These steady-state duty cycles and standards are intended to establish average emission levels over several discrete modes of engine operation. 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 will 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

Engine manufacturers may use emission credits to meet OB/PWC standards under part 91. We are adopting an ABT program for the new HC+NOx emission standards that is similar to the previous program (see part 1045, subpart H). A description of the ABT provisions for the new OB/PWC standards is described below.

OB/PWC engine manufacturers that have generated HC+NOx credits under the 2006 standards will be able to use those credits to demonstrate compliance with the new HC+NOx standards being adopted in this final rule. The credits generated under the 2006 standards are subject to a three-year credit life. Therefore, a manufacturer will be able to use those credits for demonstrating compliance with the new standards as long as the credits have not expired.

We are allowing an indefinite life for emission credits earned under the new standards for OB/PWC engines. We consider these emission credits to be part of the overall program for complying with 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. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards, consistent with the statutory requirement to establish standards that represent the greatest degree of emission reduction achievable, considering cost, safety, lead time, and other factors. If we were to allow the use of credits generated under the standards adopted in this rule to meet more stringent standards adopt in a future rulemaking, we may need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued use of existing emission credits, depending on the level of emission credit banks. Alternatively, we may adopt future standards without allowing the use of existing emission credits.

We are adopting the equation for calculating emission credits for OB/PWC engines as proposed. This equation represents a simpler calculation than is currently used for OB/PWC engines and is based on the equation that is common in many of our other ABT programs. The primary difference is that the regulatory useful life will 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 will be reported in units of kilograms rather than grams.

We are also adopting an averaging program for CO emissions. Under this program, manufacturers can 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 not establishing a banking program for CO emissions. As noted in the proposal, 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. Furthermore, because we generally allow trading only with banked credits, we are not allowing trading of CO emission credits.

EPA proposed that manufacturers would not be able to earn credits for one pollutant while using credits to comply with the emissions standard for another pollutant. We are dropping that provision for the final rule. The proposed restriction was modeled on similar requirements in other ABT programs where there was concern that a manufacturer could use technologies to reduce one pollutant while increasing another pollutant. The types of technologies manufacturers are expected to use to comply with the new standards include direct-injection two-stroke engines or four-stroke engines. Both of these technologies should result in reductions in both HC+NOx emissions and CO emissions compared to current designs. While the technologies are expected to reduce both HC+NOx emissions and CO emissions, there could be situations where these technologies are capable of meeting one of the emission standards but not the other. EPA does not want to preclude such engines from being able to certify using the provisions of the ABT program and is therefore dropping the proposed restriction from the final rule.

For OB/PWC engines subject to the new emission standards, we are adopting FEL caps to prevent the sale of very high-emitting engines. For HC+NOx, the FEL cap will be the applicable 2006 and later model year HC+NOx standard, which is dependent on the average power of an engine family. For CO, the FEL cap will be 150 g/kW-hr above the newly adopted CO standard, which is also dependent on the average power of an engine family. We believe these FEL caps will 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.

We are specifying that OB/PWC engines are in a separate averaging set from SD/I engines, with an exception for certain jet boat engines. This means that credits earned by OB/PWC engines may be used only to offset higher emissions from other OB/PWC engines. Likewise, credits earned by SD/I engines may be used only to offset higher emissions from other SD/I engines. As described Section III.C.2, manufacturers will be able to use credits generated from OB/PWC engines to demonstrate that their jet boat engines meet the HC+NOx and CO standards for SD/I engines if the majority of units sold in the United States from those related OB/PWC engine families are sold for use as OB/PWC engines.

Finally, manufacturers may include as part of their federal credit calculation the sales of engines in California as long as they don’t separately account for those emission credits under the California regulations. We originally proposed to exclude engines sold in California that are subject to the California ARB standards. However, we consider California’s current HC+NOx standards to be equivalent to those we are adopting in this rulemaking, so we would expect a widespread practice of producing and marketing 50-state products. Therefore, as long as a manufacturer is not generating credits under California’s averaging program for OB/PWC engines, we would allow manufacturers to count those engines when calculating credits under EPA’s program. This is consistent with how EPA allows credits to be calculated in other nonroad sectors, such as recreational vehicles.

(4) Durability Provisions

We are keeping the 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 updating 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. Accordingly, the new warranty period for outboard engines is five years or 175 hours of operation, whichever comes first. The new 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 new approach will slightly decrease the warranty period in terms of hours, but will somewhat increase the period in terms of calendar years (or months).

If the manufacturer offers a longer mechanical warranty for the engine or any of its components at no additional charge, we are requiring 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 keeping the 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+NOx emissions. For the HC+NOx standard, we are requiring that manufacturers use a single deterioration factor for the sum of HC and NOx 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 will require separate deterioration factors for HC and NOx 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 specifying that manufacturers may not schedule critical emission-related maintenance during the useful life period (see §1045.125). This will prevent manufacturers from designing engines with emission controls that depend on scheduled maintenance that is not likely to occur with in-use engines.

D. Changes to OB/PWC Test Procedures

We are making 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 will 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 keeping the duty cycle specified for OB/PWC engines, with two adjustments (see §1045.505). First, we are requiring that manufacturers may choose to run the specified duty cycle as a ramped-modal cycle. Second, we are changing the low-power test mode from a specified 25 percent load condition to 25.3 percent load, which will complete the intended alignment with the E4 duty cycle adopted by the International Organization for Standardization.

(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 are defining 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. The nominal value of maximum test speed is defined at that point where the length of this line reaches its maximum value.

The engine mapping procedures in part 1065 that we referenced in the proposal allow manufacturers to declare a value for maximum test speed that is within 2.5 percent of the calculated (or measured) nominal value. Based on the manufacturers' descriptions of the way they instruct boat builders to match propellers to their engines, we have included in the final rule a special allowance for manufacturers to declare a value for maximum test speed that is up to 500 rpm below the calculated value. This equates to about 8 percent of the calculated value for most engines; however, we would never expect manufacturers to select a value for maximum test speed that is above the nominal value, so the total allowable range is not much greater than for other engines. We also note that the maximum test speed for a four-stroke engine that remains installed in a vessel is the highest engine speed that can occur. As long as the propeller matching and other vessel characteristics do not take the engine outside of the manufacturer's specified range, the engine would need to meet the Not-to-Exceed standards based on the in-use value for maximum test speed. These provisions related to maximum test speed apply equally to OB/PWC engines and SD/I engines.

(3) 40 CFR Part 1065

We are requiring that OB/PWC engines certified to the new exhaust emission standards use the test procedures in 40 CFR part 1065 instead of those in 40 CFR part 91.[95] Part 1065 includes detailed laboratory and equipment specifications and procedures for equipment calibration and emission measurements. These new procedures will apply starting with the introduction of new exhaust standards, though we will 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 new standards, we will allow the carryover of any test data generated prior to 2009 under the test procedures in 40 CFR part 91.

(4) Engine Break-in

Testing new engines requires a period of engine operation to stabilize emission 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 will 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 requiring that low-hour marine spark-ignition 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 new allowance for up to 30 hours of engine operation is consistent with what we have done for recreational vehicles and will 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 keeping 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.

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

Section III.D.2 discusses the general concept and approach behind NTE standards for Marine SI engines. In addition, Section III.D.2 presents specific zones and limits for catalyst-equipped marine engines. We are applying the same general NTE testing provisions to OB/PWC engines, including the same broad NTE zone and ambient conditions (see §1045.515).

[95] 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).

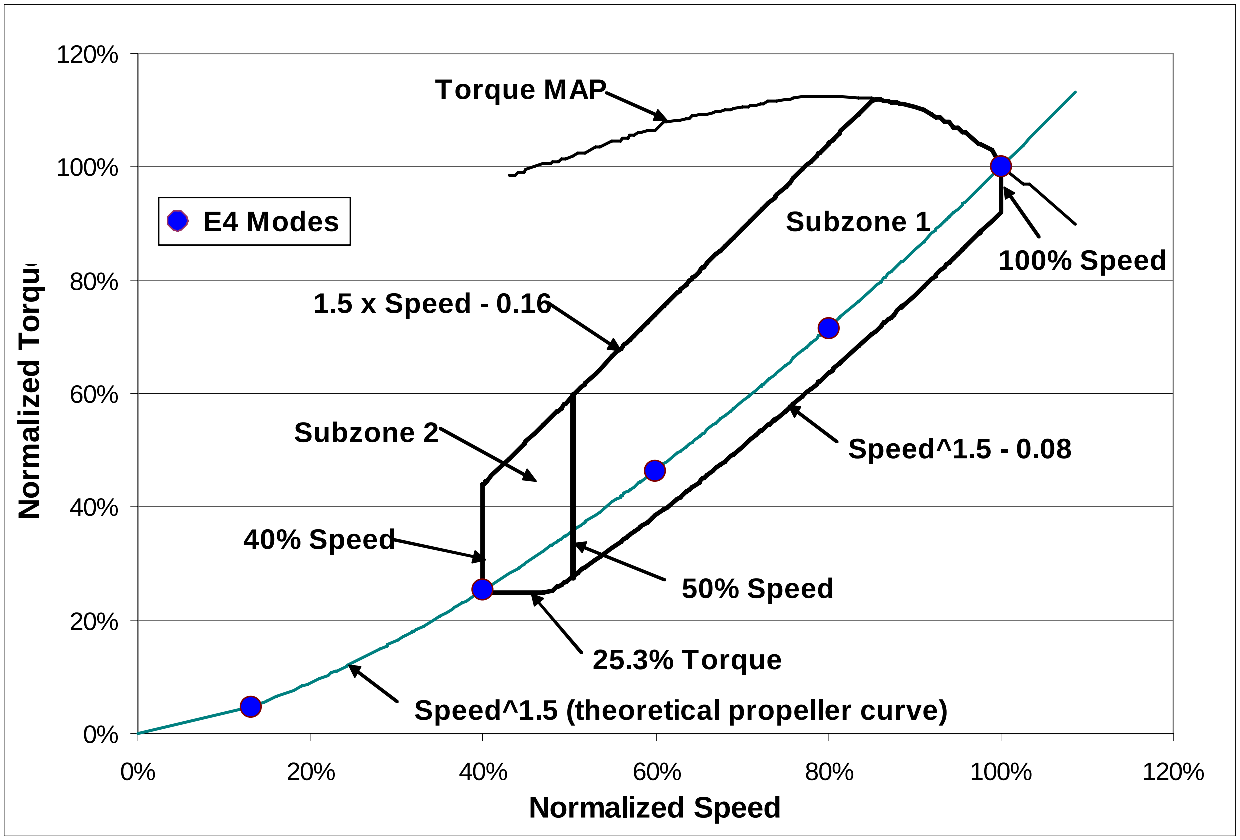
We anticipate that most OB/PWC engines subject to the NTE standards will use engine-based controls to meet the exhaust emission standards. For that reason, this discussion focuses on the NTE zone and subzones for engines not equipped with catalysts. Data presented in Chapter 4 of the RIA suggests that the emissions characteristics of marine engines are largely dependent on technology type. Four-stroke engines tend to have relatively constant emission levels throughout the NTE zone. In contrast, two-stroke engines tend to have high variability in emissions, not only within the NTE zone but between different engine designs as well. Therefore, we developed separate NTE approaches and standards for four-stroke and two-stroke engines. These approaches and standards are discussed below.

(a) Four-Stroke Marine Engines

The NTE approach for four-stroke marine engines without catalysts is similar to that for catalyst-equipped engines as described in Section III. We are applying the same NTE zone; however, we are establishing different subzones and emission limits based on data presented in the Final RIA. Emission data for four-stroke marine engines suggest that brake-specific emission rates are relatively constant throughout the NTE zone. One exception is slightly higher HC+NOx emissions at low power. To account for this, we are subdividing the NTE zone to have a low-power subzone below 50 percent of maximum test speed. In this low-power subzone, the HC+NOx NTE limit is 1.6, while it is 1.4 for the remainder of the NTE zone. The CO NTE limit is 1.5 throughout the NTE zone. Figure IV-1 presents the NTE zone and subzones. These limits would apply to all non-catalyzed four-stroke engines. See Section III.D.2 for a detailed discussion of NTE requirements that apply for catalyst-equipped engines (including OB/PWC engines).

As discussed above in Section IV.C.2, we are providing extra lead time for 2010-2012 model year engines certified using preexisting data. The purpose of this provision is to allow testing and calibration work to better fit into product development cycles. We have received an indication that a small subset of existing outboard engines may need additional time to meet the 1.4 NTE limit at mid-range speeds due to technological challenges associated with high-power supercharging. Manufacturers have indicated that a slightly higher limit of 1.6 would be feasible in the 2013 time frame, but additional time would be needed for hardware changes to meet the 1.4 limit. To address this issue, we are temporarily expanding Subzone 2 to include mid-range speeds up to 70 percent of maximum test speed for supercharged outboard engines greater than 150 kW. Beginning with the 2015 model year, these engines would be subject to the same NTE zone and standards as other four-stroke engines.

Figure IV-2: NTE Zone and Subzones for Four-Stroke Engines without Catalysts



(b) Two-Stroke Marine Engines

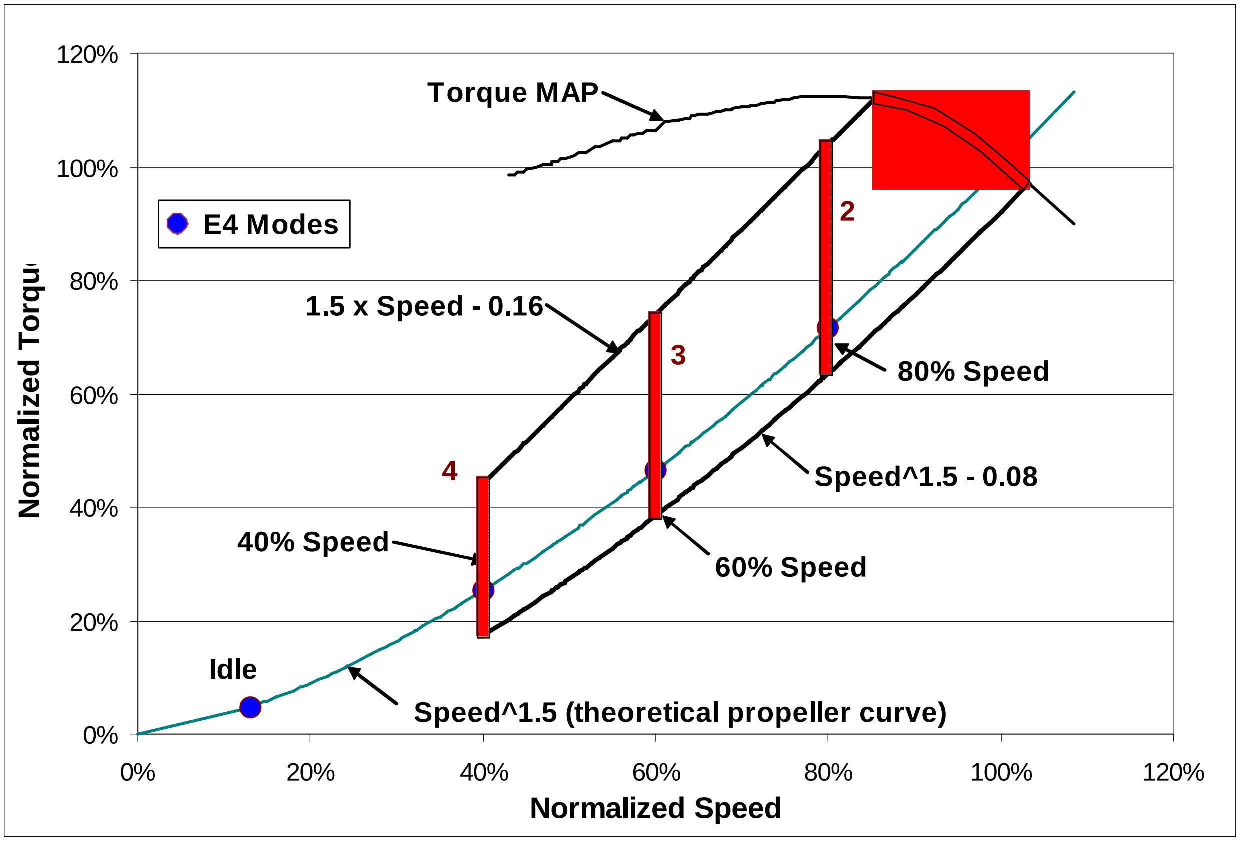
The emission data presented in Chapter 4 of the Final RIA for two-stroke direct-injection marine engines suggest that these engines have high variability in emissions, not only within the NTE zone but between different engine designs as well. Due to this variability, we do not believe that a flat (or stepped) limit in the NTE zone could be effectively used to establish meaningful standards for these engines. At the same time, we continue to believe that NTE standards are valuable for facilitating in-use testing. We therefore developed a weighted NTE approach specifically for these engines. In the long term, we may consider further emission reductions based on catalytic control applied to OB/PWC engines. In this case, we would revisit the appropriateness of the weighted NTE approach in the context of those standards.

Under the weighted NTE approach, emission data is collected at five test points. These test points are idle, full power, and the speeds specified in Modes 2 through 4 of the 5-mode duty cycle. Similar to the 5-mode duty cycle, the five test points are weighted to achieve a composite value. This composite value must be no higher than 1.2 times the FEL for that engine family.

The difference in this approach from the 5-mode duty cycle is that the test torque is not specified. During an in-use test, the engine would be set to the target speed and the torque value would be allowed to float. The actual torque would depend on the propeller design, the weight and condition of the boat, and other factors. In addition, the engine speed at wide open throttle would be based on actual performance on the boat. Because in-use engines installed in boats do not generally operate on the theoretical propeller curve used to define the 5-mode duty cycle, this approach helps facilitate NTE testing.

At each test mode, limits are placed on allowable engine operation. These limits are generally based on the NTE zone presented above for four-stroke engines, but there are two exceptions. First, the lower torque limit at 40 percent speed is lowered slightly to better ensure that an engine on an in-use boat is capable of operating within the NTE zone. Second, the speed range is extended at wide-open throttle for the same reason. Figure IV-2 presents the NTE zone and subzones. These limits would apply to all non-catalyzed two-stroke engines. See Section III.D.2 for a detailed discussion of NTE requirements that apply to catalyst-equipped engines (including OB/PWC engines).

Figure IV-2: Weighted NTE Approach for two-stroke Engines



During laboratory testing, any point within each of the four non-idle subzones may be chosen as test points. These test points do not necessarily need to lie on a propeller curve. Note that measured power should be used in the calculation of the weighted brake-specific emissions.

(6) Test fuel

As described below in Section V.D.3, we are adopting provisions that will allow manufacturers to use a 10 percent ethanol blend for certification testing of exhaust emissions from Small SI engines as an alternative to the standard gasoline test fuel. We are adopting similar provisions for Marine SI engines in this rule. This option to use a 10 percent ethanol blend will begin with the implementation date of the new exhaust standards for both OB/PWC engines and SD/I engines. The option to use a 10 percent ethanol blend would apply to PLT testing as well if the manufacturer based their certification on the 10 percent ethanol blend. The test fuel specifications are based on using the current gasoline test fuel and adding ethanol until the blended fuel has 10 percent ethanol by volume. While we will allow use of a 10 percent ethanol blend for certification, we expect to use our test fuel without oxygenates for all confirmatory testing for exhaust emissions. Therefore, an engine manufacturer will want to consider the impacts of ethanol on emissions in evaluating the compliance margin for the standard, or in setting the FEL for the engine family if it is participating in the ABT program. We could decide at our own discretion to do exhaust emissions testing using a 10 percent ethanol blend if the manufacturer certified on that fuel.

Ethanol has been blended into in-use gasoline for many years and its use has been increasing in recent years. Under provisions of the Energy Independence and Security Act of 2007, ethanol is required to be used in significantly greater quantities. We project that potentially 80 percent of the national gasoline pool will contain ethanol by 2010, making ethanol blends (up to 10 percent) the de facto in-use fuel. As ethanol blends become the main in-use fuel, we believe it makes sense for manufacturers to optimize their engine designs with regard to emissions, performance, and durability on such a fuel. While limited data on Marine SI engines operated on a 10 percent ethanol blend suggests the HC emissions will decrease and NOx emission will increase or stay the same, these effects result in small decreases in total HC+NOx emission levels, with the difference generally being around 10 percent. CARB is currently running a test program to look at the emission impacts of ethanol blends on a range of Marine SI engines. Based on the results of that test program, we may consider changes to the provisions allowing the use of a 10 percent ethanol blend for certification and production-line testing.

E. Additional Certification and Compliance Provisions

(1) Production-Line Testing

We are continuing 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. The final rule includes a variety of amendments and adjustments as described in the proposal. We may also require manufacturers to perform production line testing under the selective enforcement auditing provisions of 40 CFR part 1068, subpart E.

(2) In-Use Testing

We are also continuing 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, however, making a variety of changes and clarifications to the current 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 will 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 adopting 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 complete applications we receive by December 31 of a given calendar year for the following model year, we 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 have the option of making their own selections for in-use testing. The regulations include criteria to serve as guidance for manufacturers to make appropriate selections. For example, we 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 will treat engine families differently for in-use testing if we receive the application after December 31. This applies, for example, if we receive a complete application for a 2010 engine family in February 2010. In these cases, the engine family will automatically be subject to in-use testing, without regard to the 25 percent limitation that will 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 provision will eliminate the manufacturers' ability to game the testing system by delaying a family of potential concern until the next calendar year. We expect to receive few new applications after the end of the calendar year. This will 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.

(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 we are not requiring manufacturers to include crankcase emission 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 the regulatory useful life, 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, a potential option to address a nonconformity is that 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 adopting a more general approach to addressing potential noncompliance under the in-use testing program than is specified in 40 CFR part 91. The final regulations do not specify how manufacturers could generate emission credits to offset a nonconforming engine family. This new 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 will apply. For example, we 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:

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

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.

$(\text{STD-CL})_i$ = 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 will 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 are adopting the field testing provisions described below as an option for all OB/PWC and 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 in the field. A portable flame ionization detector can measure total hydrocarbon concentrations. A portable analyzer based on zirconia technology can measure NOx emissions. A nondispersive infrared (NDIR) unit can measure CO. We are requiring manufacturers to specify how they will intend to draw 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 are therefore requiring manufacturers to design their engine control systems 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 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 new NTE standards. We are adopting the requirement to meet the torque-broadcasting requirements in the 2013 model year, which aligns with the final implementation of the 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.

In response to comments received from manufacturers, we have agreed to adopt a provision allowing manufacturers to request hardship relief under the in-use testing program if conditions outside their control prevent them from completing the required testing. We would expect this to be a rare occurrence, but this provision will allow us to accommodate manufacturers if extreme unforeseen circumstances prevent a manufacturer from completing a test program.

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 removing the requirement to select engines that have had service accumulation representing less than 75 percent of the useful life. This gives manufacturers the flexibility to test somewhat older engines if they want to. Second, we are slightly adjusting 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 requiring that manufacturers explain why they excluded any particular engines from testing. Finally, we are requiring 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 accepting the pre-existing certification for these engines used in marine applications, on the condition that the engine is not changed from its certified configuration in any way (see §1045.605). We allow this in a similar way for a limited number of engines certified to the

Small SI emission standards (see §1045.610). The number of installed marine engines must generally be less then five percent of the total U.S. sales of that engine model in all applications.

(6) Import-specific information at certification

We are requiring additional information to improve our ability to oversee compliance related to imported engines (see §1045.205). In the application for certification, the following additional information is necessary: (1) the port or ports at which the manufacturer has imported engines over the previous 12 months, (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. See Section 1.3 of the Summary and Analysis of Comments for further discussion related to naming test facilities in the United States.

(7) Alternate fuels

The emission standards apply to all spark-ignition engines regardless of the fuel they use. Almost all Marine SI engines operate on gasoline, but these engines may also operate on other fuels, such as natural gas, liquefied petroleum gas, ethanol, or methanol. The test procedures in 40 CFR part 1065 describe adjustments needed for operating test engines with oxygenated fuels.

In some special cases, a single engine is designed to alternately run on different fuels. For example, some engines can switch back and forth between natural gas and LPG. We are adding a clarification to the regulations to describe how manufacturers would submit certification data and divide such engines into engine families. We would expect a manufacturer to submit test data on each fuel type. If manufacturers produce engines that run only on one fuel where that dedicated-fuel engine is identical to a dual-fuel engine with respect to that fuel, those engines could be included in the same family. This is also true for the second fuel. For example, if a manufacturer produces an engine that can run on both gasoline and LPG and also produces that engine model in gasoline-only and LPG-only versions without adjusting the calibration or other aspects of that configuration, those engines may all be included in the same engine family.

Once an engine is placed into service, someone might want to convert it to operate on a different fuel. This would take the engine out of its certified configuration, so we are requiring that someone performing such a fuel conversion to go through a certification process. We will allow certification of the complete engine using normal certification procedures, or the aftermarket conversion kit could be certified using the provisions of 40 CFR part 85, subpart V. This contrasts with the provisions in part 91 that allow for fuel conversions that can be demonstrated not to increase emission levels above the applicable standard. We propose to apply this requirement starting January 1, 2010. (See §91.1103 and §1045.645.)

(8) Special Provisions Related to Altitude

As described in Section IV.C.1, we are allowing manufacturers to comply with emission standards at high altitudes using an altitude kit. Manufacturers using altitude kits to comply at altitude must take steps to describe their altitude kits in the application for certification and explain their basis for believing that engines with these altitude kits will comply with emission standards at high altitude. Manufacturers must also describe a plan for making information and parts available such that the widespread use of altitude kits will reasonably be expected in high-altitude areas. For a more thorough description of these compliance provisions, see the discussion in Section V.E.5 for nonhandheld Small SI engines.

F. Other Adjustments to Regulatory Provisions

We are moving 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 provisions in the new language that may involve noteworthy changes from the current regulations in part 91. 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 making 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. As a result, all engines within an engine family must have the same approximate bore diameter and use the same method of air aspiration (for example, naturally aspirated vs. turbocharged). Under the previous regulation, manufacturers were allowed the discretion to consider bore and stroke dimensions and aspiration method for subdividing engine families beyond what was required under the primary criteria 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 changes the engine's combustion and emission control in important ways. We are also requiring 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 were to produce an engine model that runs on natural gas or another alternative fuel, that engine model should be in its own engine family. See Section IV.E.7 for a discussion of dual-fuel engines. Finally we are removing the provision currently in part 91 related to the engine-cooling mechanism. Manufacturers pointed out that raw-water cooling and separate-circuit cooling do not have a significant effect on an engine's emission characteristics.

The new regulatory language related to engine labels remains largely unchanged from the previous requirements (see §1045.135). 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 warranty provisions are described above. We are adding 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 specifying 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 routine in-use testing. To the extent 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 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 example, maximum engine power determines the applicable CO standard for engines at or below 40 kW. For bigger engines, emission credits are calculated based on total power output. As a result, we are specifying that manufacturers determine their engines' maximum engine power as the point of maximum engine power on the engine's nominal power curve (see §1045.140). This value may be established as a design value, but must be determined consistent with the engine mapping procedures in §1065.510. The manufacturer must adjust the declared value for maximum engine power of it does not fall within the range of values from production engines.

The new requirements related to the application for certification will 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 requiring that manufacturers submit projected sales volumes for each family, rather than allowing manufacturers to 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 for such things as emission credit calculations. We are also requiring 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 requiring 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 will apply this provision and what we will require of manufacturers where we disagree with a manufacturer's judgment.

We are also establishing new defect-reporting requirements. These are requirements are described in Section VIII of the preamble to the proposed rule.

It is common practice for one company to produce engine blocks that a second company modifies for use as a marine engine. Since our regulations prohibit the sale of uncertified engines, we are establishing 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 VIII.C.1 for more information.

G. Small-Business Provisions

The OB/PWC market has traditionally been made up of large businesses. 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 new standards. As a result, we are adopting only three small business regulatory relief provisions for small business manufacturers of OB/PWC engines. We are allowing 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 extending the economic hardship relief to OB/PWC engine manufacturers that qualify as small businesses (see §1068.250). We are defining small business eligibility criteria for OB/PWC engine manufacturers based on an employee cut-off of 250 employees.

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

H. Technological Feasibility

(1) Level of Standards

Over the past several years, manufacturers have demonstrated their ability to achieve significant HC+NOx 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. Recent certification data for these types of engines show that these technologies may be used to achieve emission levels significantly below the current exhaust emission standards. In fact, California standards require a 65 percent reduction beyond the current federal standards.

Our own analysis of recent certification data shows that most four-stroke outboard engines and many two-stroke direct injection outboard engines can meet the final HC+NOx standard. Similarly, although PWC engines tend to have higher HC+NOx emissions, presumably due to their higher power densities, many of these engines can also meet the new HC+NOx 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 the two-stroke direct injection engines show emissions well below the new standards. In addition, the majority of four-stroke engines meet the new CO standards as well.

We therefore believe the HC+NOx and CO emission standards will 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 Final RIA presents charts that compare certification data to the new standards.

(2) Implementation Dates

We are implementing the new emission standards beginning with the 2010 model year. This gives two additional years beyond the implementation date of the same standards in California. This additional time may be necessary for manufacturers that do not 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 EPA's 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 new standards, manufacturers' efforts will 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, will 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 engine 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 certified to the current OB/PWC emission standards have HC+NOx 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 a single combustion event 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 minimizes scavenging losses. Manufacturers currently offer four-stroke marine engines with maximum engine power ranging from 1.5 to more than 250 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+NOx emissions. For PWC engines, the HC+NOx 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 Final 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 will be necessary.

(4) Regulatory Alternatives

We considered a level of 10 g/kW-hr HC+NOx for OB/PWC engines above 40 kW with an equivalent percent reduction below the new standards for engines at or 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 had 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 NOx emissions with any kind of aftertreatment is especially challenging.

Therefore, unlike the new standards for sterndrive and inboard engines, we are not adopting OB/PWC standards that require the use of catalysts. Catalyst technology would be necessary for significant additional control of HC+NOx and CO emissions for these engines. 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 final 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 new exhaust emission standards represent the greatest degree of emission control achievable in the contemplated time frame. While manufacturers can meet the standards with their full product line in 2010, requiring full compliance with a nationwide program earlier, such as in the same year that California introduces new emission standards, will pose an unreasonable requirement. Allowing two years 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 will be required to meet emission standards substantially more stringent than we are adopting has not been adequately demonstrated for outboard or personal watercraft engines. As such, we believe the new standards for HC+NOx 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 VII, we do not believe the final standards will 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 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 final rule is the result of a Congressional mandate that springs from the new California ARB standards. In 2003, 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+NOx emissions. California ARB did not change the applicable CO emission standard.[96]

We are adding 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 to update 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

[96] 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.

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. For nonhandheld engines, manufacturers must comply with all the provisions in part 1054 once the Phase 3 standards begin to apply in 2011 or 2012. For handheld engines, manufacturers must comply with the provisions in part 1054 starting in 2010. Note, however, that part 1054 specifies that certain provisions do not apply for handheld engines until sometime after 2010.

Engines and equipment subject to part 1054 are also subject to the general compliance provisions in 40 CFR part 1068. These include prohibited acts and penalties, exemptions and importation provisions, selective enforcement audits, defect reporting and recall, and hearing procedures. See Section VIII of the preamble to the proposed rule for further discussion of these general compliance provisions.

B. Engines Covered by This Rule

This action includes more stringent 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 changing the level of exhaust emission standards for these engines. As described in Section VI, we are also adopting new 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 engine standards for that size engine.

(1) Engines Covered by Other Programs

The Small SI engine 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 certain offroad utility vehicles. However, if an amphibious vehicle or other recreational vehicle with an engine at or below 19 kW is not subject to standards under part 1051, its engine will need to meet the Small SI engine standards. We also do not consider vehicles such as go karts or golf carts to be subject to part 1051 because they are not intended for high-speed operation over rough terrain; these engines are also subject to Small SI engine standards. The Small SI engine 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 engine 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 finalizing more stringent exhaust emission standards that will 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 engine 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 (or in later rulemakings) will also apply at the same time. Since these engines are not required to meet the Small SI engine standards we have not included them in the analyses associated with this final rule.

(2) Maximum Engine Power and Engine Displacement

Under the current regulations, “rated power” and “power rating” are determined by the manufacturer with little or no direction for selecting appropriate values. We are establishing an objective approach to establishing the alternative term “maximum engine power" under the regulations (see §1054.140). This value has regulatory significance for Small SI engines only to establish whether or not engines are instead subject to Large SI engine standards. Determining maximum engine power is therefore relevant only for those engines that are approaching the line separating these two engine categories. We are requiring that manufacturers determine and report maximum engine power if their emission-data engine has a maximum modal power at or above 15 kW (at or above 25 kW if engine displacement is at or below 1000 cc).

Similarly, the regulations depend on engine displacement to differentiate engines for the applicability of different standards. The regulations currently provide no objective direction or restriction regarding the determination of engine displacement. We are defining 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-sectional area of the cylinders, the stroke length, and the number of cylinders.

For both maximum engine power and displacement, the declared values must be within the range of the values from production engines considering normal production variability. This does not imply that production engines need to be routinely tested or measured to verify the declared values, but it serves to define a range of appropriate values and provides a mechanism by which we can ensure that the declared values conform to the production engines in question. If production engines are found to have different values for maximum engine power or displacement, 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 has adopted emission standards for stationary compression-ignition engines sold or used in the United States (71 FR 39154, July 11, 2006). EPA also recently adopted emission standards for stationary spark-ignition engines in a separate action (73 FR 3568, January 18, 2008). 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 stationary rule, stationary spark-ignition engines below 19 kW are almost all sold into residential applications so we believe it is not appropriate to include requirements for owners or operators that will normally be part of a program for implementing standards for stationary engines. As a result, we indicated in the stationary rule that it is most appropriate to set exhaust and evaporative emission standards for stationary spark-ignition engines and equipment below 19 kW as if they were used in nonroad applications. This will 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 a different regulatory approach for engines used solely in 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 believe there are no particular 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 requiring that handheld and nonhandheld equipment with engines meeting all the following criteria will be considered as being 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.

We are also including a provision allowing us to approve an exemption for cases in which an engine manufacturer can provide clear and convincing evidence that an engine will be used solely for competition even though not all the above criteria apply for a given situation. This may occur, for example, if a racing association specifies a particular engine model in the competition rules, where that engine has design features that prevent it from being certified, or from being used for purposes other than competition.

Engine manufacturers will make their request for each new model year and we will 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.

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 extending 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. We discovered while conducting the SBAR Panel described in Section VI.G that some companies are producing noncompliant engines under this exemption. As a result, we are keeping this exemption but are adding several provisions to allow us to better monitor how it is used (see §1054.660). We are also keeping the requirement that equipment manufacturers use certified engines if they are available. We are updating 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 explicitly allowing 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 requiring 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 defining "emergency rescue situations" as firefighting or other situations in which a person is retrieved from imminent danger. Finally, we are clarifying that EPA may discontinue the exemption on a case-by-case basis if we find that such 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 are applying the provisions of this section for new equipment built on or after January 1, 2010.

The current regulations also specify an exemption allowing individuals to import up to three nonconforming handheld or nonhandheld engines one time. We are keeping this exemption with three adjustments (see §1054.630). First, we are allowing 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 their possession. Second, we are allowing such an importation once every five years but are requiring 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 new 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 no longer requiring submission of the taxpayer identification number since this is not essential for ensuring compliance. We are applying these changes starting January 1, 2010.

C. Final Requirements

A key element of the new requirements for Small SI engines is the more stringent exhaust emission standards for nonhandheld engines. We are also finalizing several changes to the certification program that will apply to both handheld and nonhandheld engines. For example, we are clarifying 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 adding 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 rule.

The timing for implementation of the new exhaust emission standards is described below. Unless we specify otherwise, all the additional regulatory changes will apply when engines are subject to the emission standards and the other provisions under 40 CFR part 1054. This will be model year 2012 for Class I engines and model year 2011 for Class II engines. For handheld engines, we are generally requiring that manufacturers comply with the provisions of part 1054, including the certification provisions, starting in the 2010 model year. These new 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 from the Phase 2 standards.

(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 nonhandheld Small SI engines. As described in the Final 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 establish emission standards that are consistent with those adopted by California ARB. We are finalizing HC+NOx 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 maintaining the existing CO standard of 610 g/kW-hr.

We are eliminating 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 revising the regulations such that engines at or below 80 cc are subject to the Phase 3 standards for handheld engines and equipment in part 1054 starting in the 2010 model year. We are allowing engines at or below 80 cc to be used without restriction in nonhandheld equipment. The 80 cc threshold aligns with the California ARB program. For nonhandheld engines above 80 cc, we are treating 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+NOx level on these smallest Class I engines. However, for those engines unable to achieve the level of the new standards (either with or without a catalyst), manufacturers may elect to rely on emission credits 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 will be able to generate sufficient credits to meet standards across the full product line. (See §1054.101 and §1054.801.)

We are making 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 increasing each of the specified weight limits by two kilograms, 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).

Finally, we are revising the list of applications identified in the handheld definition as being subject to the handheld standards. We are specifically adding hand-supported jackhammers or rammer/compactor to the handheld definition as we have approved these types of applications in the past as meeting the attributes laid out in the definition. We are removing the "one-person" term from the auger description in the handheld definition because some augers can be operated by two people, but still have other attributes that would lead to the equipment being considered handheld. We are also removing the specific mention of pumps and generators from the handheld definition if they are below the specified weight limit. With the change noted earlier that allows manufacturers to use engines below 80cc in either handheld or nonhandheld applications, we believe these applications no longer need to be cited for special treatment in the handheld definition.

The regulations in part 90 allow manufacturers to rely on altitude kits to comply with emission requirements at high altitude. We are continuing this approach but are clarifying 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 will ensure that all areas east of the Rocky Mountains and most of the populated areas in Pacific Coast states will 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 in the owner's manual the altitude ranges for proper engine performance and emission control that are expected with and without the altitude kit. The owner's 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 adopting 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 requiring handheld engines to comply with the current standards without altitude kits at barometric pressures above 96.0 kPa, which will 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 (i.e., marine generator engines) are covered by the same regulations as land-based engines of the same size. However, the marine generator 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. Manufacturers of marine generator engines have recently developed advanced technology in an effort to improve fuel consumption and CO emission controls 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 responsive to market demand. We are establishing a CO standard of 5.0 g/kW-hr CO for marine generator engines to reflect the recent trend in marine generator engine designs (see §1054.105). We believe this standard is necessary to prevent backsliding in

CO emissions that could occur if new manufacturers were to attempt to enter the market with less expensive, high-CO designs. See Section II for a discussion of air quality concerns related to CO emissions.

At this time, we are continuing the current regulatory approach for wintertime engines (e.g., engines used exclusively to power equipment such as snowthrowers and ice augers). Under this final rule, the HC+NOx exhaust emission standards will be optional for wintertime engines. However, if a manufacturer chooses to certify its wintertime engines to such standards, those engines will be subject to all the requirements as if the optional standards were mandatory. We are adopting a definition of wintertime engines to clarify which engines qualify for these special provisions.

All engines subject to standards must continue to control crankcase emissions. In the case of snowthrower engines, crankcase emissions may be vented to the ambient air as long as manufacturers take crankcase emissions into account in demonstrating compliance with exhaust emission standards.

(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 long-term 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 Phase 2 final rule expressed a remaining concern that manufacturers might not select the most appropriate useful life value. This concern related to both ensuring effective in-use emission control and 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 would be 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.

After assessing several ideas, we chose to adopt 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 adopting three provisions 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 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 will encourage manufacturers to use the new provisions related to preliminary approval in §1054.210 if there is any uncertainty related to the useful life selection. We would rather work together early to establish this in the certification process rather than reviewing a completed application for certification to evaluate whether the completed durability demonstration is sufficient.

Second, we are modifying 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 allowing manufacturers to select longer useful life values in 100-hour increments, up to 3,000 hours for Class I engines and up to 5,000 hours for Class II engines. Durability testing for certification will 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 including the specified maximum values corresponding with the applicable useful life for comparable diesel engines or Large SI engines. We are not allowing for longer useful life values for handheld engines.

Third, we are requiring 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 owner's manual. We believe it is important for equipment manufacturers and consumers to be able to find an unambiguous designation showing the engine manufacturer's expectations about the useful life of the engine. Comments on the proposed rule also indicated an interest in using descriptive terms to identify the useful life on the label. We believe any terminology will communicate less effectively than the numerical value of the useful life, but we will allow manufacturers to use specified descriptive terms in addition to the number of hours.

We are also including a provision in the final rule stating that the useful life is defined as a five-year period if the engine has not yet exceeded the specified number of operating hours during that time. This is consistent with our other engine programs. This does not affect the certification process. If we test an in-use engine within the five-year useful life period and there is no clear indication that it has not yet exceeded the specified number of operating hours, it would need to meet applicable emission standards. Conversely, if an engine has not yet exceeded the number of operating hours but the engine is six years old, it is no longer required to meet emission standards.

(3) Averaging, Banking, and Trading

EPA has included averaging, banking, and trading (ABT) programs in most of the emission control programs for highway and nonroad engines. EPA's existing Phase 2 regulations for Small SI engines include an exhaust ABT program (see 40 CFR 90.201 through 90.211). We are adopting an ABT program for the Phase 3 HC+NOx exhaust emission standards that is similar to the existing program (see part 1054, subpart H). The new exhaust ABT program is intended to enhance the ability of engine manufacturers to meet more stringent emission standards. The exhaust ABT program is also structured to avoid delay of the transition to the new exhaust emission controls. As described in Section VI.D, we are establishing a separate evaporative ABT program for fuel tanks used in Small SI equipment. Credits may not 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 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 averaging or trading for future model years. 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 adopting any change in the general equation under which emission credits are calculated, EPA is allowing 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. Furthermore, even though we are not establishing new exhaust emission standards for handheld engines, the handheld engine regulations are migrating to part 1054. Therefore, handheld engines will be included in the new 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 separating handheld engines and nonhandheld engines into two distinct averaging sets starting with the 2011 model year. Under the new 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 can 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 will 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 more careful accounting. Because manufacturers have been aware of this new requirement since the proposal, keeping records to distinguish handheld credits and nonhandheld credits will be relatively straightforward for 2006 and later model years.

We are making 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 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 adopting new exhaust requirements for handheld engines, we are addressing this existing practice by specifying that an engine manufacturer may use emission credits from their nonhandheld engines for their handheld engines under certain conditions. Specifically, a manufacturer may use credits from their nonhandheld engines for their handheld engines 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. Furthermore, we are limiting the number of handheld engines for which a manufacturer can use emission credits from their nonhandheld engines to 30,000 per year. We believe these provisions allow 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. (See §1054.740.)

A second exception to the provision restricting credit exchanges between handheld engines and nonhandheld engines arises because of our handling of engines below 80cc. Under the new 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 will 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. (See §1054.701.)

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 emission 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 establishing FEL caps to prevent the sale of very high-emitting engines. Under the new FEL caps, manufacturers will need to establish FELs at or below the levels of the Phase 2 HC+NOx 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 will be 40.0 g/kW-hr since these engines were Class I-B engines under the Phase 2 regulations and subject to this higher level.) For handheld engines, where we are not adopting new exhaust emission standards, we are maintaining the FEL caps as currently specified in the part 90 ABT regulations.

For nonhandheld engines we are adding two special provisions related to the transition from Phase 2 to Phase 3 standards in §1054.740. First, we are providing 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 establishing provisions to allow the use of Phase 2 credits for a limited time under specific conditions. The following discussions describe each of these provisions in more detail for Class I engines and Class II engines separately.

For Class I engines, engine manufacturers can 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 will 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 will earn Transitional Phase 3 credits. The Transitional Phase 3 credits will 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 will earn Enduring Phase 3 credits in addition to the Transitional Phase 3 credits described above. The Enduring Phase 3 credits will 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.

Engine manufacturers may certify their Class I engines using Phase 2 credits generated by Class I or Class II 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 transitional Phase 3 credits to demonstrate compliance with the Phase 3 standards, subject to the cross-class credit restriction noted below which applies prior to model year 2013. If these Transitional Phase 3 credits are sufficient to demonstrate compliance, the manufacturer may not use Phase 2 credits. If these Transitional 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. If manufacturers still need credits to demonstrate compliance, they may then use their remaining Phase 3 credits (i.e., their Enduring Phase 3 credits or any other Phase 3 credits generated in 2012 or 2013, subject to the cross-class credit restriction noted below which applies prior to model year 2013).

The maximum number of Phase 2 HC+NOx exhaust emission credits that manufacturers could use for their Class I engines will 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 will 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 will not include their wintertime engines in the calculations unless the engines are certified to meet the otherwise applicable HC+NOx emission standard. The maximum number of Phase 2 HC+NOx exhaust emission credits a manufacturer could use for their Class I engines (calculated in kilograms) will 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. If a manufacturer uses less than its calculated total credits based on the 1.6 g/kW-hr limit in 2012, the remainder will be available for use in 2013. This provision allows for limited 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 will allow manufacturers to substantially delay the introduction of Phase 3 emission controls.

For Class II engines, 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 will 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 will earn Transitional Phase 3 credits. The Transitional Phase 3 credits will 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 will earn Enduring Phase 3 credits in addition to the Transitional Phase 3 credits described above. The Enduring Phase 3 credits will 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.

Engine manufacturers may certify their Class II engines using Phase 2 credits generated by Class I or Class II 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 transitional Phase 3 credits to demonstrate compliance with the Phase 3 standards, subject to the cross-class credit restriction noted below which applies prior to model year 2013. If these Transitional credits are sufficient to demonstrate compliance, the manufacturer may not use Phase 2 credits. If these Transitional 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. If the manufacturer still needs credits to demonstrate compliance, they may then use their remaining Phase 3 credits (i.e., their Enduring Phase 3 credits or any other Phase 3 credits generated in 2011, 2012, or 2013, subject to the cross-class credit restriction noted below which applies prior to model year 2013).

The maximum number of Phase 2 HC+NOx exhaust emission credits a manufacturer could use for their Class II engines will 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 will 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 will not include their wintertime engines in the calculations unless the engines are certified to meet the otherwise applicable HC+NOx emission standard. The maximum number of Phase 2 HC+NOx exhaust emission credits a manufacturer could use for their Class II engines (calculated in kilograms) will 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 will allow manufacturers to substantially delay the introduction of Phase 3 emission controls.

To avoid the use of credits to delay the introduction of Phase 3 technologies, we are also not allowing manufacturers to 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 not allowing manufacturers to 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 exchanged across engine classes or traded among manufacturers.

We are making one additional adjustment related to the exhaust ABT program for engines subject to the new emission standards. We are adopting a requirement 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 requiring that 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.

As described below in Section V.E.3, we are allowing equipment manufacturers to install a limited number of Class II engines, certified by engine manufacturers with a catalyst as Phase 3 engines, into equipment without the catalyst. (This is only 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 engines based on the use of a catalyst, EPA is concerned that engine manufacturers could be earning exhaust ABT credits for engines that are sold but never have the catalyst installed. Therefore, EPA believes it is appropriate to adjust such credits to account for the fact that equipment manufacturers may in many cases legally install a non-catalyzed muffler on an engine that is part of a family whose certification depends on the use of a catalyst. Therefore, EPA is adopting a 0.9 adjustment factor for calculating credits for engine families that are available under the delegated assembly provisions and are also participating in the TPEM program. In addition, EPA is including an option that will allow engine manufacturers to track the final configuration of the engines to determine the actual number of engines that were downgraded under the TPEM program. A manufacturer would need to track sales for all the equipment manufacturers purchasing the given engine family. The engine manufacturer could use the resulting number of engines that were not downgraded in its calculation of ABT credits for that specific engine family. Engine manufacturers may specifically direct equipment manufacturers not to participate in the TPEM program for certain engine models, which would allow for a more straightforward accounting of the number of engines that are downgraded under the TPEM program.

For all emission credits generated by engines under the Phase 3 exhaust ABT program, we are allowing an indefinite 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 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. Emission credit balances will be part of the analysis for determining the appropriate level and timing of new standards, consistent with the statutory requirement to establish standards that represent the greatest degree of emission reduction achievable, considering cost, safety, lead time, and other factors. If we were to allow the use of Phase 3 credits to meet future standards, we may 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, depending on the level of Phase 3 credit banks. Alternatively, we could adopt future standards without allowing the use of Phase 3 credits. The final requirements in this rulemaking describe 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.

Finally, manufacturers may include as part of their federal credit calculation the sales of engines in California as long as they don't separately account for those emission credits under the California regulations. We originally proposed to exclude engine sold in California which are subject to the California ABR standards. However, we consider California's current HC+NOx standards to be equivalent to those we are adopting in this rulemaking, so we would expect a widespread practice of producing and marketing 50-state products. Therefore, as long as a manufacturer is not generating credits under California's averaging program for small engines, we would allow manufacturers to count those engines when calculating credits under EPA's program. This is consistent with how EPA allows credits to be calculated in other nonroad sectors, such as recreational vehicles.

D. Testing Provisions

The test procedures provide an objective measurement for establishing whether engines comply with emission standards. The following sections describe a variety of changes to the current test procedures. Except as identified in the following sections, we are preserving the testing-related regulatory provisions that currently apply under 40 CFR part 90 for Phase 2 engines. Note that there is no presumption that any previous approvals, guidance, or judgments related to alternatives, deviations, or interpretations of the testing requirements under the Phase 1 or Phase 2 program will continue to apply; any decisions on such issues will be handled going forward on a case-by-case basis.

(1) Migrating Procedures to 40 CFR Part 1065

Manufacturers have been using the procedures in 40 CFR part 90 to test their engines for certification of Phase 1 and Phase 2 engines. As part of a much broader effort, we have adopted comprehensive testing specifications in 40 CFR part 1065 that are intended to serve as the basis for testing all types of engines. The procedures in part 1065 include updated information reflecting the current state of available technology. We are applying the procedures in part 1065 to nonhandheld engines starting with new certification testing in 2013 and later model years as specified in 40 CFR part 1054, subpart F. The procedures in part 1065 identify new types of analyzers and update a wide range of testing specifications, but leave intact the fundamental approach for measuring exhaust emissions. There is no need to shift to the part 1065 procedures for nonhandheld engines before 2013. This allows manufacturers time to make any necessary adjustments or upgrades in their lab equipment and procedures. While any new certification testing for nonhandheld engines will be subject to the part 1065 procedures starting in model year 2013, manufacturers will be allowed to continue certifying nonhandheld engines using carryover data generated under the part 90 procedures.

We are not setting new exhaust emission standards for handheld engines so there is no natural point in time for shifting to the part 1065 procedures. We nevertheless believe handheld engines should also use the part 1065 procedures for measuring exhaust emissions. We are requiring manufacturers to start using the part 1065 procedures in the 2013 model year as described above for nonhandheld engines. Manufacturers will be allowed to continue certifying handheld engines using carryover data generated under the part 90 procedures, but any new certification testing will be subject to the part 1065 procedures starting with the 2013 model year.

We have taken several steps to address the concerns raised by engine manufacturers related to the specified test procedures in part 1065. First, we have confirmed that the calculations in part 1065 yield the same emission results for a given set of raw data from testing. The two calculation methods resulted in differences that were less than 1 percent for both handheld and nonhandheld engines. We have identified a variety of clarifications and adjustments that we need to make to the equations in §1065.655 to ensure accurate calculations for engines operating with rich air-fuel mixtures. Second, we have modified the cycle-validation criteria in §1054.505 to more carefully reflect achievable torque control for small engines. The new criteria are based on a combination of specifications for continuous measurements and mean values, including specification of absolute thresholds where a percentage approach would not work for very small torque values. Third, we are adjusting the fueling instructions in part 1065 to allow for fuel-oil mixtures with two-stroke engines.

We also acknowledge that handheld engines that depend on special fixtures for proper testing should be tested under the provisions of §1065.10(c) for special test procedures. This would require that manufacturers describe their test fixtures and make them available upon request. Further effort may be required to incorporate more specific requirements or specifications related to these test fixtures. We expect to cooperate with government agencies from California and from other countries in an effort to harmonize Small SI test procedures, for part 1065 procedures generally and for these special test procedures in particular.

(2) Duty Cycle

The regulations under part 90 currently specify duty cycles for testing engines for exhaust emissions. The current requirements specify how to control speeds and loads and describe the situations in which the installed engine governor controls engine speed. We are extending these provisions to testing under the new standards with a few adjustments described below. For engines equipped with an engine speed governor, the current regulations at 40 CFR 90.409(a)(3) state:

For Class I, Class I-B, and Class II engines subject to Phase 2 standards that are equipped with an engine speed governor, the governor must be used to control engine speed during all test cycle modes except for Mode 1 or Mode 6, and no external throttle control may be used that interferes with the function of the engine's governor; a controller may be used to adjust the governor setting for the desired engine speed in Modes 2-5 or Modes 7-10; and during Mode 1 or Mode 6 fixed throttle operation may be used to determine the 100 percent torque value.

In addition, the current regulations at 40 CFR 90.410(b) state:

> For Phase 2 Class I, I-B, and II engines equipped with an engine speed governor, during Mode 1 or Mode 6 hold both the specified speed and load within ± five percent of point, during Modes 2-3, or Modes 7-8 hold the specified load with ± five percent of point, during Modes 4-5 or Modes 9-10, hold the specified load within the larger range provided by ±0.27 Nm (±0.2 lb-ft), or ±ten (10) percent of point, and during the idle mode hold the specified speed within ± ten percent of the manufacturer's specified idle engine speed (see Table 1 in Appendix A of this subpart for a description of test Modes).

Manufacturers have raised questions about the interpretation of these provisions. Our intent is that the current requirements specify that testing be conducted as follows:

- Full-load testing occurs at wide-open throttle to maintain engines at rated speed, which is defined as the speed at which the engine's maximum power occurs (as declared by the manufacturer).
- Idle testing occurs at the manufacturer's specified idle speed with a maximum load of five percent of maximum torque. The regulation allows adjustment to control speeds that are different than will be maintained by the installed governor.
- The installed governor must be used to control engine speed for testing at all modes with torque values between idle and full-load modes. The regulation allows adjustments for nominal speed settings that are different than will be maintained by the installed governor without modification.

We are adopting the Phase 3 standards with adjustments to the regulatory requirements currently described in 40 CFR part 90 (see §1054.505). Since each of these adjustments may have some effect on measured emission levels, we believe it is appropriate to implement these changes concurrent with the Phase 3 standards. To the extent the adjustments apply to handheld engines, we believe it is appropriate to apply the changes for new testing with 2013 and later model year engines for the reasons described above for adopting the test procedures in part 1065.

First, for engines with installed governors we are requiring the engine speed during the idle mode to be controlled by the governor. We believe there is no testing limitation that will call for engine operation at idle to depart from the engine's governed speed. Allowing manufacturers to arbitrarily declare an idle speed only allows manufacturers to select an idle speed that gives them an advantage in achieving lower measured emission results but not in a way that corresponds to in-use emission control. We are also aware that some production engines have a user-selectable control for selecting high-speed or low-speed idle (commonly identified as "rabbit/turtle" settings). We believe this parameter adjustment may have a significant effect on emissions that should be captured in the certification test procedure. As a result, we are requiring that manufacturers conduct testing with user-selectable controls set to keep the engine operating at low-speed idle if any production engines in the engine family have such an option. For engines with no installed governor, part 1065 specifies that the engine should operate at the idle speed declared by the manufacturer.

Second, we are allowing an option in which manufacturers will test their nonhandheld engines using a ramped-modal version of the specified duty cycle. We expect this testing to be equivalent to the modal testing described above but it will have advantages for streamlining test efforts by allowing for a single result for the full cycle instead of relying on a calculation from separate modal results. Under the new requirement we will allow manufacturers the option to select this type of testing. Manufacturers must use the same test method for production-line testing that they use used for certifying the engine family. Manufacturers may include results from both types of testing in their application for certification, in which case they could use either method for production-line testing. EPA's confirmatory testing will involve the same type of testing performed by the manufacturers for certification.

Third, the part 90 regulations currently specify two duty cycles for nonhandheld engines: (1) testing at rated speed; and (2) testing at 85 percent of rated speed. The regulations direct manufacturers simply to select the most appropriate cycle and declare the rated speed for their engines. We are making this more objective by stating that rated speed is 3600 rpm and intermediate speed is 3060 rpm, unless the manufacturer demonstrates that a different speed better represents the in-use operation for their engines. This is consistent with the most common in-use settings and most manufacturers' current practice.

In addition, we are adding regulatory provisions to clarify how nonhandheld engines are operated to follow the prescribed duty cycle. As described in part 90, we are requiring that the engines operate ungoverned at wide-open throttle for the full-power mode. This test mode is used to denormalize the rest of the duty cycle. This operation is intentionally not representative of in-use operation, but disabling the governor allows for more uniform testing that is not dependent on the various governing strategies that manufacturers might use. To avoid a situation where engines are designed to control emissions over the test cycle, with less effective controls under similar modes of operation that engines experience in use, we are adding a requirement for manufacturers to provide an explanation in the application for certification if air-fuel ratios are significantly different for governed and ungoverned operation at wide-open throttle, especially for fuel-injected engines. Manufacturers would need to explain why this emission control strategy is not a defeat device. If we test engines governed and ungoverned at wide open throttle, we would expect to see little or no difference in emission rates. If we would observe higher emission rates with governed engine operation, manufacturers would again need to justify why this discrepancy is not a defeat device. Engines with conventional carburetors offer a limited ability to manipulate air-fuel ratios at different operating points, so in these cases manufacturers would simply state that air-fuel ratios do not vary significantly at governed and ungoverned points of full-load operation.

Testing at other modes occurs with the governor controlling engine speed. Before each test mode, manufacturers may adjust the governor to target the same nominal speed used for the full-power mode, with a tolerance limiting the variation in engine speed at each mode. Alternatively, testing may be done by letting the installed governor control engine speed, in which case only the torque value will need to be controlled within an established range. Any EPA testing will be done only with installed governors controlling engine speed in the standard configuration, regardless of the method used by manufacturers for their own testing. Any such engine with test results that exceed applicable emission standards would be considered to fail, without regard to emission results that might be different with testing in which the governor is adjusted to target a given nominal speed.

A different duty cycle applies to handheld engines, which are generally not equipped with governors to control engine speed. The current regulations allow manufacturers to name their operating speed for testing at each of the test modes. However, we are concerned that this approach allows manufacturers too much discretion for selecting a rated speed for high-load testing. We are revising this approach to specify that manufacturers must select a speed that best represents in-use operation for the engine family if the in-use applications involve operation centered on a given nominal speed (±350 rpm). Engine manufacturers generally also make their own equipment, so this can often be established for engines in an engine family. For engine families without such a predominant operating speed, we require that engine manufacturers test their engines within 350 rpm of the speed at which the engine produces maximum power. Some engine families may have a dominant engine speed, but also include a variety of applications that operate at different in-use speeds. We specify for these cases that engine manufacturers must test at both of the test speeds identified above, in which case EPA testing might also involve emission measurements using either (or both) test speeds. We are further requiring manufacturers to describe in their application for certification how they select the value for rated speed.

(3) Test Fuel

We are requiring Phase 3 exhaust emission testing with a standard test fuel consistent with the existing requirements under 40 CFR part 90 (see 40 CFR part 1065, subpart H). The existing regulatory specifications allow for no oxygenates in the test fuel. Because California ARB specifies a test fuel which contains the oxygenate MTBE (but also allows for the use of EPA's test fuel), we understand that some engine manufacturers will have emission data from engines that meet EPA's Phase 3 standards based on testing to meet California's Tier 3 Small Off-Road Engine requirements for 2007 and later model years. In some cases the test data will be based on California's oxygenated test fuel, although manufacturers have the option to certify using a test fuel such as that specified by EPA in 40 CFR part 90. To allow for a quicker transition to the new EPA standards, we will allow for use of this pre-existing exhaust emission test data (based on California's oxygenated test fuel) for EPA certification purposes through the 2012 model year. Manufacturers could also use the California ARB test fuel for their PLT testing, if they based their certification on that fuel. The use of the California ARB data would be subject to the provisions for carryover data for demonstrating compliance with the standards in effect. (The carryover provisions for Phase 3 are specified in §1054.235.) While we will allow use of California ARB data for certification through the 2012 model year, we will use our test fuel without oxygenates for all confirmatory testing we perform for exhaust emissions. We are limiting the timeframe for such a provision because we ultimately want the exhaust emission test results to be performed using the EPA specified test fuel.

In the proposal we noted our concerns about testing with oxygenated fuels since this could affect an engine's air-fuel ratio, which in turn could affect the engine's combustion and emission characteristics. Because of the relatively recent dramatic increase in the use of ethanol (another oxygenate) in the broad motor gasoline pool, we have reexamined our position (as discussed below) and are adopting provisions that will allow manufacturers to use a 10 percent ethanol blend for certification testing for exhaust emissions from nonhandheld engines, as an alternative to the standard test fuel. This option to use a 10 percent ethanol blend will begin with the implementation date of the Phase 3 exhaust standards. The use of the ethanol blend would apply to production-line testing as well if the manufacturer based their certification on the 10 percent ethanol blend. We are also committing to using a 10 percent ethanol blend for all confirmatory testing we perform for exhaust emissions under the provisions described below.

Ethanol has been blended into in-use gasoline for many years, and until as recently as 2005, was used in less than one-third of the national gasoline pool. However, ethanol use has been increasing in recent years and, under provisions of the Energy Independence and Security Act of 2007, ethanol will be required in significantly greater quantities. We project that potentially 80 percent of the national gasoline pool will contain ethanol by 2010, making ethanol blends up to 10 percent the de facto in-use fuel. As ethanol blends become the primary in-use fuel, we believe it makes sense for manufacturers to optimize their engine designs with regard to emissions, performance, and durability on such a fuel. We also believe manufacturers need to know that any confirmatory testing we do on their engines will be performed on the same fuel the manufacturer used for certification since the fuel can impact the ability to demonstrate compliance with the emission standards.

Limited data of nonhandheld engine emissions tested on 10 percent ethanol blends suggests the HC emissions will decrease and NOx emissions will increase compared to emissions from the same engine operated on current certification fuel without oxygenates. Depending on the relative HC and NOx levels of the engines, these offsetting effects can result in small increases or decreases in total HC+NOx emission levels. Because the impact on HC+NOx emissions can vary slightly from engine family to engine family, we do not want manufacturers varying their certification fuel from one family to another to gain advantage with regard to emissions certification.

Therefore, if a manufacturer wishes to use a 10 percent ethanol blend for certification, they should use the 10 percent ethanol blend for all their Phase 3 nonhandheld engines for a given engine class by the third year of the Phase 3 standard (i.e., by the 2014 model year for Class I engines and by the 2013 model year for Class II engines). During the transition period, we will perform any confirmatory testing on the 10 percent ethanol blend if that is the fuel used by the manufacturer for certification. At the end of the transition period, we will perform any confirmatory testing on the 10 percent ethanol blend if that is the fuel used by the manufacturer for certification, but only if the manufacturer has certified all their nonhandheld engines in that engine class on the 10 percent ethanol blend. If the manufacturer has not certified all its engines in a given engine class on the 10 percent ethanol blend, we may decide to test the engine on our current test fuel without oxygenates. (See §1054.145 and §1054.501.)

For handheld engines, where we do not have sufficient data on the impact of ethanol blends on emissions, we are adopting a slightly different approach. Manufacturers will have the option to use a 10 percent ethanol blend for certification beginning with the 2010 model year. The option to use a 10 percent ethanol blend would apply to PLT testing as well if the manufacturer based their certification on the 10 percent ethanol blend. While we will allow use of a 10 percent ethanol blend for certification, we expect to use our test fuel without oxygenates for all confirmatory testing for exhaust emissions. Therefore, an engine manufacturer will want to consider the impacts of ethanol on emissions in evaluating the compliance margin for the standard, or in setting the FEL for the engine family if it is participating in the ABT program. We could decide at our own discretion to do exhaust emissions testing using a 10 percent ethanol blend if the manufacturer certified on that fuel. It should be noted that both EPA and the California ARB are currently running test programs to assess the emission impacts of a 10 percent ethanol blend on a range of Small SI engines, including handheld engines. Based on the results of that test program, we may want to consider changes to the provisions allowing the use of a 10 percent ethanol blend for certification and PLT testing for handheld engines. If the results of the handheld engine testing show that emissions are comparable on both fuels, we would expect to revise the provisions for handheld engines and take a similar approach to that described above for nonhandheld engines. (See §1054.501.)

The test fuel specifications for the 10 percent ethanol blend are based on using the current gasoline test fuel and adding fuel-grade ethanol until the blended fuel contains 10 percent ethanol by volume. In addition, we recognize that in some cases using fuel-grade ethanol may be less practical than using other grades and so we will allow the use of other grades, provided they do not affect a manufacturer's ability to demonstrate compliance with the emission standards. To understand this allowance, it is helpful to remember that one of the main purposes of certification is for the manufacturer to use test data to show that the engines produced will conform to the regulations. Implicit in this is the concept that if EPA were to test an engine in the family according to the specified procedures, its measured emissions would be below the standards. Allowing a manufacturer to deviate from the specified test procedures could potentially hinder our ability to determine whether the engines would meet the standards when tested according to the specified procedures. Nevertheless, it is possible to overcome this concern based on the expected impact of the deviation on measured emissions and on the manufacturer's compliance margin (that is, the degree to which the measured certification emissions are below the standard). For example, we would conclude that a deviation that was expected to change measured emission rates by less than 0.1 g/kW-hr would clearly not affect a manufacturer's "ability to demonstrate compliance with the emission standards" if the certified emission level was 1.0 g/kW-hr below the standard (or below the Family Emission Limit). On the other hand, a deviation that was expected to change measured emission rates by 0.1 to 0.5 g/kW-hr would affect a manufacturer's "ability to demonstrate compliance with the emission standards" if the compliance margin was only 0.5 g/kW-hr. Another way to show that a deviation will not affect a manufacturer's "ability to demonstrate compliance with the emission standards" is to show through engineering analysis that a deviation will actually cause measured emissions to increase relative to the specified procedures.

It should be noted that this is the first time EPA regulations specify the use of an ethanol test fuel for exhaust emissions testing for certification purposes. It is likely that EPA will consider similar test fuel changes in the future for other vehicle and engine categories including those addressed in this final rule. As part of those deliberations, it is possible that EPA could decide that the test fuel specifications for the ethanol blend should be different than those adopted in this rule. Should that occur, EPA would need to consider whether changes to the test fuel specifications adopted in this rule for the 10 percent ethanol blend are appropriate for Small SI engine testing.

E. Certification and Compliance Provisions for Small SI Engines and Equipment

(1) Deterioration Factors

As part of the certification process, manufacturers generate deterioration factors to demonstrate that their engines meet emission standards over the full useful life. We are adopting some changes from the procedures currently included in part 90 (see §1054.240 and §1054.245). Much of the basis for these changes comes from the experience gained in testing many different engines in preparation for this final rule. First, we are discontinuing bench aging of emission components. Testing has shown that operating and testing the complete engine is necessary to get accurate deterioration factors. Second, we are allowing assigned deterioration factors for a limited number of small-volume nonhandheld engine <u>families</u>. Manufacturers could use assigned deterioration factors for multiple small-volume nonhandheld engine families as long as the total production for all the nonhandheld engine families for which the manufacturer is using assigned deterioration factors is estimated at the time of certification to be no more than 10,000 units per year. Third, we are allowing assigned deterioration factors for all engines produced by small-volume nonhandheld engine <u>manufacturers</u>.

For the HC+NOx standard, we are specifying that manufacturers use a single deterioration factor for the sum of HC and NOx emissions. However, if manufacturers get 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 will require separate deterioration factors for HC and NOx emissions. The advantage of a combined deterioration factor is that it can account for an improvement in emission levels for a given pollutant 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. This is the same approach we adopted for recreational vehicles.

EPA is not establishing the values for the assigned deterioration factors for small-volume nonhandheld engine manufacturers in this final rule. In an effort to develop deterioration factors that are appropriate for Small SI engines, we plan to evaluate certification data from Phase 3 engines certified early with EPA and from engines certified under California ARB's Tier 3 standards (which began in 2007 and 2008). Because we are not promulgating new exhaust standards for handheld engines, the assigned deterioration factor provisions adopted for Phase 2 handheld engines are being retained.

Although we are not establishing new exhaust standards for handheld engines, handheld engine manufacturers noted that California ARB has approved certain durability cycles for accumulating hours on engines for the purpose of demonstrating the durability of emission controls. The durability cycles approved by California ARB vary from a 30-second cycle for chainsaws to a 20-minute cycle for blowers, with 85 percent of the time operated at wide open throttle and 15 percent of the time operated at idle. Engine manufacturers can run the durability cycles repeatedly until they accumulate the hours of operation equivalent to the useful life for the engine family. Our current regulations state that "service accumulation is to be performed in a manner using good judgment to ensure that emissions are representative of production engines." While we are not changing the regulatory language regarding service accumulation, the California ARB-approved durability cycles are appropriate and acceptable to EPA for accumulating hours on handheld engines for demonstrating the durability of emission controls.

(2) Delegated Final Assembly

The current practice of attaching exhaust systems to engines varies. Class I engines are typically designed and produced by the engine manufacturer with complete emission control systems. Equipment manufacturers generally buy these engines and install them in their equipment, adjusting equipment designs if necessary to accommodate the mufflers and the rest of the exhaust system from the engine manufacturer.

Engine manufacturers generally produce Class II engines without exhaust systems, relying instead on installation instructions to ensure that equipment manufacturers get mufflers that fall within a specified range of backpressures that is appropriate for a given engine model. Equipment manufacturers are free to work with muffler manufacturers to design mufflers that fit into the space available for a given equipment model, paying attention to the need to stay within the design specifications from the engine manufacturers. A similar situation applies for air filters, where equipment manufacturers in some cases work with component manufacturers to use air filters that are tailored to the individual equipment model while staying within the design specifications defined by the engine manufacturer.

The existing regulations require that certified engines be in their certified configuration when they are introduced into commerce. We therefore need special provisions to address the possibility that engines will need to be produced and shipped without exhaust systems or air intake systems that are part of the certified configuration. We have adopted such provisions for heavy-duty highway engines and for other nonroad engines in 40 CFR 85.1713 and 40 CFR 1068.260, respectively. These provisions generally require that engine manufacturers establish a contractual arrangement with equipment manufacturers and take additional steps to ensure that engines are in their certified configuration before reaching the ultimate purchaser.

We are applying delegated-assembly provisions for nonhandheld engines that are similar to those adopted for heavy-duty highway engines. In fact, we have modified the proposed requirements and the requirements that apply to heavy-duty highway engines (and to other nonroad engines) such that a single set of requirements in part 1068 will simultaneously apply to all these engine categories. This combined approach incorporates substantial elements of the program we proposed for Small SI engines.

This approach generally requires that engine manufacturers apply for certification in the normal way, identifying all the engine parts that make up the engine configurations covered by the certification. Equipment manufacturers will be able to work with muffler manufacturers to get mufflers with installed catalysts as specified in the engine manufacturer's application for certification. If equipment manufacturers need a muffler or catalyst that is not covered by the engine manufacturer's certification, the engine manufacturer will need to amend the application for certification. This may require new testing if the data from the original emission-data engine are not appropriate for showing that the new configuration will meet emission standards, as described in §1054.225. (Alternatively, the equipment manufacturer may take on the responsibility for certifying the new configuration, as described in §1054.612.) Engine manufacturers will also identify in the application for certification their plans to sell engines without emission-related components. We are adopting several provisions to ensure that engines will eventually be in their certified configuration. For example, engine manufacturers will establish contracts with affected equipment manufacturers, include installation instructions to make clear how engine assembly should be completed, keep records of the number of engines produced under these provisions, and obtain annual affidavits from affected equipment manufacturers to confirm that they are installing the proper emission-related components on the engines and that they have ordered the number of components that corresponds to the number of engines involved.

While the delegated-assembly provisions are designed for direct shipment of engines from engine manufacturers to equipment manufacturers, we are aware that distributors play an important role in providing engines to large numbers of equipment manufacturers. We are requiring that these provisions apply to distributors in one of two ways. First, engine manufacturers may have an especially close working relationship with primary distributors. In such a case, the engine manufacturer can establish a contractual arrangement allowing the distributor to act as the engine manufacturer's agent for all matters related to compliance with the delegated-assembly provisions. This allows the distributor to make arrangements with equipment manufacturers to address design needs and perform oversight functions. We will hold the engine manufacturer directly responsible if the distributor fails to meet the regulatory obligations that will otherwise apply to the engine manufacturer. However, starting in 2015, we are allowing this approach only with our specific approval for individual manufacturers and distributors. While this arrangement is necessary to facilitate making engines available under the Transition Program for Equipment Manufacturers, we are concerned that it will be difficult for EPA and for manufacturers to properly ensure that all engines are built up to a certified configuration when assembly responsibilities are so far removed from the engine manufacturer. This is underscored by a recent finding that an equipment manufacturer was intentionally not following an engine manufacturer's instructions when installing Small SI engines such that the final installation involved an engine that was not in a certified configuration. In the years before 2015, we expect that EPA and manufacturers will learn a lot about delegated assembly, including the extent to which there are cases in which engines are improperly assembled, whether those problems represent intentional violations or mistakes as part of a good-faith effort to meet applicable requirements. We will be prepared to judge individual requests based on the experience gained under the initial years of the Phase 3 standards. However, given the challenges associated with engine manufacturers allowing distributors to act as their agents with respect to delegated assembly, we expect manufacturers to ask us to allow this only in unusual circumstances when the standard approach would be very impractical. Also, depending on the broader experience with this provision before 2015, we may consider changing the regulation to allow this to continue without our specific approval, for Small SI engines or for all types of engines. If we find that there are substantial problems in implementing this provision, we may also consider removing the allowance to continue using distributors this way for delegated assembly past 2014.

Second, other distributors may receive shipment of engines without exhaust systems, but they will add any aftertreatment components before sending the engines on to equipment manufacturers. Engine manufacturers will treat these distributors as equipment manufacturers for the purposes of delegated assembly. Equipment manufacturers buying engines from such a distributor will not have the option of separately obtaining mufflers from muffler manufacturers. However, we would expect distributors to cooperate with small equipment manufacturers to work out any necessary arrangements to specify and design their components and equipment. This second situation involves a more straightforward compliance scenario so this provision does not expire. In both of these scenarios, the engine manufacturer continues to be responsible for the in-use compliance of all their engines.

Engine manufacturers will need to affix a label to the engine to clarify that it needs certain emission-related components before it is in its certified configuration. This labeling information is important for alerting assembly personnel to select mufflers with installed catalysts; the label will also give in-house inspectors or others with responsibility for quality control a tool for confirming that all engines have been properly assembled and installed. Given the large numbers of engine and equipment models and the interchangeability of mufflers with and without catalysts, we believe proper labeling will reduce the possibility that engines will be misbuilt. This labeling can be done with either of two approaches. First, a temporary label may be applied such that it could not be removed without a deliberate action on the part of the equipment manufacturer. We believe it is not difficult to create a label that will stay on the engine until it is deliberately removed. Second, manufacturers may add the words "delegated assembly" to the engine's permanent emission control information label (or "DEL ASSY" where limited space requires an abbreviation).

In addition, engine manufacturers will need to perform or arrange for audits to verify that equipment manufacturers are properly assembling engines. Engine manufacturers may rely on third-party agents to perform auditing functions. Since the purpose of the audit is to verify that equipment manufacturers are properly assembling products, they may not perform audits on behalf of engine manufacturers. We are requiring that audits involve at a minimum reviewing the equipment manufacturer’s production records and procedures, inspecting the equipment manufacturer's production operations, and inspecting the final assembled products. Inspection of final assembled products may occur at any point in the product distribution system. For example, products may be inspected at the equipment manufacturer's assembly or storage facilities, at regional distribution centers, or at retail locations. The audit must also include confirmation that the number of aftertreatment devices shipped was sufficient for the number of engines involved. Engine manufacturers would keep records of the audit results and make these records available to us upon request. These auditing specifications represent a minimum level of oversight. In certain circumstances we may expect engine manufacturers to take additional steps to ensure that engines are assembled and installed in their certified configuration. For example, equipment manufacturers with very low order volumes, an unclear history of compliance, or other characteristics that will cause some concern may prompt us to require a more extensive audit to ensure effective oversight in confirming that engines are always built properly. Engine manufacturers must describe in the application for certification their plan for taking steps to ensure that all engines will be in their certified configuration when installed by the equipment manufacturer. EPA approval of a manufacturer’s plan for delegated assembly will be handled as part of the overall certification process.

We are requiring that engine manufacturers annually audit twelve equipment manufacturers, or fewer if they are able to audit all participating equipment manufacturers on average once every four years. These audits will be divided over different equipment manufacturers based on the number of engines sold to each equipment manufacturer. We specify that these auditing rates are reduced to a maximum of four equipment manufacturers per year starting in 2015. In 2019 and later, manufacturers would continue to perform a maximum of four audits annually, but we specify that audits may be divided evenly to cover all equipment manufacturers over a ten-year period.

We are not adopting the proposed requirement for engine manufacturers to establish an alphanumeric designation to identify each unique catalyst design and instruct equipment manufacturers to stamp this code on the external surface of the exhaust system. However, manufacturers may choose to do this voluntarily as a means of more readily assessing whether engines have been properly assembled.

We are requiring that all the same provisions apply for separate shipment related to air filters if they are part of an engine’s certified configuration, except for the auditing. However, this does not apply if manufacturers identify intake systems, including air filters, by simply instructing equipment manufacturers to maintain the pressure drop within a certain range. This is typical of the way many exhaust systems are handled today. We will require auditing related to air filters that are specifically identified in the application for certification only if engine manufacturers are already performing audits related to catalysts. We believe there is much less incentive or potential for problems with equipment manufacturers producing engines with noncompliant air filters so we believe a separate auditing requirement for air filters is unnecessary.

The final regulation specifies that the exemption expires when the equipment manufacturer takes possession of the engine and the engine reaches the point of final equipment assembly. The point of final equipment assembly for purposes of delegated assembly for aftertreatment components is the point at which the equipment manufacturer attaches a muffler to the engine. Engines observed in production or inventory assembled with improper mufflers will be considered to have been built contrary to the engine manufacturer's installation instructions. Catalysts are invariably designed as part of the muffler, so no reason exists for installing a different muffler once a given muffler has been installed using normal production procedures. If equipment manufacturers sell equipment without following these instructions, they will be considered in violation of the prohibited acts (i.e., selling uncertified engines). If there is a problem with any given equipment manufacturer, we will disallow continued use of the delegated-assembly provisions for that equipment manufacturer until the engine manufacturer has taken sufficient steps to remedy the problem.

We are aware that the new approach of allowing equipment manufacturers to make their own arrangements to order mufflers results in a situation in which the equipment manufacturer must spend time and money to fulfill their responsibilities under the regulations. This introduces a financial incentive to install mufflers with inferior catalysts, or to omit the catalyst altogether. To address this concern, we are requiring that engine manufacturers get written confirmation from each equipment manufacturer before an initial shipment of engines for a given engine model. This confirmation will document the equipment manufacturer's understanding that they are using the appropriate aftertreatment components. The written confirmation will be due within 30 days after shipping the engines and will be required before shipping any additional engines from that engine family to that equipment manufacturer.

The shipping confirmation included in the rule for heavy-duty highway engines is a very substantial provision to address the fact that vehicle manufacturers will gain a competitive advantage by producing noncompliant products, and that engines in commerce will be labeled as if they were fully compliant even though they are not yet in their certified configuration. This is especially problematic when a muffler with no catalyst can easily be installed and can perform without indicating a problem. To address this concern we are requiring that equipment manufacturers include in their annual affidavits an accounting for the number of aftertreatment components they have ordered relative to the number of engines shipped without the catalysts that the mufflers will otherwise require.

Production-line testing normally involves building production engines using normal assembly procedures. For engines shipped without catalysts under the delegated-assembly provisions, it is not normally possible to do this at the engine manufacturer's facility, where such testing will normally occur. To address this, we are specifying that engine manufacturers must arrange to get a randomly selected catalyst that will be used with the engine. The catalyst must come from any point in the normal distribution from the aftertreatment component manufacturer to the equipment manufacturer. The catalyst may come from the engine manufacturer's own inventory as long as it is randomly procured. Engine manufacturers are required to keep records showing how they randomly selected catalysts.

See Section 2.8 of the Summary and Analysis of Comments for further discussion of issues related to delegated assembly.

(3) Transition Program for Equipment Manufacturers

Given the level of the new Phase 3 exhaust emission standards for Class II engines, we believe there may be situations where the use of a catalyzed muffler could require equipment manufacturers to modify their equipment. We are therefore establishing a set of provisions to provide equipment manufacturers with reasonable lead time for transitioning to the new standards. These provisions are similar to the program we adopted for nonroad diesel engines (69 FR 38958, June 29, 2004).

Equipment manufacturers will not be obligated to use any of these provisions, but all equipment manufacturers that produce Class II equipment are eligible to do so. We are also requiring that all companies under the control of a common entity will be considered together for the purposes of applying these allowances. Manufacturers will be eligible for the allowances described below only if they have primary responsibility for designing and manufacturing equipment, and if their manufacturing procedures include installing engines in the equipment.

(a) General provisions

Under the final rule, beginning in the 2011 model year and lasting through the 2014 model year, each equipment manufacturer may install Class II engines not certified to the Phase 3 emission standards in a limited number of equipment applications produced for the U.S. market (see §1054.625). We refer to these here as "flex engines." These flex engines will need to meet the Phase 2 standards. The maximum number of "allowances" each manufacturer can use are based on 30 percent of an average year's production of Class II equipment. The number of allowances is calculated by determining the average annual U.S.-directed production of equipment using Class II engines produced from January 1, 2007 through December 31, 2009. Thirty percent of this average annual production level is the total number of allowances an equipment manufacturer may use under this transition program over four years. Manufacturers can use these allowances for their Class II equipment over four model years from 2011 through 2014, with the usage spread over these model years as determined by the equipment manufacturer. Equipment produced under these provisions can use engines that meet the Phase 2 emission standards instead of the Phase 3 standards. If an equipment manufacturer newly enters the Class II equipment market during 2007, 2008 or 2009, the manufacturer will calculate its average annual production level based only on the years during which it actually produced Class II equipment. Equipment manufacturers newly entering the Class II equipment market after 2009 will not receive any allowances under the transition program and will need to incorporate Phase 3 compliant engines into the Class II equipment beginning in 2011.

Equipment using engines built before the effective date of the Phase 3 standards will not count toward an equipment manufacturer's allowances. Equipment using engines that are exempted from the Phase 3 standards for any reason will also not count toward an equipment manufacturer's allowances. For example, we are allowing small-volume engine manufacturers to continue producing Phase 2 engines for two model years after the Phase 3 standards apply. All engines subject to the Phase 3 standards, including those engines that are certified to FELs at higher levels than the standard, but for which an engine manufacturer uses exhaust ABT credits to demonstrate compliance, will count as Phase 3 complying engines and will not be included in an equipment manufacturer's count of allowances.

The choice of the allowances based on 30 percent of one year's production is based on our best estimate of the degree of reasonable lead time needed by the largest equipment manufacturers to modify their equipment designs as needed to accommodate engines and exhaust systems that have changed as a result of more stringent emission standards. We believe this level of allowances responds to the need for lead time to accommodate the workload related to redesigning equipment models to incorporate catalyzed mufflers while ensuring a significant level of emission reductions in the early years of the new program.

As described in Section VI, technologies for controlling running losses may involve a significant degree of integration between engine and equipment designs. In particular, routing a vapor line from the fuel tank to the engine's intake system depends on engine modifications that will allow for this connection. As a result, any equipment using flex engines will not need to meet running loss standards.

(b) Coordination between engine and equipment manufacturers

We are establishing two separate paths for complying with administrative requirements related to the new transition program, depending on how the engine manufacturer chooses to make flex engines available. Engine manufacturers choosing to use the delegated-assembly provisions described above will be enabling equipment manufacturers to make the decision whether to complete the engine assembly in the Phase 3 configuration or to use a non-catalyzed muffler such that the engine will meet Phase 2 standards and will therefore need to be counted as a flex engine. If engine manufacturers do not use the delegated-assembly provisions, equipment manufacturers will need to depend on engine manufacturers to produce and ship flex engines that are already in a configuration meeting Phase 2 standards and labeled accordingly. Each of these scenarios involves a different set of compliance provisions, which we describe below. Note that in no case may an equipment manufacturer remove a catalyzed muffler from an engine and replace it with a noncatalyzed muffler; this would be a violation of the prohibition against tampering.

(i) Compliance based on engine manufacturers

Engine manufacturers will in many cases produce complete engines. This will be the case if the engine does not require a catalyst or if the engine manufacturer chooses to design their own exhaust systems and ship complete engine assemblies to equipment manufacturers.

Under this scenario, we are requiring that equipment manufacturers request a certain number of flex engines from the engine manufacturer. The regulatory provisions specifically allow engine manufacturers to continue to build and sell Phase 2 engines needed to meet the market demand created by the transition program for equipment manufacturers, provided they receive the written assurance from the equipment manufacturer that such engines are being procured for this purpose. We are requiring that engine manufacturers keep copies of the written assurance from equipment manufacturers for at least five years after the final year in which allowances are available.

Engine manufacturers are currently required to label their certified engines with a variety of information. We are requiring that engine manufacturers producing complete flex engines under this program identify on the engine label that they are flex engines. In addition, equipment manufacturers are required to apply an Equipment Flexibility Label to the engine or piece of equipment that identifies the equipment as using an engine produced under the Phase 3 transition program for equipment manufacturers. These labeling requirements allow EPA to easily identify flex engines and equipment, verify which equipment manufacturers are using these flex engines, and more easily monitor compliance with the transition provisions. Labeling of the equipment could also help U.S. Customs to quickly identify equipment being imported lawfully using the Transition Program for Equipment Manufacturers.

While manufacturers will need to meet Phase 2 standards with their flex engines, they will not need to certify them for the current model year. We are instead applying the provisions of 40 CFR 1068.265, which require manufacturers to keep records showing that they meet emission standards without requiring submission of an application for certification.

(ii) Compliance based on equipment manufacturers

We are adopting a different set of compliance provisions for engine manufacturers that make arrangements to ship engines separately from exhaust-system components. Under this scenario, as discussed above, the engine manufacturers must establish a relationship with the equipment manufacturers allowing the equipment manufacturer to install catalysts to complete engine assembly in compliance with Phase 3 standards.

In this case, engine manufacturers will design and produce their Phase 3 engines and label them accordingly. The normal path for these engines covered by the delegated-assembly provisions will involve shipment of the engine without an exhaust system to the equipment manufacturer. The equipment manufacturer will then follow the engine manufacturer's instructions to add the exhaust system including the catalyst to bring the engine into a certified Phase 3 configuration. Under the transition program, equipment manufacturers will choose for each of these engines to either follow the engine manufacturer's instructions to install a catalyst to make it compliant with Phase 3 standards or install a non-catalyzed muffler to make it compliant with Phase 2 standards. Any such engines downgraded to Phase 2 standards will count toward the equipment manufacturer's total number of allowances under the transition program.

To make this work, engine manufacturers will need to take certain steps to ensure overall compliance. First, engine manufacturers will need to include emission data in the application for certification showing that the engine meets Phase 2 standards without any modification other than installing a non-catalyzed exhaust system. This may include a specified range of backpressures that equipment manufacturers must meet in procuring a non-catalyst muffler. If the Phase 3 engine without a catalyst will otherwise still be covered by the emission data from engines produced in earlier model years under the Phase 2 standards, manufacturers could rely on carryover emission data to make this showing. Second, the installation instructions we specify under the delegated-assembly provisions will need to describe the steps equipment manufacturers must take to make either Phase 3 engines or Phase 2 flex engines. Third, for engine families that generate positive emission credits under the exhaust ABT program, engine manufacturers must generally decrease the number of ABT credits generated by the engine family by 10 percent. We believe the 10 percent decrease should provide an emission adjustment commensurate with the potential use of the equipment manufacturer flexibility provisions. (As described earlier in Section V.C.3, EPA is including an option that will allow engine manufacturers to track the final configuration of the engines to determine the actual number of engines that were downgraded for the TPEM program.)

Equipment manufacturers using allowances under these provisions must keep records that allow EPA or engine manufacturers to confirm that equipment manufacturers followed appropriate procedures and produced an appropriate number of engines without catalysts. In addition, we are requiring that equipment manufacturers place a label on the engine as close as possible to the engine manufacturer's emission control information label to identify it as a flex engine. The location of this label is important since it effectively serves as an extension of the engine manufacturer's label, clarifying that the engine meets Phase 2 standards, not the Phase 3 standards referenced on the original label. This avoids the problematic situation of changing or replacing labels, or requiring engine manufacturers to send different labels.

Engine manufacturers might choose to produce Class II engines that are compliant with the Phase 3 standards before the 2011 model year and set up arrangements for separate shipment of catalyzed mufflers as described in Section V.E.2. We expect any engine manufacturers producing these early Phase 3 engines to continue production of comparable engine models that meet Phase 2 standards rather than forcing all equipment manufacturers to accommodate the new engine design early. We believe it will not be appropriate for equipment manufacturers to buy Phase 3 engines in 2010 or earlier model years and downgrade them to meet Phase 2 emission standards as described above. We are therefore allowing the downgrading of Phase 3 engines only for 2011 and later model years.

Because equipment manufacturers in many cases depend on engine manufacturers to supply certified engines in time to produce complying equipment, we are also adopting a hardship provision for all equipment manufacturers (see §1068.255). An equipment manufacturer will be required to use all its allowances under the transition program described above before being eligible to use this hardship.

(iii) Reporting and recordkeeping requirements

Equipment manufacturers choosing to participate in the transition program will be required to keep records of the U.S-directed production volumes of Class II equipment in 2007 through 2009 broken down by equipment model and calendar year. Equipment manufacturers will also need to keep records of the number of flex engines they use under this program.

We are also establishing certain notification requirements for equipment manufacturers. Any manufacturer wishing to participate in the new transition provisions need to notify EPA before producing equipment with flex engines. They must submit information on production of Class II equipment over the three-year period from 2007 through 2009, calculate the number of allowances available, and provide basic business information about the company. For example, we will want to know the names of related companies operating under the same parent company that are required to count engines together under this program. This early notification will not be a significant burden to the equipment manufacturer and will greatly enhance our ability to ensure compliance. Indeed, equipment manufacturers will need to have the information required in the notification to know how to use the allowances.

We are establishing an ongoing reporting requirement for equipment manufacturers participating in the Phase 3 transition program. Under the program, participating equipment manufacturers will be required to submit an annual report to EPA that shows its annual number of equipment produced with flex engines under the transition provisions in the previous year. Each report must include a cumulative count of the number of equipment produced with flex engines for all years. To ease the reporting burden on equipment manufacturers, EPA intends to work with the manufacturers to develop an electronic means for submitting information to EPA.

(c) Additional Allowances for Small and Medium-Sized Companies

We believe small-volume equipment manufacturers will need a greater degree of lead time than manufacturers that sell large volumes of equipment. The small companies are less likely to have access to prototype engines from engine manufacturers and generally have smaller engineering departments for making the necessary design changes. Allowances representing thirty percent of annual U.S.-directed production provide larger companies with substantial lead time to plan their product development for compliance but smaller companies may have a product mix that requires extensive work to redesign products in a short amount of time. We are therefore specifying that small-volume equipment manufacturers may use this same transition program with allowances totaling 200 percent of the average annual U.S.-directed production of equipment using Class II engines from 2007 through 2009. For purposes of this program, a small-volume equipment manufacturer is defined as a manufacturer that produces fewer than 5,000 pieces of nonhandheld equipment per year subject to EPA regulations in each of the three years from 2007 through 2009 or meets the SBA definition of small business equipment manufacturer (i.e., generally fewer than 500 employees for manufacturers of most types of equipment). These allowances are spread over the same four-year period between 2011 and 2014. For example, a small-volume equipment manufacturer could potentially use Phase 2 engines on all their Class II equipment for two years or they might sell half their Class II equipment with Phase 2 engines for four years assuming production stayed constant over the four years.

Medium-sized equipment manufacturers, i.e., companies that produce too much equipment to be considered a small-volume equipment manufacturer but produce fewer than 50,000 pieces of Class II equipment annually, may also face difficulties similar to that of small-volume equipment manufacturers. These companies may be like small-volume manufacturers if they have numerous product lines with varied approaches to installing engines and mufflers. Other companies may be more like bigger companies if they produce most of their equipment in a small number of high-volume models or have consistent designs related to engine and muffler installations. We are therefore creating special provisions that will enable us to increase the number of transition allowances that are available to these medium-sized companies that have annual U.S.-directed production of Class II equipment of between 5,000 and 50,000 in each of the three years from 2007 through 2009. To obtain allowances greater than 30 percent of average annual production, a medium-sized manufacturer will need to notify us before they produce equipment with flex engines by January 31, 2010 if they believe the standard allowances based on 30 percent of average annual production of Class II equipment do not provide adequate lead time starting in the 2011 model year. Additional allowances may be requested only if the equipment manufacturer can show they are on track to produce a number of equipment models representing at least half of their total U.S.-directed production volume of Class II equipment in the 2011 model year compliant with all exhaust and evaporative emission standards. As part of their request, the equipment manufacturer will need to describe why more allowances are needed to accommodate anticipated changes in engine designs resulting from engine manufacturers' compliance with changing exhaust emission standards. The equipment manufacturer will also need to request a specific number of additional allowances needed with supporting information to show why that many allowances are needed. We may approve additional allowances up to 70 percent of the average annual U.S.-directed production of Class II equipment from 2007 through 2009. If a medium-sized company were granted the full amount of additional allowances, they will have allowances equivalent to 100 percent of the average annual production volume of Class II equipment.

As noted above, the determination of whether a company is a small- or medium-sized manufacturer will be based primarily on production data over the 2007 through 2009 period submitted to EPA before 2011. After a company's status as a small- or medium-sized company has been established based on the data, EPA is requiring that manufactures keep that status even if a company's production volume grows during the next few years, such that the company will no longer qualify as a small- or medium-sized company. EPA believes equipment manufacturers need to know at the beginning of the transition program (i.e., 2011) how many allowances they will receive under the program. Changing a company's size determination during the program, which could affect the number of allowances available, will make it difficult for companies to plan and could lead to situations where a company is in violation of the provisions based on the use of allowances that were previously allowed. Likewise, if a company is purchased by another company or merges with another company after the determination of small- or medium-size status is established in 2010, the combined company could, at its option, keep the preexisting status for the individual portions of the combined company. If the combined company chooses to keep the individual designations, the combined company must submit the annual reports on the use of allowances broken down for each of the previously separate companies.

(d) Requirements for importers and imported equipment

Under this final rule, only companies that manufacture equipment can qualify for the relief provided under the Phase 3 transition provisions. Equipment manufacturers producing equipment outside the United States that comply with the provisions discussed below can enjoy the same transition provisions as domestic manufacturers. Such equipment manufacturers that do not comply with the compliance-related provisions discussed below will not receive allowances. Importers that do not manufacture equipment will not receive any transition relief directly, but could import equipment with a flex engine if it is covered by an allowance or transition provision associated with a foreign equipment manufacturer. This will allow transition provisions to be used by equipment manufacturers producing equipment outside the United States in the same way as equipment manufacturers producing equipment domestically, at the option of the overseas manufacturer, while avoiding the potential for importers to inappropriately use allowances. These regulations apply equally to foreign equipment manufacturers and to domestic equipment manufacturers that build equipment outside the country that is eventually sold in the United States.

All equipment manufacturers wishing to use the transition provisions for equipment produced outside the United States must comply with all the requirements discussed above. Along with the equipment manufacturer's notification described earlier, an overseas equipment manufacturer will have to comply with various compliance related provisions (see §1054.626). These provisions are similar to those adopted for nonroad diesel engines. As part of the notification, the such an equipment manufacturer will have to:

- Agree to provide EPA with full, complete and immediate access to conduct inspections and audits;
- Name an agent in the United States for service;

- Agree that any enforcement action related to these provisions will be governed by the Clean Air Act;
- Submit to the substantive and procedural laws of the United States;
- Agree to additional jurisdictional provisions;
- Agree that the equipment manufacturer will not seek to detain or to impose civil or criminal remedies against EPA inspectors or auditors for actions performed within the scope of EPA employment related to the provisions of this program;
- Agree that the equipment manufacturer becomes subject to the full operation of the administrative and judicial enforcement powers and provisions of the United States without limitation based on sovereign immunity; and
- Submit all reports or other documents in the English language, or include an English language translation.

In addition to these provisions, we are requiring equipment manufacturers producing equipment for importation under the transition program to comply with a bond requirement for equipment imported into the United States. We believe a bond program is an important tool for ensuring that importing equipment manufacturers are subject to the same level of enforcement as equipment manufacturers producing equipment domestically. Specifically, we believe a bonding requirement for these equipment manufacturers is an important enforcement tool for ensuring that EPA has the ability to collect any judgments assessed against an overseas equipment manufacturer for violations of these transition provisions.

Under a bond program, the participating equipment manufacturer will have to maintain a bond in the proper amount that is payable to satisfy judgments that result from U.S. administrative or judicial enforcement actions for conduct in violation of the Clean Air Act. The equipment manufacturer will generally obtain a bond in the proper amount from a third party surety agent that has been listed with the Department of the Treasury. As discussed in Sections V.E.6, EPA is establishing other bond requirements as well. An equipment manufacturer that is required to post a bond under any of these provisions will be required to obtain only one bond of the amount specified for those sections. Equipment manufacturers may avoid the bond requirements based on the level of assets in the United States, as described in Section V.E.6.

In addition to the equipment manufacturer requirements discussed above, EPA is also requiring importers of equipment with flex engines from a complying equipment manufacturer to comply with certain provisions. EPA believes these importer provisions are essential to EPA's ability to monitor compliance with the transition provisions. Therefore, the regulations require each importer to notify EPA prior to their initial importation of equipment with flex engines. Importers will be required to submit their notification before importing equipment with flex engines from a complying equipment manufacturer. The importer's notification will need to include the following information:

- The name and address of importer (and any parent company);
- The name and address of the manufacturers of the equipment and engines the importer expects to import; and
- Number of units of equipment with flex engines the importer expects to import for each year broken down by equipment manufacturer.

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

(e) Provisions for rotation-molded fuel tanks

Equipment manufacturers may face challenges in transitioning to rotation-molded fuel tanks that meet the new permeation standards. These modified fuel tanks may require equipment manufacturers to adjust the designs of their equipment to ensure that the new fuel tanks can be incorporated without problems. We are therefore allowing equipment manufacturers to use noncompliant rotational-molded fuel tanks for two additional years on limited numbers of 2011 and 2012 model year equipment using Class II engines. Equipment manufacturers may use noncompliant rotational-molded fuel tanks if the production volume of the fuel tank design used in Class II equipment models is collectively no more than 5,000 units in the 2011 model year. In the 2012 model year, equipment manufacturers may use noncompliant rotational-molded fuel tanks if the production volume of the fuel tank design used in Class II equipment models is collectively no more than 5,000 units in the 2012 model year, but the total number of exempted rotational-molded fuel tanks across the manufacturer's Class II equipment is limited to 10,000 units. If production volumes are greater than 5,000 for a given fuel tank design (or greater than 10,000 corporate-wide in 2012), all those tanks must comply with emission standards. Tank designs would be considered identical if they are produced under a single part number to conform to a single design or blueprint. In addition, tank designs would be considered identical if they differ only with respect to production variability, post-production changes (such as different fittings or grommets), supplier, color, or other extraneous design variables. We originally proposed to allow noncompliant rotation-molded fuel tanks for any equipment that was counted under the allowances described in this section which used flex engines meeting Phase 2 exhaust emission standards. However, the approach being finalized today could be applied to any equipment using Class II engines (subject to the constraints noted above), whether or not the equipment uses a flex engine.

(4) Equipment Manufacturer Recertification

It has generally been engine manufacturers that certify with EPA for exhaust emissions because the standards are engine-based. However, because the Phase 3 nonhandheld standards are expected to result in the use of catalysts, a number of equipment manufacturers, especially those that make low-volume models, believe it may be necessary to produce their own unique engine/muffler designs, but using the same catalyst substrate already used in a muffler that is part of an engine manufacturers certified configuration. In this situation, the engine will not be covered by the engine manufacturer's certificate, as the engine/muffler design is not within the specifications for the certified engine. The equipment manufacturer is therefore producing a new distinct engine which is not covered by a certificate and therefore needs to be certified with EPA.

To allow the possibility of an equipment manufacturer certifying such an engine/muffler design with EPA, we are establishing a simplified engine certification process for nonhandheld equipment manufacturers (see §1054.612). Under the simplified certification process, the nonhandheld equipment manufacturer will need to demonstrate that it is using the same catalyst substrate as the approved engine manufacturer's engine family, provide information on the differences between their engine/exhaust system and the engine/exhaust system certified by the engine manufacturer, and explain why the emissions deterioration data generated by the engine manufacturer will be representative for the equipment manufacturer's configuration. The equipment manufacturer will need to perform low-hour emission testing on an engine equipped with their modified exhaust system and demonstrate that it meets the emission standards after applying the engine manufacturer's deterioration factors for the certified engine family. We will not require production-line testing for these engines. The equipment manufacturer will be responsible to meet all the other requirements of an engine manufacturer under the regulations, including labeling, warranty, defect reporting, payment of certification fees, and other things. The useful life period selected for the original certification will also apply for the equipment manufacturer's streamlined certification. This provision is primarily intended for easing the transition to new standards. Starting in the 2015 model year, we are therefore limiting these recertification provisions to small-volume emission families (sales below 5,000 units).

(5) Special Provisions Related to Altitude

For nonhandheld engines we are requiring compliance with our standards at all altitudes, consistent with other engine categories.[97] However, since spark-ignition engines without electronic control of air/fuel ratio cannot compensate for changing air density, their emissions generally change with changing altitude. In recognition of this technological limit, we are adopting special testing and compliance provisions related to altitude. As described in Section V.C.1, we are requiring that nonhandheld engines meet emission standards without an altitude kit, but will allow, in certain cases, testing at barometric pressures below 94.0 kPa (which is roughly equivalent to an elevation of 2,000 feet above sea level) using an altitude kit. (An altitude kit may be as simple as a single replacement part for the carburetor that allows a greater volumetric flow of air into the carburetor to make the engine operate as it would at low altitudes.) Such kits were allowed under part 90 and we are keeping the provisions that already apply in part 90 related to descriptions of these altitude kits in the application for certification. This includes a description of how engines comply with emission standards at varying atmospheric pressures, a description of the altitude kits, and the associated part numbers.

During certification, manufacturers will have two choices regarding testing and compliance at barometric pressures below 94.0 kPa: (1) test engines for demonstrating compliance with the standards without an altitude kit; or (2) test engines for demonstrating compliance with the standards using an altitude kit. Those manufacturers choosing Option 2 will be required to identify the altitude range for which it expects proper engine performance and emission control will occur with and without the altitude kit, state that engines will comply with applicable emission standards throughout the useful life with the altitude kit installed according to instructions, and include any supporting information. Manufacturers choosing Option 2 will also need to describe a plan for making information and parts available to consumers such that widespread use of altitude kits will reasonably be expected in high-altitude areas. For nonhandheld engines, this will involve all counties with elevations substantially above 4,000 feet (see Appendix III to part 1068). This includes all U.S. counties where 75 percent of the land

[97] Note that we are not changing exhaust standards for handheld engines and are therefore codifying altitude provisions in the new part 1054 that are consistent with those that apply under part 90.

mass and 75 percent of the population are above 4,000 feet (see 45 FR 5988, January 24, 1980 and 45 FR 14079, March 4, 1980).

Assuming we grant a certificate that includes a manufacturer's reliance on an altitude kit during testing, any compliance testing at higher altitudes (more precisely, lower barometric pressures) would be conducted with the altitude kit installed on the engine according to the manufacturer's instructions. Note that manufacturers would not be required to submit test data from high-altitude testing in their applications, provided they could demonstrate through engineering analysis the basis for knowing the altitude kits will allow the engines to meet the emission standards at high altitude. Any high-altitude testing of an engine family that does not use these high altitude provisions will be tested without an altitude kit installed.

We considered requiring manufacturers relying on altitude kits to ensure that all engines sold in high-altitude areas were sold with altitude kits installed, but determined that such a requirement would have been burdensome to the manufacturers, impractical, and very disruptive to the market, and may not work in practice. Certificate holders will be the engine manufacturers, which generally have little or no control over the location at which the sale to the ultimate purchaser is made. In most cases, the engines will be sold to equipment manufacturers and/or through distributors or large retailers. However, even in cases when a manufacturer might have control over the location at which the sale to the ultimate purchaser is made, it is not clear that the manufacturer could ensure that every piece of equipment sold in a high-altitude area has an engine with an altitude kit installed. In light of these potential problems, we believe the approach being finalized will be effective and is the most appropriate approach. It is not tampering for a consumer not to install the altitude kit. We expect it will be common practice for consumers to install altitude kits because they are inexpensive, easy to install, and improve performance at higher altitudes. Manufacturers have also emphasized that retailers and consumers are well aware of the need to modify engines for proper operation in high-altitude areas. Toward that end, we are requiring manufacturers to make the information and parts sufficiently easy for the consumer to obtain so that the manufacturer "would reasonably expect that altitude kits would be widely used in the high-altitude counties." This approach should result in effective control of emissions in high-altitude areas while still addressing the manufacturers' concerns regarding control over distribution practices and point of sale. In fact, it is worth noting that we expect this overall approach to be more effective in achieving emission reductions than the current regulations under Phase 2. Nevertheless, should we determine that operation of engines in high-altitude areas without altitude kits installed is widespread, we would reconsider the need for additional requirements.

(6) Special Provisions for Compliance Assurance

EPA's experiences in recent years have highlighted the need for more effective tools for preventing the introduction of noncompliant engines into U.S. commerce. These include noncompliant engines sold without engine labels or with counterfeit engine labels. We are adopting the special provisions in the following sections to help us address these problems.

(a) Importation Form

Importation of engines is regulated both by EPA and by U.S. Customs and Border Protection. Current Customs regulations specify that anyone importing a nonroad engine (or equipment containing a nonroad engine) must complete a declaration form before importation.

EPA has created Declaration Form 3520-21 for this purpose. Customs requires this in many cases, but there are times when they allow engines to be imported without the proper form. It will be an important advantage for EPA's own compliance efforts to be able to enforce this requirement. We are therefore modifying part 90 to mirror the existing Customs requirement (and the EPA requirement in §1068.301) for importers to complete and retain the declaration form before importing engines (see §90.601). This will facilitate a more straightforward processing of cases in which noncompliant products are brought to a U.S. port for importation because currently no requirement exists for measuring emissions or otherwise proving that engines are noncompliant at the port facility. Since this is already a federal requirement, we are making this effective immediately with the final rule.

(b) Assurance of warranty coverage

Manufacturers of Small SI engines subject to the standards are required to provide an emission-related warranty so owners are able to have repairs done at no expense for emission-related defects during an initial warranty period. Established companies are able to do this with a network of authorized repair facilities that can access replacement parts and properly correct any defects. In contrast, we are aware that some manufacturers are selling certified engines in the United States without any such network for processing warranty claims. As such, owners who find that their engines have an emission-related defect are unable to properly file a warranty claim or get repairs that should be covered by the warranty. In effect, this allows companies to certify their engines and agree to provide warranty coverage without ever paying for legitimate repairs that should be covered by the warranty. We are therefore requiring that all manufacturers demonstrate several things before we will approve certification for their engines (see §90.1103 and §1054.120). The following provisions apply to manufacturers who certify engines, and include importers who certify engines. First, we are requiring manufacturers to provide and monitor a toll-free telephone number and an e-mail address for owners to receive information about how to make a warranty claim and how to make arrangements for authorized repairs. Second, we are requiring manufacturers to provide a source of replacement parts within the United States. For imported parts, this will require at least one distributor within the United States.

Finally, we are requiring manufacturers to have a network of authorized repair facilities or to take one of multiple alternate approaches to ensure that owners will be able to get free repair work done under warranty. In the proposal we specified that warranty-related repairs may be limited to authorized repair facilities as long as owners did not have to travel more than 100 miles for repairs (or further in remote areas of the country). For companies without a nationwide repair network, we proposed alternative methods for meeting warranty obligations, including free shipping, free service calls, or reimbursement of costs through local nonauthorized service centers. Manufacturers suggested a different metric for demonstrating a readiness to meet warranty obligations, focusing on maintaining authorized service centers in every metropolitan area with a population of 100,000 or greater (according to the 2000 census). We agree that the suggested approach would provide an effective demonstration of a valid warranty network and are including that in the regulation; however, we believe it is still appropriate to include the proposed provisions related to the 100-mile specification in the final rule. For example, there may be some companies with a regional market that have an effective network of repair facilities in that region, but not in other parts of the country. In this circumstance, it is appropriate to allow the manufacturer multiple paths for showing that it will be able to respond effectively to all warranty claims nationwide. We are therefore including the 100-mile approach as an additional alternative in the regulations, as well as including a variety of adjustments to address the concerns raised in the comments.

We believe these requirements are both necessary and effective for ensuring proper warranty coverage for all owners. At the same time, we are adopting a flexible approach that allows companies to choose from a variety of alternatives for providing warranty service. We therefore believe these requirements are readily achievable for any company. We are therefore implementing these requirements starting with the 2010 model year. This should allow time for the administrative steps necessary to arrange for any of the allowable compliance options described above.

(c) Bond requirements related to enforcement and compliance assurance

Certification initially involves a variety of requirements to demonstrate that engines and equipment are designed to meet applicable emission standards. After certification is complete, however, several important obligations apply to the certifying manufacturer or importer. For example, we require ongoing testing of production engines, as well as reporting of recurring defects. Manufacturers may also need to pay penalties if there is a violation and may need to perform a recall if their products are found to be noncompliant. For companies operating within the United States, we are generally able to take steps to communicate clearly and insist on compliance with applicable regulations. For example, in certain circumstances we may meet with specific company representatives, halt production, or seize assets. For companies without staff or assets in the United States, these alternatives are not available. Accordingly, we have limited ability to enforce our requirements or recover any appropriate penalties, which increases the risk of environmental problems as well as problems for owners. This creates the potential for a company to gain a competitive advantage if they do not have substantial assets or operations in the United States by avoiding some of the costs of complying with EPA regulations.

To address this concern, we are adopting a requirement for manufacturers of certified engines and equipment (including importers) to post a bond to cover any potential compliance or enforcement actions under the Clean Air Act. Manufacturers and importers will be exempt from the bond requirement if they are able to sufficiently demonstrate an assurance that they will meet any compliance- or enforcement-related obligations. The bonding requirements apply for companies that do not have fixed assets in the United States meeting the smallest applicable thresholds from the following:

- A threshold of $3 million applies for manufacturers that have been certificate holders in each of the preceding ten years without failing a test conducted by EPA officials or having been found by EPA to be noncompliant under applicable regulations.
- A threshold of $6 million applies for secondary engine manufacturers or for equipment manufacturers that certifiy no engines with respect to exhaust emission standards. A secondary engine manufacturer is generally a certifying company that buys partially complete engines for final assembly from another engine manufacturer.
- A threshold of $10 million applies for companies that do not qualify for the smaller specified bond thresholds.

The value of the bond must be at least $500,000, though a higher bond value may apply based on multiplying the annual volume of shipments by a per-engine rate. The per-engine bond amount is $25 for handheld engines and Class I engines. Class II engines cover a much wider range of applications, so we further differentiate the bond for those engines. The proposed per-engine bond amounts for Class II engines is $50 for engines between 225 and 740 cc, $100 for engines between 740 and 1,000 cc, and $200 for engines above 1,000 cc. These values are generally scaled to be approximately 10 to 15 percent of the retail value. In the case of handheld engines, this is based on the retail value of equipment with installed engines, since these products are generally marketed that way. Class II engines are very often sold as loose engines to equipment manufacturers, so the corresponding per-engine bond values are based on the retail value of the engine alone. This approach is similar to the bond requirements that apply for nonroad diesel engines (see §1039.626).

The total bond amount will be based on the value of imported products over a one-year period. If a bond is used to satisfy a judgment, the company will then be required to increase the amount of the bond within 90 days of the date the bond is used to cover the amount that was used. Also, we will require the bond to remain in place for five years after the company no longer imports Small SI engines.

These bonding requirements apply for 2010 and later model year engines and are enforceable for all products introduced into U.S. commerce starting January 1, 2010.

(d) Bond requirements related to warranty

Warranty is an additional potential compliance obligations. Engine manufacturers must service warranty claims for emission-related defects that occur during the prescribed warranty period. We have experience with companies that have faced compliance-related problems where it was clear that they did not have the resources to make warranty repairs if that were necessary. Such companies benefit from certification without bearing the full range of associated obligations. We believe it is appropriate to add a requirement to post a bond to ensure that a company can meet their warranty obligations. The concern for being able to meet these obligations applies equally to domestic and foreign manufacturers. The biggest indicator of a manufacturer’s ability to make warranty repairs relates to the presence of repair facilities in the United States. We are therefore adopting a bond requirement starting with the 2010 model year for all manufacturers (including importers) that do not have a repair network in the United States that is available for processing warranty repairs (see §90.1007 and §1054.120). Such a repair network will need to involve at least 100 authorized repair facilities in the United States, or at least one such facility for each 5,000 engines sold in the United States, whichever is less. Companies not meeting these criteria will need to post a bond as described above for compliance assurance. We will allow companies that must post bond to arrange for warranty repairs to be done at independent facilities. Note that a single bond payment will be required for companies that must post bond for compliance-related obligations, as described above, in addition to the bond for warranty-related obligations.

(e) Restrictions related to naming model years

We are adopting the proposed provisions that restrict what model years can be assigned to imported products. Importers can only declare a model year up to one year before the calendar year of importation in cases where new emission standards start to apply. We are adopting this requirement for all engine categories subject to part 1068. See the detailed discussion of this issue in Section VIII.C.

(f) Import-specific information at certification

We are requiring additional information to improve our ability to oversee compliance related to imported engines (see §90.107 and §1054.205). In the application for certification, we are requiring the following additional information starting with the 2010 model year: (1) the port or ports at which the manufacturer has imported engines over the previous 12 months, (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. See Section 1.3 of the Summary and Analysis of Comments for further discussion related to naming test facilities in the United States. The current regulations in part 90 do not include these specific requirements; however, we do specify already that we may select imported engines at a port of entry. In such a case, we will generally direct the manufacturer to do testing at a facility in the United States. The new provision allows the manufacturers to make these arrangements ahead of time rather than relying on EPA's selection of a test lab. Also, the current regulations state in §90.119 that EPA may conduct testing at any facility to determine whether engines meet emission standards.

(g) Counterfeit emission labels

We have observed that some importers attempt to import noncompliant products by creating an emission control information label that is an imitation of a valid label from another company. We are not requiring that certifying manufacturers take steps to prevent this, but we are including a provision that specifically allows manufacturers to add appropriate features to prevent counterfeit labels. This may include the engine's serial number, a hologram, or some other unique identifying feature. This provision is effective immediately upon completion of the final rule since it is an allowance and not a requirement (see §90.114 and §1054.135).

(h) Partially complete engines

As described in Section VIII, we are clarifying the engine manufacturers' responsibilities for certification with respect to partially complete engines. While this is intended to establish a path for secondary engine manufacturers to get their engines from the original engine manufacturer, we are aware that this will also prevent manufacturers from selling partially complete engines as a strategy to circumvent certification requirements. If long blocks or engines without fuel systems are introduced into U.S. commerce, either the original manufacturer or the company completing engine assembly will need to hold a certificate for that engine.

(7) Using Certified Small SI Engines in Marine Applications

Manufacturers have described situations in which Small SI engines are used in marine applications. As described in Section III.E.5, we are allowing limited numbers of certified Small SI engines to be used as marine propulsion engines without certifying to the Marine SI emission standards in part 1045 (see §1045.610).

(8) Alternate fuels

The emission standards apply to all spark-ignition engines regardless of the fuel they use. Almost all Small SI engines operate on gasoline, but these engines may also operate on other fuels, such as natural gas, liquefied petroleum gas, ethanol, or methanol. The test procedures in 40 CFR part 1065 describe adjustments needed for operating test engines with oxygenated fuels.

In some special cases, a single engine is designed to alternately run on different fuels. For example, some engines can switch back and forth between natural gas and LPG. We are adding a clarification to the regulations to describe how manufacturers would submit certification data and divide such engines into engine families. Manufacturers would submit test data for each type of fuel. If a manufacturer certifies a dual-fuel engine family, but produces engines that run only on one fuel where that dedicated-fuel engine is identical to the certified dual-fuel engine with respect to that fuel, those engines could be included in the same family. This is also true for the second fuel. For example, if a manufacturer produces an engine that can run on both gasoline and LPG, and also produces that engine model in gasoline-only and LPG-only versions, without adjusting the calibration or other aspects of that each respective configuration, those engines may all be included in the same engine family. In effect, these engines are covered by the original certificate because they are made to conform to the description included in the original application for certification except that they do not have the full functionality of the dual-fuel engines.

Once an engine is placed into service, someone might want to convert it to operate on a different fuel. This would take the engine out of its certified configuration, so we are requiring that someone performing such a fuel conversion go through a certification process. We will allow certification of the complete engine using normal certification procedures, or the aftermarket conversion kit could be certified using the provisions of 40 CFR part 85, subpart V. This contrasts with the existing provisions that allow for fuel conversions that can be demonstrated not to increase emission levels above the applicable standard. We are applying this requirement starting January 1, 2010. (See §90.1003 and §1054.635.)

(9) Other Provisions

We are also making a variety of changes in the provisions that make up the certification and compliance program. Most of these changes serve primarily to align with the regulations we have started to apply to other types of engines.

The new warranty provisions are based on the requirements that already apply under 40 CFR part 90. We are adding an administrative requirement to describe the provisions of the emission-related warranty in the owners manual. We expect that many manufacturers already do this but believe it is appropriate to require this as a routine practice. (See §1054.120.)

Testing new engines requires a period of engine operation to stabilize emission levels. The regulations specify two separate figures for break-in periods for purposes of certification testing. First, engines are generally operated long enough to stabilize emission levels. Second, 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 Marine SI engines, we are requiring that the engine can be presumed to have stabilized emission levels after

12 hours of engine operation, with a provision allowing approval for more time if needed, and we generally require that low-hour test engines have no more than 30 hours of engine operation. However, given the shorter useful life for many Small SI engines, this will not make for a meaningful process for establishing deterioration factors. For example, emission levels in Small SI engines may not stabilize before deterioration begins to affect emission levels, which will prevent the engine from ever truly having stabilized emission levels. Also, the low-hour emission test should occur early enough for the deterioration factor to adequately represent the deterioration over the engine's lifetime.

We are requiring that Small SI engines with a useful life above 300 hours can be presumed stable after 12 hours with low-hour testing generally occurring after no more than 24 hours of engine operation. For Small SI engines with useful life below 300 hours, we are requiring a combination of provisions to address this concern. First, we are allowing manufacturers to establish a stabilization period that is less than 12 hours without showing that emission levels have fully stabilized (see §1054.501). Second, we are specifying that low-hour testing must generally occur after no more than 15 hours of engine operation (see §1054.801). This allows some substantial time for break-in, stabilization, and running multiple tests, without approaching a significant fraction of the useful life. Third, we are requiring that manufacturers consistently test low-hour production-line engines (and emission-data engines in the case of carryover deterioration factors for certification) using the same degree of service accumulation to avoid inaccurate application of deterioration factors (see §1054.240 and §1054.305).

We are clarifying the maintenance that manufacturers may perform during service accumulation as part of the certification process. The general approach is to allow any amount of maintenance that is not emission-related, but to allow emission-related maintenance only if it is a routine practice with in-use engines. In most of our emission control programs we specify that 80 percent of in-use engines should undergo a particular maintenance step before manufacturers can do that maintenance during service accumulation for certification testing. We are aware that Small SI engines are predominantly operated by homeowners with widely varying practices in servicing their lawn and garden equipment. As such, achieving a rate of 80 percent may be possible only for the most obvious maintenance steps. We are therefore adopting a more accommodating approach for Small SI engines. In particular, we are allowing manufacturers to perform a maintenance step during certification based on information showing that 60 to 80 percent of in-use engines get the specified maintenance at the recommended interval. We will approve the use of such maintenance based on the relative effect on performance and emissions. For example, we may allow scheduled fuel-injector replacement if survey data show this is done at the recommended interval for 65 percent of engines and performance degradation is shown to be roughly proportional to the degradation in emission control for engines that do not have their fuel injectors replaced.

One maintenance step of particular interest is replacement of air filters. In larger spark-ignition engines, we do not treat replacement of air filters as critical emission-related maintenance, largely because those engines have feedback controls to compensate for changes in varying pressure drop across the air filter. However, for Small SI engines varying air flow through the air filter has a direct effect on the engine's air-fuel ratio, which in turn directly affects the engine's emission rates for each of the regulated pollutants. Service accumulation generally takes place in laboratory conditions with far less debris, dust, or other ambient particles that will cause filter loading, so filter changes should be unnecessary to address this conventional concern. We are concerned that the greater affect is from fuel and oil that may deposit on the back side of the filter, especially from crankcase ventilation into the intake. This effect will go undetected if there are no measurements with filters that have experienced significant engine operation. We believe it would be appropriate for this rulemaking to allow manufacturers to clean or change air filters as long as manufacturers perform emission measurements before and after these maintenance steps. It would be best to perform testing with each air filter change; however, we would find it acceptable if manufacturers tested engines before and after every other air filter change. This approach allows for continued air filter changes, consistent with our testing to establish the feasibility of the Phase 3 emission standards, but properly identifies the effect on emissions. We are taking a similar approach for maintenance with spark plugs, except that tests must occur before and after each step to clean or replace the spark plugs. We will be interested in a future rulemaking to set emission standards based on less optimistic assumptions regarding the degree of air filter and spark plug maintenance with in-use equipment. See Section 2.4 of the Summary and Analysis of Comments for a more detailed discussion related to maintenance.

We are defining criteria for establishing engine families that are very similar to what is currently specified in 40 CFR part 90. We are requiring that engines with turbochargers be in a different family than naturally aspirated engines since that will be likely to substantially change the engine's emission characteristics. Very few if any Small SI engines are turbocharged today so this change will not be disruptive for any manufacturer. We are also specifying that engines must have the same number and arrangement of cylinders and approximately the same total displacement. This will help us avoid the situation where manufacturers argue that engines with substantially different engine blocks should be in the same engine family. We will implement this provision consistent with the approach adopted by California ARB in which they limit engine families to include no more than 15 percent variation in total engine displacement. Similarly, the current regulations in part 90 do not provide a clear way of distinguishing engine families by cylinder dimensions (bore and stroke) so we are also changing part 90 to limit the variation in displacement within an engine family to 15 percent. (See §1054.230 and §90.116.)

The test procedures for Small SI engines are designed for engines operating in constant-speed applications. This covers the large majority of affected equipment; however, we are aware that engines installed in some types of equipment, such as small utility vehicles or go carts, are not governed to operate only at a single rated speed. These engines will be certified based on their emission control over the constant-speed duty cycle even though they do not experience constant-speed operation in use. We are not prepared to establish a new duty cycle for these engines but we are requiring engine manufacturers to explain how their emission control strategy is not a defeat device in the application for certification. For example, if engines will routinely experience in-use operation that differs from the specified duty cycle for certification, the manufacturer should describe how the fuel-metering system responds to varying speeds and loads not represented by the duty cycle. We are also requiring that engine distributors and equipment manufacturers that replace installed governors must get a new certificate of conformity for those engines to avoid a tampering violation.

F. Small-Business Provisions

(1) Small Business Advocacy Review Panel

On August 17, 2006, we convened a Small Business Advocacy Review Panel (SBAR Panel or the Panel) under section 609(b) of the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA). The purpose of the Panel was to collect the advice and recommendations of representatives of small entities that could be affected by this rule and to prepare a report containing the Panel's recommendations for small entity flexibilities based on those comments, as well as on the Panel's findings and recommendations regarding the elements of the Initial Regulatory Flexibility Analysis (IRFA) under section 603 of the RFA. Those elements of an IRFA are:

- A description of, and where feasible, an estimate of the number of small entities to which the rule will apply;
- A description of projected reporting, recordkeeping, and other compliance requirements of the 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 rule; and
- A description of any significant alternative to the rule that accomplishes the stated objectives of applicable statutes and that minimizes any significant economic impact of the rule on small entities.

The report of the Panel has been placed in the rulemaking record for this final rule.

In addition to EPA's Director of the Office of Regulatory Management and Information who acted as chairperson, the Panel consisted of the Director of EPA's Assessment and Standards Division of the Office of Transportation and Air Quality, the Administrator of the Office of Management and Budget's Office of Information and Regulatory Affairs, 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 1,000 people are considered small businesses for the SBAR Panel. Companies that manufacture equipment and that employ fewer than 500 people, or fewer than 750 people for manufacturers of construction equipment, or fewer than 1,000 people for manufacturers of generators, 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, 14 of them represented a cross-section of Small SI engine manufacturers, equipment manufacturers, and fuel system component manufacturers. (The rest of the companies were involved in the Marine SI market.)

With input from small entity representatives, the Panel drafted a report providing findings and recommendations to us on how to reduce the potential burden on small businesses that may occur as a result of the proposed rule. The Panel report is included in the rulemaking record for this final rule. In light of the Panel report, and where appropriate, we proposed a number of provisions for small business engine manufacturers and small business equipment manufacturers. We are adopting all the flexibility options as proposed. The following section describes the flexibility options being adopted in this final rule.

(2) Burden Reduction Approaches for Small-Volume Nonhandheld Engine Manufacturers

We are incorporating several provisions for small business nonhandheld engine manufacturers. The purpose of these provisions is to reduce the burden on companies for which fixed costs cannot be distributed over a large number of engines.

Under EPA's current Phase 2 regulations, EPA provided a number of provisions for small-volume engine manufacturers. For the Phase 2 regulations, the criteria for determining if a company was a "small-volume engine manufacturer" was based on whether the company projected at certification to have production of no more than 10,000 nonhandheld engines per year (excluding engines sold in California that are subject to the California ARB standards). Based on past experience, EPA believes that determining the applicability of the provisions based on number of employees, as compared to volume of products, can be more problematic given the nature of the workforce in terms of full-time, part-time, contract, overseas versus domestic, and parent companies. EPA believes it can avoid these potential complications and still provide relief to nearly all small businesses by continuing to use the annual sales criteria for determining which entities qualify as a small volume engine manufacturer under the Phase 3 program. For these reasons, EPA is retaining the current production-based criteria for determining who is a small-volume engine manufacturer and, as a result, eligible for the Phase 3 flexibilities described below (see §1054.801).

Based on confidential sales data provided to EPA by engine manufacturers, the 10,000 unit cut-off for engine manufacturers will include all the small business engine manufacturers currently identified using SBA's employee-based definition. To ensure all small businesses have access to the flexibilities described below, EPA is also allowing engine manufacturers exceeding the production cut-off level noted above but having fewer than 1,000 employees to request treatment as a small-volume engine manufacturer (see §1054.635). In such a case, the manufacturer will need to provide information to EPA demonstrating that the manufacturer has fewer employees than the 1,000 cut-off level to be approved as a small-volume engine manufacturer.

If a small-volume engine manufacturer grows over time and exceeds the production volume limit of 10,000 nonhandheld engines per year, the engine manufacturer will no longer be eligible for the small-volume flexibilities. However, because some of the flexibilities described below provide manufacturers with the ability to avoid certain testing such as durability testing or production line testing, it may be difficult for a manufacturer to fully comply with all the testing requirements immediately upon losing its small-volume status. In such cases, the engine manufacturer can contact EPA and request additional time, subject to EPA approval, before they would be required to meet the testing requirements that generally apply to engine manufacturers.

(a) Assigned deterioration factors

We are allowing small-volume engine manufacturers to 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 §1054.240). EPA is not establishing actual levels for the assigned deterioration factors with this final rule. EPA intends to analyze emissions deterioration information that becomes available over the next few years to determine what deterioration factors will be appropriate for nonhandheld engines. This is likely to include deterioration data for engines certified to comply with California ARB's Tier 3 standards and engines certified early to EPA's Phase 3 standards. Prior to the implementation date for the Phase 3 standards, EPA will provide guidance to engine manufacturers specifying the levels of the assigned deterioration factors for small-volume engine manufacturers.

(b) Exemption from production-line testing

We are exempting small-volume engine manufacturers from the production-line testing requirements (see §1054.301). Therefore, small-volume engine manufacturers will not be required to perform production-line testing on any of their engine families.

(c) Additional lead time

We are allowing small-volume engine manufacturers to delay implementation of the Phase 3 exhaust emission standards for two years (see §1054.145). Small-volume engine manufacturers will be required to comply with the Phase 3 exhaust emission standards beginning in model year 2014 for Class I engines and model year 2013 for Class II engines. Under this approach, manufacturers will be able to apply this delay to all their nonhandheld engines or to just a portion of their production. For those engine families that are certified to meet the Phase 3 standards prior to these delayed dates by selecting an FEL at or below the Phase 3 standards, small volume engine manufacturers can generate early Phase 3 credits (as discussed in Section V.C.3) through the 2013 model year for Class I engines and through the 2012 model years for Class II engines. This option provides more lead time for small-volume engine manufacturers to redesign their products. They will also be able to learn from some of the hurdles overcome by larger manufacturers.

(d) Broad engine families

We are also allowing small-volume engine manufacturers to use a broader definition of engine family for certification purposes. Under the existing engine family criteria specified in the regulations, manufacturers group their various engine lines into engine families that have similar design characteristics including the combustion cycle, cooling system, cylinder configuration, number of cylinders, engine class, valve location, fuel type, aftertreatment design, and useful life category. We are allowing small-volume engine manufacturers to group all their Small SI engines into a single engine family for certification by engine class and useful life category, subject to good engineering judgment (see §1054.230).

(e) Hardship provisions

We are also establishing two types of hardship provisions for nonhandheld engine manufacturers consistent with the Panel recommendations. As has been our experience with similar provisions already adopted, we anticipate that hardship mechanisms will be used sparingly. First, under the unusual circumstances hardship provision, any manufacturer subject to the new standards may apply for hardship relief if circumstances outside their control cause the failure to comply and if failure to sell the subject engines or equipment or fuel system component would have a major impact on the company's solvency (see §1068.245). An example of an unusual circumstance outside a manufacturer's control may be an "Act of God," a fire at the manufacturing plant, or the unforeseen shutdown of a supplier with no alternative available. The terms and time frame of the relief will depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards. This hardship provision will be available to all manufacturers of engines, equipment, boats, and fuel system components subject to the new standards, regardless of business size.

Second, an economic hardship provision allows small businesses subject to the new standards to petition EPA for limited additional lead time to comply with the standards (see §1068.250). A small business must make the case that it has taken all possible business, technical, and economic steps to comply, but the burden of compliance costs would have a significant impact on the company's solvency. Hardship relief could include requirements for interim emission reductions and/or the purchase and use of emission credits. The length of the hardship relief decided during review of the hardship application will be up to one year, with the potential to extend the relief as needed. We anticipate that one to two years will normally be sufficient. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards. This hardship provision will be available only to qualifying small businesses.

(3) Burden Reduction Approaches for Small-Volume Nonhandheld Equipment Manufacturers

We are establishing three provisions for small-volume nonhandheld equipment manufacturers. The purpose of these provisions is to reduce the burden on companies for which fixed costs cannot be distributed over large sales volumes. That is useful for small-volume equipment manufacturers that may need more lead time to redesign their equipment to accommodate the new Phase 3 engine designs.

Under EPA's current Phase 2 regulations, EPA provided a number of lead time provisions for small-volume equipment manufacturers. For the Phase 2 regulations, the criteria for determining if a company was a "small-volume equipment manufacturer" was based on whether the company produced fewer than 5,000 nonhandheld pieces of equipment per year (excluding equipment sold in California that are subject to the California ARB standards). For the same reasons noted above for engine manufacturers, EPA is retaining the current production-based criteria for determining who is a small-volume equipment manufacturer and, as a result, eligible for the Phase 3 flexibilities described below (see §1054.801). The determination of which companies qualify as small-volume equipment manufacturers for the purposes of the flexibilities described below will be based on the average annual U.S.-directed production of nonhandheld equipment over three years from 2007 through 2009.

Based on estimated sales data for equipment manufacturers, EPA believes the 5,000 unit cut-off for equipment manufacturers will include almost all the small business equipment manufacturers using SBA's employee-based definition. However, to ensure all small businesses have access to the flexibilities described below, EPA is also allowing equipment manufacturers which exceed the production cut-off level noted above, but comply with SBA's employee-based definition (e.g., 500 employees for equipment manufacturers, 750 employees for construction equipment manufacturers, and 1,000 employees for generator manufacturers), to request treatment as a small-volume equipment manufacturer (see §1054.635). In such a case, the manufacturer must provide information to EPA demonstrating that the manufacturer has fewer employees than the applicable employee cut-off level to be approved as a small-volume equipment manufacturer.

(a) Additional lead time

As described in Section V.E.3., EPA is implementing a transition program for all equipment manufacturers that produce Class II equipment. Under that program, equipment manufacturers can install Phase 2 engines in limited numbers of Class II equipment over the first four years the Phase 3 standards apply (i.e., 2011 through 2014). The number of equipment that can use Phase 2 engines is based on 30 percent of an average annual production level of Class II equipment. However, for small-volume equipment manufacturers, EPA is allowing a higher level of allowances. Small-volume equipment manufacturers can install Phase 2 engines at a level of 200 percent of an average annual production level of Class II equipment. Small-volume equipment manufacturers can use these allowances over the same four year period of the transition program noted above (see §1054.625). Therefore, a small-volume equipment manufacturer could potentially use Phase 2 engines on all their Class II equipment for two years, consistent with the SBAR Panel's recommendation, or they might, for example, sell half their Class II equipment with Phase 2 engines for four years assuming sales stay constant over time.

(b) Simplified certification procedure

We are establishing a simplified engine certification procedure for all equipment manufacturers, including small-volume equipment manufacturers (see §1054.612). See Section V.E.4 for further discussion of this provision.

(c) Hardship provisions

Because nonhandheld equipment manufacturers in many cases depend on engine manufacturers to supply certified engines in time to produce complying equipment, we are also establishing a hardship provision for all nonhandheld equipment manufacturers, regardless of size. The provision will allow an equipment manufacturer to request more time if they are unable to obtain a certified engine and they are not at fault and will face serious economic hardship without an extension (see §1068.255).

G. Technological Feasibility

(1) Level of Standards

We are promulgating new, more stringent exhaust HC+NOx standards for Class I and II Small SI engines. We are also establishing a new CO standard for Small SI engines used in marine generator applications.

For the 2008 model year manufacturers have certified nearly 500 Class I and II engine families to the Phase 2 standards using a variety of engine designs and emission control technology. All Class I engines were produced using carbureted air-fuel induction systems. A small number of engines used catalyst-based emission control technology. Similarly, Class II engines were predominantly carbureted. A limited number of these engines used catalyst technology, electronic engine controls and fuel injection, or were water-cooled. In both classes, several engine families were certified at levels that will comply with the new Phase 3 standards. Also, several families were very close to the new emission standards. This suggests that, even accounting for the relative increase in stringency associated with the Phase 3 requirements, some families either will not need to do anything or will require only modest reductions in their emission performance to meet the new standards. However, many engine families clearly will have to do more to improve their emission controls.

Based on our own testing of advanced technology for these engines, our engineering assessments, and statements from the affected industry, we believe the new requirements will require many engine manufacturers to adopt exhaust aftertreatment technology using catalyst-based systems. Other likely changes include improved engine designs and fuel delivery systems. Finally, adding electronic controls or fuel injection systems may obviate the need for catalytic aftertreatment for some engine families, with the most likely candidates being multi-cylinder engine designs.

(2) Implementation Dates

We are establishing HC+NOx 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 maintaining the existing CO standard of 610 g/kW-hr. We expect manufacturers to meet these standards by improving engine combustion and adding catalysts on most engines.

For spark-ignition engines used in marine generators, we are promulgating a more stringent Phase 3 CO emission standard of 5.0 g/kW-hr. This will apply equally to all sizes of engines subject to the Class I and II Small SI engine standards, with implementation dates as described above relative to Class I and Class II engines.

(3) Technological Approaches

Our feasibility assessment began by evaluating the emissions performance of current technology for Small SI engines and equipment. These initial efforts focused on developing a baseline for emissions and general engine performance so we could assess the potential for new emission standards for engines and equipment in this category. This process involved laboratory and field evaluations of the current engines and equipment. We reviewed engineering information and data on existing engine designs and their emissions performance. Patents of existing catalyst/muffler designs for Class I engines were also reviewed. We engaged engine manufacturers and suppliers of emission control-related engine components in discussions regarding recent and expected advances in emissions performance beyond that required to comply with the current Phase 2 standards. Finally, we purchased catalyst/muffler units that were already in mass production by an engine manufacturer for use on European walk-behind lawn mowers and conducted engineering and chemical analyses on the design and materials of those units.

We used the information and experience gathered in the above effort, along with the previous catalyst design experience of our engineering staff, to design and build prototype catalyst-based emission control systems that were capable of effectively and safely achieving the new Phase 3 requirement based on dynamometer and field testing. We also used the information and the results of our engine testing to assess the potential need for improvements to engine and fuel system designs, and the selective use of electronic engine controls and fuel injection on some engine types. A great deal of this effort was conducted in association with our more exhaustive study regarding the efficacy and safety of implementing advanced exhaust emission controls on Small SI engines, as well as new evaporative requirements for these engines. In other testing, we evaluated advanced emission controls on a multi-cylinder Class II engine with electronic fuel injection. The results of that study are also discussed in Section VII.

In our test program to assess the feasibility of achieving the Phase 3 HC+NOx standard, we evaluated 15 Class I engines of varying displacements and valve-train designs. Each of these engines was equipped with a catalyst-based control system and all achieved the applicable standard at the end of their regulatory useful lives. Our work also suggests that manufacturers of Class I engines may need to improve the durability of their basic engine designs, ignition systems, or fuel metering systems for some engines to comply with the emission regulations.

We tested five single-cylinder, overhead-valve Class II engines with prototype catalyst/muffler control systems. Three of the engines were carbureted and two were equipped with electronic engine and fuel controls. This latter technology improves the management of air-fuel mixtures and ignition spark timing. Each of the engines achieved the requisite emission limit for HC+NOx (i.e., 8.0 g/kW-hr). Based on this work and information from one manufacturer of emission controls, we believe either a catalyst-based system or electronic engine controls appear sufficient to meet the standard. Recent certification data also suggests a number of Class II engines may be able to comply with the new standard with engine modifications only. Finally, similar to Class I engines, we found that manufacturers of Class II engines may also need to improve the durability of their ignition systems or fuel metering systems for some engines to comply with the emission regulations.

Multi-cylinder Class II engines are very similar to their single-cylinder counterparts regarding engine design and combustion characteristics. There are no multi-cylinder Class I engines. Based on these attributes and our testing of two twin-cylinder engines, we conclude that the Phase 3 HC+NOx standard is technically feasible.

Nonetheless, we also found that multi-cylinder engines may present a unique concern with the application of catalytic control technology under atypical operating conditions. More specifically, the concern relates to the potential consequences of combustion misfire or a complete lack of combustion in one of the two or more cylinders when a single catalyst/muffler design is used. A single muffler is typically used in Class II applications. In a single-catalyst system, the unburned fuel and air mixture from the malfunctioning cylinder could combine with hot exhaust gases from the other, properly operating cylinder. This condition can create high temperatures within the muffler system as the unburned fuel and air charge from the misfiring cylinder combusts within the exhaust system. This could potentially destroy the catalyst.

One solution is simply to have a separate catalyst/muffler for each cylinder. Another solution is to employ electronic engine controls to monitor ignition and put the engine into "limp-mode" until necessary repairs are made. For engines using carburetors, this would effectively require the addition of electronic controls. For engines employing electronic fuel injection that may need to add a small catalyst, it will require that the electronic controls incorporate ignition misfire detection if they do not already utilize the inherent capabilities within the engine management system.

As described earlier, we also expect some engine families to use electronic fuel injection to meet the Phase 3 standard without employing catalytic aftertreatment. Engine families that already use these fuel metering systems and are reasonably close to complying with the new requirement are likely to need only additional calibration changes to the engine management system for compliance. In addition, we expect that some engine families that currently use carbureted fuel systems will convert directly to electronic fuel injection. Manufacturers may adopt this strategy to couple achieving the standard without a catalyst and realizing other advantages of using fuel injection such as easier starting, more stable and reliable engine operation, and reduced fuel consumption.

Our evaluation of electronic fuel injection systems that could be used to attain the new standard found that a rather simple, low-cost system should be sufficient. We demonstrated this proof of concept as part of the engine test program we conducted in anticipation of the proposed rule. In that program, we fitted two single-cylinder Class II engines with an electronic control unit and fuel system components developed for motor-scooters and small-displacement motorcycles for Asian markets. The sensors for the system were minimized to include a throttle position sensor, air charge temperature sensor, oil temperature sensor, manifold absolute pressure sensor, and a crankshaft position sensor. This is in contrast to the fuel injection systems currently used in some equipment with two-cylinder Class II engine applications that employ more sophisticated and expensive automotive-based components.

Finally, there are a number of Class II engines that use gaseous fuels (i.e., liquefied petroleum gas or natural gas). Based on our engineering evaluation of current and likely emission control technology for these engines, we conclude that there are no special concerns relative to achieving the Phase 3 HC+NOx standard.

Turning to the Phase 3 CO standard for Class I and II Small SI engines used in marine generator applications, these engines have several rather unique design considerations that are relevant to achieving the new standard. Marine generator engines are designed to operate for very long periods. Manufacturers generally design the engines to operate at lower loads to accommodate continuous operation. Manufacturers also design them to take advantage of the cooling available from the water in the lake or river where the boat is operating (seawater). By routing seawater through the engine block, or using a heat exchanger that transfers heat from the engine coolant to the seawater, manufacturers are able to maintain engine temperatures as well as or better than automotive engines. Stable temperatures in the engine block make a very significant difference in engine operation, enabling much less distortion of the cylinders and a much more consistent combustion event. These operating characteristics make it possible to introduce advanced technology for controlling emissions. Manufacturers also use this cooling water in a jacketing system around the exhaust in order to minimize surface temperatures and reduce the risk of fires on boats.

The vast majority of gasoline marine generators are produced by two engine manufacturers. Recently, these two manufacturers have converted their marine generator product lines to new designs which can reduce CO emissions by more than 99 percent. These manufacturers stated that this action is to reduce the risk of CO poisoning in response to demands from boat builders. These low-CO emission designs use closed-loop electronic fuel injection and catalytic control. Both of these manufacturers have certified low-CO engines capable of complying with the new standards. These manufacturers also use electronic controls to monitor catalyst function.

(4) Consideration of Regulatory Alternatives

In developing the final emission standards, we considered what was achievable with catalyst technology. Our technology assessment work indicated that the new emission standards are feasible in the context of provisions for establishing emission standards prescribed in section 213 of the Clean Air Act. We also considered what could be achieved with larger, more efficient catalysts and improved fuel induction systems. In particular, Chapter 4 of the Final RIA presents data on Class I engines with more active catalysts and on Class II engines with closed-loop control fuel injection systems in addition to a catalyst. In both cases larger emission reductions were achieved.

Based on this work we considered HC+NOx standards involving a 50 percent reduction for Class I engines and a 65-70 percent reduction for Class II engines. Chapter 11 of the Final RIA evaluates these alternatives, including an assessment of the overall technology and costs of meeting more stringent standards. For Class I engines a 50 percent reduction standard would require base engine changes not necessarily involved with the standards we are finalizing and the use of a more active catalyst. For Class II engines this would likely require the widespread use of closed-loop fuel injection systems rather than carburetors and some other engine upgrades in addition to the use of three-way catalysts.

We believe it is not appropriate at this time to adopt more stringent exhaust emission standards for Small SI engines. Our key concern is lead time. More stringent standards will require three to five years of lead time beyond the 2011 model year start date we are allowing for the program contained in this final rule. We believe it will be more effective to implement the new Phase 3 standards to achieve near-term emission reductions needed to reduce ozone precursor emissions and to minimize growth in the Small SI exhaust emissions inventory in the post 2010 time frame. More efficient catalysts, engine improvements, and closed-loop electronic fuel injection could be the basis for more stringent Phase 4 emission standards at some point in the future.

(5) Our Conclusions

We believe the Phase 3 exhaust emission standards for nonhandheld Small SI engines will achieve significant emission reductions. Manufacturers will likely meet the new standards with a variety of strategies including catalysts packaged in mufflers, engine modifications, and fuel-injection systems. Test data from readily available technologies have demonstrated the feasibility of achieving the new emission levels.

As discussed in Section VII, we believe the new standards will have no negative effects on energy, noise, or safety and may lead to some positive effects.

VI. Evaporative Emissions

A. Overview

In this final rule, we are also establishing standards for controlling evaporative emissions from fuel systems in marine vessels and equipment powered by Small SI engines. These new standards include requirements for controlling permeation and diurnal emissions from marine vessels and permeation and running loss emissions from Small SI equipment.

Evaporative emissions refer to hydrocarbons released into the atmosphere when gasoline or other volatile fuels escape from a fuel system. The primary source of evaporative emissions from nonroad gasoline engines and equipment is known as *permeation*, which occurs when fuel penetrates the material used in the fuel system and reaches the ambient air. This is especially common through rubber and plastic fuel-system components such as fuel lines and fuel tanks. *Diurnal emissions* are another important source of evaporative emissions. Diurnal emissions occur as the fuel heats up due to increases in ambient temperature. As the fuel heats, liquid fuel evaporates into the vapor space inside the tank. In a sealed tank, these vapors will increase the pressure inside the tank; however, most tanks are vented to prevent this pressure buildup. The evaporating fuel therefore drives vapors out of the tank into the atmosphere. *Running loss emissions* are similar to diurnal emissions except that vapors escape the fuel tank as a result of heating from the engine or some other source of heat during operation rather than from normal daily temperature changes.

Other sources of evaporative emissions include diffusion and refueling. *Diffusion emissions* occur when vapor escapes the fuel tank through an opening as a result of random molecular motion, independent of changing temperature. Although we are not adopting a specific standard for diffusion emissions, we expect that these emissions will be controlled through the running loss and diurnal emission controls. *Refueling losses* are vapors that are displaced from the fuel tank to the atmosphere when someone fills a fuel tank. *Refueling spitback* is the spattering of liquid fuel droplets coming out of the filler neck during a refueling event. *Spillage* is fuel that is spilled while refueling. We are continuing to work with manufacturers to develop industry standards for refueling emission control, and we are adopting a requirement that manufacturers use fuel system designs that will help facilitate a reduction in fuel spillage.

B. Fuel Systems Covered by This Rule

The new evaporative emission standards will apply to fuel systems for both Small SI engines and Marine SI engines. The marine standards apply to fuel systems related to both propulsion and auxiliary engines. In some cases, specific standards are required only for certain types of equipment, as described below. These standards will apply only to new products.

We are incorporating the regulations related to evaporative emission standards in 40 CFR part 1060, as described in Section VI.C. Also, as described in Section VIII, we are allowing component manufacturers and some equipment manufacturers to certify products under the provisions of part 1060 with respect to recreational vehicles and Large SI engine. We have also adopted requirements for controlling evaporative emissions from marine compression-ignition engines that operate on volatile liquid fuels (such as methanol or ethanol). Now that we are adopting final requirements in part 1060, we are including a reference to part 1060 for these marine compression-ignition engines.

The following definitions are important in establishing which components are covered by the new standards: "evaporative," "fuel system," "fuel line," "portable nonroad fuel tank," and "installed marine fuel tank." See the full text of these definitions in the final regulations at §1060.801.

Note in particular that the new standards will apply to fuel lines, including hose or tubing that contains liquid fuel. This includes fuel supply lines but not vapor lines or vent lines that are not normally exposed to liquid fuel. We consider fuel return lines for handheld engines to be vapor lines, not fuel lines. Data in Chapter 5 of the Final RIA suggest that permeation rates through vapor lines and vent lines are already lower than the new standard; this is due to the low vapor concentration in the vapor line. In contrast, permeation rates for materials that are consistently exposed to saturated fuel vapor are generally considered to be about the same as that for liquid fuel. The new standards also do not apply to primer bulbs exposed to liquid fuel only for priming, but would apply to primer bulbs that are directly in the fuel supply line. This standard will apply to marine filler necks that are filled or partially filled with liquid fuel after a refueling event where the operator fills the tank as full as possible. In the case where the fuel system is designed to prevent liquid fuel from standing in the fill neck, the fill neck will be considered a vapor line and not subject to the new fuel line permeation standard.

A special note applies to fuel systems for auxiliary marine engines. These engines must meet exhaust emission standards that apply to land-based engines. For evaporative emissions, however, it is important that the fuel systems for propulsion and auxiliary engines be subject to the same standards because these engines typically draw fuel from a common fuel tank and share other fuel-system components. We are therefore applying the Marine SI evaporative emission standards and certification requirements to the fuel systems for both auxiliary and propulsion marine engines on marine vessels. We apply a similar approach for nonroad engines installed in motor vehicles (such as generators used to power motor homes). These engines must meet exhaust emission standards for nonroad engines, but the evaporative requirements apply under the motor-vehicle program.

Our evaporative emission standards for automotive applications are based on a comprehensive measurement from the whole vehicle. However, the evaporative standards in this final rule are generally based on individual fuel-system components. For instance, we are promulgating permeation standards for fuel lines and fuel tanks rather than for the equipment as a whole.[98] We have taken this approach for several reasons. First, most production of Small SI equipment and Marine SI vessels is not vertically integrated. In other words, the fuel line manufacturer, the engine manufacturer, the fuel tank manufacturer, and the equipment manufacturer are typically separate companies. In addition, there are several hundred equipment manufacturers and boat builders, many of which are small businesses. Testing the systems as a whole will place the entire certification burden on the equipment manufacturers and boat builders. Specifying emission standards and testing for individual components allows for measurements that are narrowly focused on the source of emissions and on the technology changes for controlling emissions. This correspondingly allows for component manufacturers to certify that their products meet applicable standards. We believe it is most appropriate for

[98] An exception to component certification is the design standard for controlling running loss emissions.

component manufacturers to certify their products since they are best positioned to apply emission control technologies and demonstrate compliance. Equipment manufacturers and boat builders will then be able to purchase certified fuel-system components rather than doing all their own testing on individual components or whole systems to demonstrate compliance with every requirement. In contrast, controlling running loss emissions cannot be done on a component basis so we are requiring engine or equipment manufacturers to certify that they meet the running loss standard. We will otherwise expect most equipment manufacturers to simply identify a range of certified components and install the components as directed by the component manufacturer to demonstrate compliance with the final emission standards.

Second, a great deal of diversity exists in fuel-system designs (hose lengths, tank sizes/shapes, number of connections, etc.). In most cases, the specific equipment types are low-volume production runs so sales will not be large enough to cover the expense of SHED-type testing. Third, there are similarities in fuel lines and tanks that allow for component data to be used broadly across products in spite of extensive variety in the geometry and design of fuel systems. Fourth, many equipment types, primarily boats, will not fit in standard-size SHEDs and will require the development of very large, very expensive test facilities if the entire vessel were tested.

Finally, by adopting separate standards for fuel line permeation, fuel tank permeation, diurnal emissions, and running loss emissions, we are able to include simplified certification requirements without affecting the level of the standards. Specifying a comprehensive test with a single standard for all types of evaporative emissions will make it difficult or impossible to rely on design-based certification. Requiring emission tests to cover the wide range of equipment models would greatly increase the cost of compliance with little or no increase in the effectiveness of the certification program. We believe the approach being adopted will allow substantial opportunities for market forces to appropriately divide compliance responsibilities among affected manufacturers and accordingly result in an effective compliance program at the lowest possible cost to society.

The new emission standards generally apply to the particular engines and their associated fuel systems. However, for ease of reference, we may refer to evaporative standards as being related to Small SI equipment or Marine SI vessels, meaning the relevant evaporative standards for engines and fuel systems used in such equipment or vessels.[99] See Section VI.F for a more detailed description of certification responsibilities for all the new evaporative standards.

C. Final Evaporative Emission Standards

We are establishing permeation standards for Small SI equipment and Marine SI vessels, covering permeation from fuel tanks and fuel lines. We are also adopting diurnal emission standards for Marine SI vessels. In addition, we are promulgating a running loss standard for

[99] "Small SI equipment" includes all nonroad equipment powered by Small SI engines. "Marine SI vessels" includes all vessels powered by engines that run on volatile liquid fuels. In almost all cases these engines are powered by gasoline. Note also that volatile liquid fuels include methanol or ethanol, which could be used in a compression-ignition engine. While we are aware of no such equipment or vessels today, they will be covered by the final regulations. In this preamble, we nevertheless refer to all the vessels that fall within the scope of the final regulations as Marine SI vessels. Throughout this section, we generally refer to Small SI equipment and Marine SI vessels as "equipment," consistent with the regulatory text.

nonhandheld Small SI equipment (except wintertime engines), with a variety of specified options for manufacturers to demonstrate compliance.

All the new evaporative emission standards apply to new equipment over a useful life period in years that matches the useful life of the corresponding engine (generally five or ten years). Manufacturers have expressed concern that they will not have time to gain five years of in-use experience on low-permeation fuel tanks by the effective dates of the tank permeation standards. Unlike barrier fuel line, which is well established technology, some fuel tanks may use barrier technologies that have not been used extensively in other applications. An example of this technology will be barrier surface treatments that must be properly matched to the fuel tank material. Therefore, we are finalizing a shorter useful life of two years for Marine SI and Small SI fuel tanks through the 2013 model year to allow manufacturers to gain experience in use (see §§1045.145 and 1054.145).

Handheld manufacturers have also expressed concerns about the durability of fuel lines used on cold-weather products. As noted below, we are adopting separate fuel line requirement for cold-weather products. The manufacturers' concerns are similar to those noted in Section VI.C.2 below regarding fuel cap gasket/O-ring materials and how they may degrade in the field such that they have excessively high permeation rates but without leaking liquid fuel. Therefore, we are adopting a shorter useful life of two years for fuel lines used on cold-weather products through the 2013 model year to allow manufacturers to gain experience in use (see §1054.145). Manufacturers have noted that they plan to gather in-use data on the permeation levels of cold-weather equipment. While we believe manufacturers will be able to design and produce cold-weather products that comply with fuel line permeation requirements for five years, we will review any industry-generated data on in-use fuel lines. Should the data demonstrate concerns with regard to in-use durability, we would consider options for addressing those concerns.

The new requirements for evaporative emissions are described in 40 CFR part 1060, with some category-specific provisions in 40 CFR parts 1045 and 1054, which are referred to as the exhaust standard-setting parts for each category of engine. The regulations in 40 CFR parts 1045 and 1054 highlight the standards that apply and provide any specific directions in applying the general provisions in part 1060. The standards, test procedures, and certification provisions are almost completely uniform across our programs so this combined set of evaporative-related provisions makes it much easier for companies to certify their products if they are not subject to the exhaust emission standards.

The rest of this section summarizes the new standards, additional requirements, and implementation dates. Unless otherwise stated, implementation dates specified below refer to the model year. Section VI.D describes how manufacturers may use emission credits to meet fuel tank permeation standards. Section VI.E describes the test procedures corresponding to each standard. Section VI.F describes how component and equipment manufacturers certify their products and how their responsibilities overlap in some cases. Section VI.F also describes the simplified process of design-based certification for meeting many of the new standards.

(1) Fuel Line Permeation Standards and Dates

Except as noted below, the new fuel line permeation standard is 15 g/m^2/day at 23°C using a test fuel containing 10 percent ethanol and applies to fuel lines intended for use in new Small SI equipment and Marine SI vessels (see §1060.102 and §1060.515). The form of the standard refers to grams of permeation over a 24-hour period divided by the inside surface area of the fuel line. This is consistent with the standard we adopted for fuel lines in recreational vehicles.

The move toward low-permeation fuel lines in recreational vehicles—and further development work in this area since the first proposed rule for marine evaporative emissions—demonstrates that low-permeation fuel lines are available on the market today for Small SI equipment and Marine SI vessels. In addition, many manufacturers are already using low-permeation technologies in response to permeation standards in California. We are therefore requiring that this standard apply beginning January 1, 2009 for Marine SI vessels and for nonhandheld Small SI equipment. Manufacturers have expressed concern that these early dates may cause them to have to transition to using new hose designs before they can use up their existing inventory. Under the provisions of §1060.601(g), manufacturers would be able to use up existing inventory under normal business practices, even beyond the standard date. However, manufacturers would not be permitted to circumvent the standards by stockpiling noncompliant hose prior to the implementation of the standards.

For handheld equipment, we are promulgating a fuel line permeation implementation date of 2012, except that small-volume emission families as defined in §1054.801 will have until 2013. Although low-permeation fuel line technology is available, handheld equipment is not currently subject to fuel line permeation requirements in California and does not typically use low-permeation fuel lines today. In addition, much of the fuel line used on handheld equipment is not straight-run fuel line for which low-permeation replacements are readily available; thus, more lead time is required.

Fuel line manufacturers have the primary responsibility to certify to the new emission standard. Equipment manufacturers may make arrangements to take on the certification responsibility if they find that to be to their advantage. If equipment manufacturers notify the fuel line manufacturer in writing that they commit to certifying the fuel line, then the fuel line manufacturer may ship uncertified and unlabeled fuel line to the equipment manufacturer.

By specifying standards for fuel-system components rather than the entire fuel system, we are separately addressing appropriate requirements for fuel line fittings that are exposed to liquid fuel but are not part of the fuel line. We are requiring that these fuel line fittings meet the broad specifications described in §1060.101(f), which generally require that fittings and connections be designed to prevent leaks. As described in Section VI.E.1, we are allowing the fuel line assembly to be tested as a single unit. This includes connecting pieces, primer bulbs, and other fuel line components as a single item (see §1060.102). For example, manufacturers may certify fuel lines for portable marine fuel tanks as assemblies of fuel line, primer bulbs, and self-sealing end connections. Finally, we are requiring that detachable fuel lines be self-sealing when they are removed from the fuel tank or the engine because this will otherwise result in high evaporative emissions (see §1060.101). To the extent that equipment manufacturers and boat builders certify their products, they will need to describe how they meet the equipment-based requirements in §1060.101(f) in their application for certification (see §1060.202). If boat builders rely on certified components instead of certifying, they will need to keep records describing how they meet the equipment-based requirements contained in §1060.101 (f) (see §1060.210).

Handheld equipment manufacturers have raised concerns that fuel lines constructed of available low-permeation materials may not perform well in some handheld applications under extreme cold weather conditions such as below -30°C. These products often use injected molded fuel lines with complex shapes and designs needed to address the unique equipment packaging issues and the high vibration and random movement of the fuel lines within the overall equipment when in use. Industry has expressed concern and the data in Chapter 5 of the Final RIA suggest that durability issues may occur from using certain low-permeation materials in these applications when the weather is extremely cold and that these could lead to unexpected fuel line leaks. Cold-weather equipment is limited to the following types of handheld equipment: chainsaws, cut-off saws, clearing saws, brush cutters with engines at or above 40cc, commercial earth and wood drills, and ice augers. This includes earth augers if they are also marketed as ice augers.

As discussed in the Final RIA, rubbers with high acrylonitrile (ACN) content are used in some handheld applications. These materials have about half the permeation of lower ACN-content rubbers also used in handheld applications. To capture the capability of these materials to reduce permeation emissions without creating other issues for cold-weather products, we are adopting a set of declining fuel line permeation standards for fuel lines used in cold-weather equipment that would phase-in from 2012 to 2016. The standard starts at 290 g/m^2/day in 2012 and declines to 275 g/m^2/day in 2013, 260 g/m^2/day in 2014, and 245 g/m^2/day in 2015. The standard for 2016 and later model years is 225 g/m^2/day. The standards would apply to all cold-weather products, including small-volume families. Manufacturers would be allowed to demonstrate compliance with the 2012 through 2015 standards with a fuel line averaging program that is limited to cold-weather fuel lines. There would not be any banking or trading of these credits. Manufacturers comply with the averaging standard by naming a Family Emission Limit for each family of fuel lines; this Family Emission Limit serves as the emission standard for the family. Manufacturers may not name a Family Emission Limit higher than 400 g/m^2/day during this period. Beginning in the 2016 model year, all fuel lines on cold-weather equipment must meet the 225 g/m^2/day standard without averaging.

Outboard engine manufacturers have expressed concern that it will be difficult for them to meet final 2009 date for the sections of fuel lines that are mounted on their engines under the engine cowl. While some sections of straight-run fuel line are used with outboard engines, many of the smaller sections between engine mounted fuel-system components and connectors are preformed or injection-molded parts. Outboard engine manufacturers stated that they will need additional time to redesign and perform testing on low-permeation under-cowl fuel lines. To address this issue, we are finalizing a phase-in of under-cowl fuel line permeation standards. For each engine model, we are adopting a phase-in, by hose length, of 30 percent in 2010, 60 percent in 2011, 90 percent in 2012-2014 and 100 percent in 2015 and later. This will allow manufacturers to transition to the use of low-permeation fuel lines in an orderly fashion. Manufacturers also commented that additional lead time is necessary to develop low permeation primer bulbs such as those in fuel line assemblies for portable marine fuel tanks. To address this development time, we are finalizing an implementation date of 2011 for primer bulbs.

(2) Fuel Tank Permeation Standards and Dates

Except as noted below, we are requiring a fuel tank permeation standard of 1.5 g/m^2/day for tanks intended for use in new Small SI equipment and Marine SI vessels based on the permeation rate of gasoline containing 10 percent ethanol at a test temperature of 28°C (see §1060.103 and §1060.520). The emission standard is based on the inside surface area of the fuel tank and is consistent with that adopted for fuel tanks in recreational vehicles.

Many Small SI equipment manufacturers are currently using low-permeation fuel tanks for products certified in California. The California tank permeation test procedures use a nominal test temperature of 40°C with California certification gasoline while we are requiring testing at 28°C with gasoline containing 10 percent ethanol. We are allowing manufacturers the alternative of testing their fuel tanks at 40°C with the EPA test fuel. Because permeation increases as a function of temperature, we are establishing an alternative standard of 2.5 g/m^2/day for fuel tanks tested at 40°C.

We consider three distinct classes of marine fuel tanks: (1) portable marine fuel tanks (generally used with small outboard engines); (2) personal watercraft (PWC) fuel tanks; and (3) other installed marine fuel tanks (generally used with SD/I engines and larger outboard engines). The fuel tank permeation standards start in 2011 for all Small SI equipment using Class II engines and for personal watercraft and portable marine fuel tanks. For Small SI equipment using Class I engines and for other installed marine fuel tanks (including engine-mounted tanks), we are applying the same standard starting in 2012. Most of the marine fuel tanks with the later standards are produced in low volumes using rotation-molded cross-link polyethylene or fiberglass construction, both of which generally present a greater design challenge. We believe the additional lead time is necessary for these fuel tanks to allow for a smooth transition to low-permeation designs. For Small SI equipment, these dates also align with the schedule for introducing the Phase 3 exhaust emission standards.

For handheld equipment, we are adopting a phased-in implementation of the fuel tank permeation standards. Manufacturers will be required to meet the new fuel tank permeation standards in 2009 for products that they already certify in California (see §90.129). The remaining equipment, except for structurally integrated nylon fuel tanks and small-volume families, will be subject to the new tank permeation standards in 2010 (see §1054.110). Structurally integrated nylon fuel tanks will be subject to the new standards in 2011 and small-volume families will have to meet the new tank permeation standards beginning in 2013. Manufacturers will need to start using EPA-specified procedures starting in 2010, except that equipment certified using carryover data will be allowed to use data collected using procedures specified for compliance in California for model years 2010 and 2011 (see §1054.145).

Fuel tank manufacturers have the primary responsibility to certify to the new emission standard. Equipment manufacturers may make arrangements to take on the certification responsibility if they find that to be to their advantage. If equipment manufacturers notify the fuel tank manufacturer in writing that they commit to certifying the fuel tank, then the fuel tank manufacturer may ship uncertified and unlabeled fuel tanks to the equipment manufacturer. Equipment manufacturers must certify that their fuel tanks meet the new emission standards if they comply using emission credits (whether the fuel tank manufacturer certifies or not), as described in Section VI.F. We are requiring that manufacturers of portable marine fuel tanks certify that their products meet the new permeation standard. This is necessary because portable fuel tanks are not sold to boat builders for installation in a vessel. Therefore, there is no other manufacturer who could be treated as the manufacturer responsible for meeting emission standards that apply to portable marine fuel tanks.

For the purpose of the new fuel tank permeation standards, a fuel cap directly mounted on the fuel tank is considered to be part of the fuel tank. The fuel cap would then be included in the tank permeation standard and test. The cap may optionally be tested separately from the tank and the results combined to determine the total tank permeation rate (see §1060.521). Cap manufacturers could also test their caps and certify them separately to the 1.5 $g/m^2/day$ permeation standard. Alternatively, manufacturers may use a default cap permeation rate as described in Section IV.F.8.

As discussed above, manufacturers have expressed concerns with the long-term durability of known low-permeation elastomers in cold-weather applications. At the same time, manufacturers have commented that existing fuel cap gasket/O-ring materials may degrade in the field within a one-year period (depending on the weather and the fuel characteristics) such that they have excessively high permeation rates, but without leaking liquid fuel. To address this issue, we are allowing manufacturers to treat fuel cap seals on cold-weather equipment as an annual maintenance item. In the case of an in-use evaluation with cold-weather equipment where the manufacturer specified this scheduled maintenance at certification, any elastomeric fuel cap seal more than one year old would be replaced prior to preconditioning the tank for permeation testing. At the same time, it is not certain that low-permeation materials will deteriorate when used for fuel cap seals in cold-weather equipment. We intend to perform testing on fuel cap seals to determine the appropriateness of allowing manufacturers to specify scheduled maintenance to address these concerns. In the event that durable materials are identified, we may remove the provision allowing for this scheduled maintenance for purposes of compliance with fuel tank permeation standards.

(3) Diurnal Emission Standards and Dates

We are promulgating diurnal emission standards for gasoline fuel tanks intended for use in new Marine SI vessels (see §1045.107). We consider three distinct classes of marine fuel tanks: (1) portable marine fuel tanks (used with small outboards); (2) personal watercraft (PWC) fuel tanks; and (3) other installed fuel tanks (including engine-mounted fuel tanks). We believe the new requirements will achieve at least a 50 percent reduction in diurnal emissions from PWC and other installed marine fuel tanks and nearly a 100 percent reduction from portable marine fuel tanks.

For portable fuel tanks, we are adopting a design requirement that the tank remain sealed up to a pressure of 5.0 psi, starting on January 1, 2010 (see §1060.105). We are also requiring that portable fuel tanks continue to be self-sealing when disconnected from an engine. We are requiring manufacturers of portable marine fuel tanks to certify that they meet the new diurnal emission standards. As described above for permeation standards, this certification responsibility may not be delegated to boat builders.

For installed fuel tanks, we are adopting a general diurnal emission standard of 0.40 g/gal/day based on a 25.6-32.2°C temperature profile. The applicable test procedures are described in Section VI.E.3. Manufacturers have expressed concerns that some very large boats stay in the water throughout the boating season and therefore will see a much smaller daily swing in fuel temperatures, which corresponds with a smaller degree of diurnal emissions. We are addressing this concern with an alternative standard and test procedure that will apply only for nontrailerable boats. Using available measurements related to fuel temperatures and emission models to relate temperatures to projected diurnal emission levels, we are adopting an alternative standard of 0.16 g/gal/day based on a 27.6-30.2°C temperature profile for fuel tanks installed in nontrailerable boats. For the purposes of this rule, we are defining a nontrailerable boat as one that is 26.0 feet or more in length, or more than 8.5 feet in width. The length specification is consistent with the U.S. Fish and Wildlife Service definition for "nontrailerable recreational vessels" in 50 CFR 86.12. The width specification is consistent with the width limitation specified in 49 CFR 658.15 by the Federal Motor Carrier Safety Administration for vehicles operating on the National Network.

Manufacturers will likely control diurnal emissions from installed marine fuel tanks either by sealing the fuel system up to 1.0 psi or by using a carbon canister in the vent line. As discussed below, we believe PWC manufacturers will likely seal the fuel tank with a pressure-relief valve while manufacturers of other boats with installed fuel tanks are more likely to use carbon canisters. However, either technology will be acceptable for either kind of installed marine fuel tank as long as every system meets the numerical standard applicable to the specific tank.

Personal watercraft currently use sealed fuel systems for preventing fuel from exiting, or water from entering, the fuel tank during typical operation. These vessels use pressure-relief valves for preventing excessive positive pressure in the fuel system; the pressure to trigger the valve may range from 0.5 to 4.0 psi. Such fuel systems also use a low-pressure vacuum-relief valve to allow the engine to draw fuel from the tank during operation without creating negative pressures in the tank. For personal watercraft, we are implementing the diurnal emission standards beginning with 2010 model year.

Other vessels with installed fuel tanks typically are designed with open vent systems. In their comments, boat builders expressed general support of the feasibility of using carbon canisters on boats. In addition, the marine industry has expressed an interest in developing consensus standards for the installation of carbon canisters in boats. However, they commented that the development of these installation standards will take time and that a phase-in would be needed for an orderly transition to installing diurnal emission controls in their boat models. Therefore, we are giving additional lead time beyond what we specified in the proposal. For fuel tanks installed on a marine engine (such as under-cowl fuel tanks on outboard engines), the diurnal emission standard will apply beginning on July 31, 2011. For other installed fuel tanks we are adopting a phase-in that begins July 31, 2011. In the period from July 31, 2011 through July 31, 2012, 50 percent of the boats produced by each company must meet the diurnal standard described above. Beginning August 1, 2012, all marine fuel tanks and boats must meet the diurnal emission standard.[100]

In addition, the industry expressed concern that there are many small boat builders that may need additional time to become familiar with installation of carbon canisters in their boats. To address this, we will allow small boat builders to make a limited number of boats without diurnal emission controls from July 31, 2011 until July 31, 2013. These allowances would be an alternative to the 50 percent phase-in concept described above. See Section VI.G.2.f for further information about the allowances for small boat builders.

[100] In this context, the date of production means the date on which the fuel tank is installed in the vessel. In the case of boats using outboard engines, it is the date that the fuel tank is installed on the vessel.

If a manufacturer uses a canister-based system to comply with the standard, we are also requiring that manufacturers design their systems not to allow liquid gasoline to reach the canister during refueling or from fuel sloshing or volume expansion (see §1060.105). Exposing carbon to liquid gasoline will significantly degrade its ability to capture and release hydrocarbon vapors. Currently, industry consensus standards in ABYC H-24 to some extent address spillage during refueling and due to fuel expansion.[101] However, under these guidelines, the refueling "blow back" test is only for a partial fill and does not necessarily prevent fuel from spilling out the vent line (where a canister would likely be installed) during refueling. In addition, although ABYC recommends that a fuel system be designed to contain 5 percent fuel expansion, the actual requirement can be met by the manufacturer by simply lowering the fuel tank capacity rating without designing the fuel system to prevent overfilling. A system that meets the current ABYC requirements in this manner would not adequately demonstrate that liquid fuel will not reach the carbon canister. However, ABYC commented that it intends to revisit its standards to include proper canister installation instructions and an improved fuel spillage performance test. One example of an approach to protect the canister from exposure to liquid gasoline is a design in which the canister is mounted higher than the fuel level and a small orifice or a float valve is installed in the vent line to stop the flow of liquid gasoline to the canister.

Fuel tank manufacturers have the primary responsibility to certify to the new diurnal emission standard. Equipment manufacturers, canister manufacturers, or system integrators may alternatively make arrangements to take on the certification responsibility. If another party notifies the fuel tank manufacturer in writing that it commits to certifying the product, then the fuel tank manufacturer may ship uncertified and unlabeled fuel tanks. We are requiring that manufacturers of portable marine fuel tanks certify that their products meet the new permeation standard. This is necessary because portable fuel tanks are not sold to boat builders for installation in a vessel. Therefore, there is no other manufacturer who could be treated as the manufacturer responsible for meeting emission standards that apply to portable marine fuel tanks.

We are requiring that manufacturers meet certain specifications with their fuel tank caps, including requirements to tether the cap to the equipment and to design the cap to provide visual, audible, or other physical feedback when the vapor seal is established.

Any increase in fuel temperature resulting from engine operation will cause a potential for fuel tank vapor emissions that are generated in a manner similar to fuel tank diurnal emissions. We are therefore not allowing manufacturers to disable their approaches for controlling diurnal emissions during engine operation (see §1060.105). This will ensure that any running loss emissions that would otherwise occur will be controlled to a comparable degree as diurnal emissions.

Although we are not finalizing diurnal emission standards for Small SI equipment, we are allowing manufacturers the option of using the SHED-based procedures and standards adopted by California ARB for nonhandheld Small SI equipment. We proposed to adopt this provision only on an interim basis to allow for a transition to EPA's standards; however, as recommended by commenters, we are adopting this as a permanent provision. Under this approach, the evaporative emission test would be for the whole equipment rather than the individual

[101] American Boat and Yacht Council, "Standards and Technical Information Reports for Small Craft; H-24 Gasoline Fuel Systems," July, 2007.

components. The SHED-based approach might allow manufacturers to use fuel tanks or fuel lines with emission levels above the component standards, but we believe the overall emission control (including control of diurnal emissions) from SHED-certified systems will be at least as great as we would achieve from requiring manufacturers to comply with the separate permeation standards. We are therefore incorporating the California ARB SHED procedure by reference and allow for certification using those procedures.

(4) Diffusion Standards and Dates

Diffusion emissions occur when vapor escapes the fuel tank through an opening as a result of random molecular motion, independent of changing temperature. Diffusion emissions can be easily controlled by venting fuel tanks in a way that forces fuel vapors to go through a long, narrow path to escape.

We did not propose diffusion standards for handheld equipment or for marine vessels. Handheld equipment use fuel caps that are either sealed or have tortuous venting pathways to prevent fuel from spilling during operation. We believe these fuel cap designs limit diffusion emissions sufficiently so that we do not need to establish a separate diffusion standard. For marine vessels, we believe the diurnal emission standard will lead manufacturers to adopt technologies that automatically limit diffusion losses, so they will also control diffusion emissions without a separate standard.

We are not finalizing the proposed diffusion standards for nonhandheld Small SI equipment. As described below, one of the design options specified in the proposal for controlling running loss emissions was an open vent system with limits on fuel temperature increases during operation. That approach would be effective for limiting running losses, but diffusion emissions could occur through the open vent. However, we believe all the remaining design options for controlling running loss emissions will effectively control diffusion emissions because there will be no direct path for vapor to escape through diffusion. A separate diffusion standard would therefore be redundant.

(5) Running Loss Emission Standards and Dates

We are establishing standards to control running loss emissions from nonhandheld Small SI equipment beginning in the same year as the Phase 3 exhaust emission standards—2012 for Class I engines and 2011 for Class II engines (see §1060.104). Equipment manufacturers will need to certify that their equipment models meet the new running loss requirements since component certification is not practical.

We have measured fuel temperatures and found that some types of equipment experience significant fuel heating during engine operation. This was especially true for fuel tanks mounted on or near the engine. This occurs in many types of Small SI equipment.

It is very difficult to define a measurement procedure to consistently and accurately quantify running losses. Also, a performance standard with such a procedure introduces a challenging testing requirement for hundreds of small-volume equipment manufacturers. Moreover, we believe there are several different design approaches that will reliably and effectively control running losses. We are therefore not controlling running losses using the conventional approach of establishing a procedure to measure running losses and adopting a corresponding emission standard. Manufacturers can choose from one of the following approaches to demonstrate control of running loss emissions:

- Vent running loss fuel vapors from the fuel tank to the engine's intake manifold in a way that burns the fuel vapors in the engine instead of venting them to the atmosphere. The use of an actively purged carbon canister would qualify under this approach.
- Use a sealed fuel tank. A fuel bladder could be used to minimize fuel vapor volume in a sealed fuel tank without increasing tank pressure.
- Use a system with an approved executive order from the California Air Resources Board. This might involve a design in which a fuel cap is fitted with a small carbon canister and mounted on a tank that is not exposed to excessive engine heat.

In the NPRM, we proposed another running loss design option whereby manufacturers could demonstrate, through testing, that the fuel temperature in the tank does not increase by more than 8°C during normal operation. Manufacturers commented that the temperature testing associated with this design option was too complex, the temperature limit was too low, and the associated diffusion requirements were infeasible. In later conversations, industry stated that these objections were significant enough that they were confident they would never use the temperature design option; we are therefore removing this approach from the final rule.

We believe any of the above approaches will ensure that manufacturers will be substantially controlling running losses, either by preventing the vapors from escaping the fuel tank or by directing the flow of running loss vapors to prevent them from escaping to the atmosphere. While none of these approaches are expected to require extensive design changes or lead time, any manufacturer choosing the option to vent running loss fuel vapors into the engine's intake manifold will need to make this change in coordination with the overall engine design. As a result, we believe it is appropriate to align the timing of the running loss standards with the introduction of the Phase 3 standards.

We are not applying the running loss requirements to handheld Small SI engines. We believe running loss emission standards should not apply to handheld engines at this time because the likely approach for controlling running losses could affect the manufacturers' ability to meet the current exhaust emission standards. As described above, we are not changing the exhaust emission standards for handheld engines in this rulemaking. In addition, there are some technical challenges that will require further investigation. For example, the compact nature of the equipment makes it harder to isolate the fuel tank from the engine and the multi-positional nature of the operation may prevent a reliable means of venting fuel vapors into the intake manifold while the engine is running.

We are also not applying the running loss requirements to Marine SI engines. Installed marine fuel tanks are generally not mounted near the engine or other heat sources so running losses should be very low. A possible exception to this is for personal watercraft or other small boats where the fuel tank may be closer to the engine. However, under the new standard for controlling diurnal emissions, we expect that PWC manufacturers will design their fuel tanks to stay pressurized up to 1 psi. This will also help to control running loss emissions. For other applications, the use of a carbon canister for controlling diurnal emissions will also limit the potential for running loss vapors to escape to the atmosphere.

(6) Requirements Related to Refueling

Refueling spitback and spillage emissions represent a substantial additional amount of fuel evaporation that contributes to overall emissions from equipment with gasoline-fueled engines. We are not adopting measurement procedures with corresponding emission standards to address these emission sources. However, we believe equipment manufacturers can take significant steps to address these refueling issues by designing their equipment based on sound practices. For example, designing a marine filler neck with a horizontal segment near the fuel inlet will almost inevitably lead to high levels of spillage since fuel flow will often reach the nozzle, leading to substantial fuel flow out of the fuel system. Maintaining a vertically angled orientation of the filler neck will allow the fuel to flow back into the filler neck and into the tank after the nozzle shuts off. Designing fuel systems for automatic shutoff would also prevent this.

For Small SI equipment, designing fuel inlets that are readily accessible and large enough to see the rising fuel level (either through the tank wall or the fuel inlet) will substantially reduce accidental spillage during refueling. We are therefore requiring that equipment manufacturers design and build their equipment such that operators could reasonably be expected to fill the fuel tank without spitback or spillage during the refueling event (see §1060.101). This new requirement mirrors the following requirement recently adopted with respect to portable fuel containers (72 FR 8428, February, 26, 2007):

> You are required to design your portable fuel containers to minimize spillage during refueling to the extent practical. This requires that you use good engineering judgment to avoid designs that will make it difficult to refuel typical vehicle and equipment designs without spillage. (40 CFR 59.611(c)(3))

While the final requirement is not as objective and quantifiable as the other standards and requirements we are adopting, we believe this is important, both to set a requirement for manufacturers in designing their products and to give EPA the ability to require manufacturers to select designs that are consistent with good engineering practice regarding effective refueling strategies. To the extent that equipment manufacturers and boat builders certify their products to emission standards, they will need to describe how they meet this refueling-related requirement in their application for certification (see §1060.202). If boat builders rely on certified components instead of applying for certification, they will need to keep records describing how they meet this refueling-related requirement (see §1060.210); Section VI.F describes how such companies can meet certification requirements without applying for a certificate.

Spitback and spillage are a particular concern for gasoline-fueled boats. Marine operators have reported that relatively large quantities of gasoline are released into the marina environment during refueling events. The American Boat and Yacht Council (ABYC) has a procedure in place to define a standard practice to address refueling. However, this procedure calls for testing by refueling up to a 75 percent fill level at a nominal flow rate of 5 gallons per minute. This procedure is not consistent with prevailing practices and is clearly not effective in preventing spills. We believe the most effective means of addressing this problem is for ABYC to revise their test procedure to reflect current practices and adopt a standard that would establish appropriate designs for preventing refueling emissions. ABYC and several boat builders announced after the proposal that they have initiated a process to work toward this outcome. The estimated time frame is to have the information and product testing in place to be able to implement these industry standards by 2012.

A variety of technological solutions are available to address spitback and spillage from marine vessels. The simplest will be a system similar to that used on cars. A small-diameter tube could run along the filler neck from the top of the tank to a point near the top of the filler neck. Once liquid fuel reaches the opening of the filler neck and the extra tube, the fuel goes faster up the small-diameter tube and triggers automatic shutoff before the fuel climbs up the filler neck. This design depends on operators using the equipment properly and may not be fully effective, for example, with long filler necks and low refueling rates. An alternative design involves a snug fit between the nozzle's spout and the filler neck, which allows for a tube to run from a point inside the tank (at any predetermined level) directly to the shutoff venturi on the spout. The pressure change from the liquid fuel in the tank reaching the tube's opening triggers automatic shutoff of the nozzle. This system prevents overflowing fuel without depending on the user. These are two of several possible configurations to address fuel spillage from marine vessels.

It is very likely that any effective design for preventing refueling losses would depend on a standardized nozzle geometry for interfacing with the filler neck. Although they have indicated that they are working to address refueling spillage, ABYC does not have the capability to regulate nozzle geometries. Therefore, as described in the proposal, we will require marina operators to transition to standardized nozzles. We are specifying that marine nozzles must have (1) a nominal spout diameter of 0.824 inches, (2) nominal placement of an aspirator hole 0.67 inches from the terminal end of the spout, (3) a straight segment for at least 2.5 inches at the end of the spout, and (4) a spring (if used) that terminates at least 3.0 inches from the end of the spout. These specifications are consistent with the products currently used for refueling motor vehicles. We therefore expect no incompatibilities for vessels that may get fuel at a marina or at a roadside refueling station. These nozzles will also cost no more than other nozzles that would have been available without this regulation. Rather than specifying a date certain by which marinas would need to convert their nozzles, we believe it is appropriate simply to specify that marinas start using compliant nozzles for any new construction or new replacement nozzles. We expect this to result in widespread use of standardized nozzles by 2012, when ABYC expects to have their refueling procedures and specifications in place. To the extent that boat builders start implementing refueling controls, we would expect market forces to accelerate the turnover to standardized nozzles. Depending on the designs selected for preventing refueling losses from vessels, we may need to also consider a maximum flow rate for marine refueling events. We understand that such a limit would need to be higher than 10 gallons per minute (the current requirement for motor vehicles), but a higher limit may be necessary to ensure that refueling controls work properly. We will continue to work with manufacturers to be aware of the need for any further standardization in fuel supply to enable their designs for controlling emissions.

(7) Summary Table of Final Evaporative Emission Standards

Table VI-1 summarizes the new standards and implementation dates discussed above for evaporative emissions from Small SI equipment and Marine SI vessels. Where a standard does not apply to a given class of equipment, "NA" is used in the table to indicate "not applicable."

Table VI-1: Final Evaporative Emission Standards and Implementation Dates

Standard/Category	Fuel Line Permeation	Tank Permeation	Diurnal	Running Loss
Standard level	15 $g/m^2/day$	1.5 $g/m^2/day$	0.40 g/gal/day	Design standard
Handheld	Model year 2012[a,b]	Model year 2009-2013[c]	NA	NA
Class I	January 1, 2009	Model year 2012	NA	Model year 2012
Class II	January 1, 2009	Model year 2011	NA	Model year 2011
Portable tanks	January 1, 2009[d]	January 1, 2011	January 1, 2010[e]	NA
Personal watercraft	January 1, 2009	Model year 2011	Model year 2010	NA
Other vessels with installed tanks	January 1, 2009[d]	Model year 2012	July 31, 2011[f,g]	NA

[a] 2013 for small-volume families not used in cold-weather equipment.
[b] A separate set of declining fuel line permeation standards applies for cold-weather equipment from 2012 through 2016.
[c] 2009 for families certified in California, 2013 for small-volume families, 2011 for structurally integrated nylon fuel tanks, and 2010 for remaining families.
[d] January 1, 2011 for primer bulbs. Phase-in for under-cowl fuel lines on outboard engines, by length: 30% in 2010, 60% in 2011, 90% in 2012-2014, 100% in 2015.
[e] Design standard.
[f] Fuel tanks installed in nontrailerable boats (≥ 26 ft. in length or > 8.5 ft. in width) may meet a standard of 0.16 g/gal/day over an alternative test cycle.
[g] See §1045.625 for allowances to delay implementation of the diurnal standard for a limited number of vessels over the first two years.

D. Emission Credit Programs

A common feature of emission control programs for motor vehicles and nonroad engines and equipment is an emission credit program that allows manufacturers to generate emission credits based on certified emission levels for engine families that are more stringent than the standard. See Section VII.C.5 of the preamble to the proposed rule for background information and general provisions related to emission credit programs.

We believe it is appropriate to consider compliance based on emission credits relative to fuel tank permeation standards. As described above, the emission standards apply to the fuel tanks directly, such that we generally expect component manufacturers to certify their products. However, we believe it is best to avoid placing the responsibility for demonstrating a proper emission credit balance on component manufacturers for three main reasons. First, it is in many cases not clear whether these components will be produced for one type of application or another. Component manufacturers might therefore be selling similar products into different applications that are subject to different standards–or no standards at all. Component manufacturers may or may not know in which application their products will be used. Second, there will be situations in which equipment manufacturers and boat builders take on the responsibility for certifying components. This may be the result of an arrangement with the component manufacturer, or equipment manufacturers and boat builders might build their own fuel tanks. We believe it will be much more difficult to manage an emission credit program in which manufacturers at different places in the manufacturing chain will be keeping credit balances. There will also be a significant risk of double-counting of emission credits. Third, most component manufacturers will be in a position to use credits or generate credits, but not both. Equipment manufacturers and boat builders are more likely to be in a position where they can keep an internal balance of generating and using credits to meet applicable requirements. Our experience with other programs leads us to believe that an emission credit program that depends on trading is not likely to be successful.

We are therefore promulgating emission credit provisions in which equipment manufacturers and boat builders keep a balance of credits for their product line. Equipment manufacturers and boat builders choosing to comply based on emission credits will need to certify all their products that either generate or use emission credits. Fuel tank manufacturers will be able to produce their fuel tanks with emission levels above or below applicable emission standards but will not be able to generate emission credits and will not need to maintain an accounting to demonstrate a balance of emission credits. Small SI engine manufacturers that provide a complete fuel system may also participate in the fuel tank credit program.

(1) Averaging, Banking, and Trading for Small SI Equipment and Marine SI Vessels

We are establishing averaging, banking, and trading (ABT) provisions for fuel tank permeation from Small SI equipment and Marine SI vessels (see subpart H in parts 1045 and 1054).

We are aware of certain control technologies that will allow manufacturers to produce fuel tanks that reduce emissions more effectively than we are requiring. These technologies may not be feasible or practical in all applications, but we are allowing equipment manufacturers using such low-emission technologies to generate emission credits. In other cases, an equipment manufacturer may want, or need, to use emission credits that will allow for fuel tanks with permeation rates above the applicable standards. Equipment manufacturers can quantify positive or negative emission credits by using the Family Emission Limit (FEL) to define the applicable emission level, then factoring in internal surface area, sales volumes, and useful life to calculate a credit total. This FEL would be established by the tank certifier (generally the fuel tank manufacturer) and would be based on permeation testing done either by the component manufacturer or the equipment or vessel manufacturer. Through averaging, these emission credits could be used by the same equipment or vessel manufacturer to offset other fuel tanks in the same model year that do not have control technologies that control emissions to the level of the standard. Through banking, such an equipment manufacturer could use the emission credits in later model years to offset high-emitting fuel tanks. The emission credits could also be traded to another equipment manufacturer to offset that company’s high-emitting fuel tanks.

We believe an ABT program is potentially very advantageous for fuel tanks because of the wide variety of tank designs. The geometry, materials, production volumes, and market dynamics for some fuel tanks are well suited to applying emission controls, but other fuel tanks pose a bigger challenge. The new emission credit program allows us to set a single standard that applies broadly without dictating that all fuel tanks be converted to low-permeation technology at the same time.

Emission credits earned under the evaporative emission ABT program will have an indefinite credit life with no discounting. We consider these emission credits to be part of the overall program for complying with the new standards. Given that we may consider further reductions beyond these standards in the future, we believe it will be important to assess the evaporative ABT credit situation that exists at the time any further standards are considered. We will set such future emission standards based on the statutory direction that emission standards must represent the greatest degree of emission reduction 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 the standards adopted in this rule for complying with more stringent future standards, we may need to adopt emission standards at more stringent levels or with an earlier start date than we would absent the continued use of existing emission credits, depending on the level of emission credit banks. Alternatively, we could adopt future standards without allowing the use of existing emission credits, or we could place limits on the amount of credits a manufacturer could use.

We are not allowing manufacturers to generate emission credits by using metal fuel tanks. These tanks will have permeation rates well below the standard, but there is extensive use of metal tanks today, so it would be difficult to allow these emission credits without undercutting the stringency of the standard and the expected emission reductions from the standard.

Within an ABT program, manufacturers are allowed to use credits only within a defined averaging set. For the evaporative emission ABT program, we are not allowing the exchange of emission credits between Small SI equipment and Marine SI vessels. The new standards are intended to be technology-forcing for each of these equipment categories. We are concerned that cross-trading may allow marginal credits in one area to hamper technological advances in another area. For Small SI equipment, we will not allow credit exchanges between handheld and nonhandheld equipment. For handheld equipment, we will allow credit exchanges between Class III, Class IV and Class V equipment. For nonhandheld equipment, we will allow credit exchanges between Class I and Class II equipment. For Marine SI vessels, we will allow credit exchanges between all types of vessels, except those using portable marine fuel tanks which, as noted below, are not included in the ABT program.

We are requiring portable marine fuel tanks to meet emission standards without an emission credit program. Emission control technologies and marketing related to portable marine fuel tanks are quite different than for installed tanks. Most, if not all, portable fuel tanks are made using high-density polyethylene in a blow-molding process. The control technologies for these tanks are relatively straightforward and readily available so we do not anticipate that these companies will need emission credits to meet the new standards. In addition, because these fuel tanks are not installed in vessels that are subject to emission standards, the fuel tank manufacturer will need to take on the responsibility for certification. As a result, we will treat these portable fuel tank manufacturers as both the component manufacturer and the equipment manufacturer with respect to their portable fuel tanks.

In the early years of the ABT program we are not establishing an FEL cap. This will give manufacturers additional time to use uncontrolled fuel tanks, primarily in small-volume applications, until they can convert their full product lines to having fuel tanks with permeation control. We are setting an FEL cap of 5.0 g/m^2/day (8.3 g/m^2/day if tested at 40°C) starting a few years after implementing the tank permeation standards. For Class II equipment and personal watercraft, the FEL cap will begin in 2014. For Class I equipment and other installed marine fuel tanks, the FEL cap will begin in 2015. For handheld equipment, the FEL cap will begin in 2015. (See §1045.107 and §1054.110.) For Small SI equipment qualifying as small-volume emission families, we are setting an FEL cap of 8.0 g/m^2/day (13.3 g/m^2/day if tested at

40°C). This is generally limited to equipment models where the manufacturer produces no more than 5,000 units with a given fuel tank design. The purpose of the FEL cap will be to prevent the long-term production of fuel tanks with no permeation control while still providing the regulatory flexibility associated with emission credit programs.

Evaporative emission credits under the tank permeation standards will be calculated using the following equation: credits [grams] = (Standard – FEL) × useful life [years] × 365 days/year × inside surface area [m^2]. Both the standard and the FEL are in units of g/m^2/day based on testing at 28°C.

As discussed earlier, we are establishing an alternative standard for tank permeation testing performed at 40°C of 2.5 g/m^2/day. Because permeation is higher at this temperature than the primary test temperature, emissions credits and debits calculated at this test temperature will be expected to be higher as well. When determining credits for a tank certified to the alternative standard, manufacturers will use the alternative standard in the credit equation. Plus, we are requiring that credits and debits that are calculated be adjusted using a multiplicative factor of 0.60 to account for the effect of temperature.

We are also allowing handheld equipment manufacturers to earn credits for equipment using fuel tanks certified earlier than required. As noted in Section VI.D.3 below, manufacturers of nonhandheld equipment and Marine SI vessels can also be rewarded for introducing products that comply with evaporative standards earlier than required.

(2) Other Evaporative Sources

We are not promulgating an emission credit program for other evaporative sources. We believe technologies are readily available to meet the applicable standards for fuel line permeation and diurnal emissions (see Section VI.H.). The exception to this is for fuel lines on cold-weather equipment and under-cowl fuel lines on outboard engines, as discussed above in Section VI.C.1, where we are adopting temporary averaging provisions (see §1045.112 and §1054.145). In addition, the diurnal emission standards for portable marine fuel tanks and PWC fuel tanks are largely based on existing technology so any meaningful emission credit program with the new standards would result in windfall credits. The running loss standard is not based on emission measurements, and refueling-related requirements are based on design specifications only, so it is not appropriate or even possible to calculate emission credits.

(3) Early-Allowance Programs

In some cases manufacturers may be able to meet the new emission standards earlier than we are requiring. We are adopting provisions for equipment manufacturers using low-emission evaporative systems early to generate allowances before the standards apply. These early allowances could be used for a limited time after the implementation date of the standards to sell equipment or fuel tanks that have emissions above the standards. We are establishing two types of allowances. The first is for Small SI nonhandheld equipment as a whole where for every year a piece of equipment is certified early, another piece of equipment could delay complying with the new standards by an equal time period beyond the implementation date. The second is similar but is just for the fuel tank rather than the whole equipment (nonhandheld Small SI or Marine SI). Equipment or fuel tanks certified for purposes of generating early allowances would need to be certified with EPA and will be subject to all applicable requirements. Manufacturers will be required to report to EPA the number of early allowances generated under these programs and how the allowances are used. These allowances are similar to the emission credit program elements described above but they are based on counting compliant products rather than calculating emission credits. Establishing appropriate credit calculations would be difficult because the early compliance is in some cases based on products meeting different standards using different procedures.

(a) Nonhandheld Small SI Equipment

Many Small SI equipment manufacturers are currently certifying products to evaporative emission standards in California. The purpose of the early-allowance program is to provide an incentive for manufacturers to begin selling low-emission products nationwide. We are providing allowances to manufacturers for equipment meeting the California evaporative emission standards that are sold in the United States outside of California and are therefore not subject to California's emission standards. Manufacturers will need to have California certificates for these equipment types. (See §1054.145.)

Allowances could be earned in any year before 2012 for Class I equipment and before 2011 for Class II equipment. The allowances may be used through the 2014 model year for Class I equipment and through the 2013 model year for Class II equipment. Allowances cannot be traded between Class I and Class II equipment. To keep this program simple, we are not adjusting the allowances based on the anticipated emission rates from the equipment. Therefore, we believe it is necessary to at least distinguish between Class I and Class II equipment.

(b) Fuel Tanks

We are also providing an early-allowance program for nonhandheld Small SI equipment for fuel tanks (see §1054.145). This program is similar to the program described above for equipment allowances, except that it will be for fuel tanks only. We will accept California-certified configurations. Allowances could be earned prior to 2011 for Class II equipment and prior to 2012 for Class I equipment; allowances could be used through 2013 for Class II equipment and through 2014 for Class I equipment. Allowances will not be exchangeable between Class I and Class II equipment.

The early-allowance program for marine fuel tanks is similar except that there are no California standards for these tanks (see §1045.145). Manufacturers certifying early to the new fuel tank permeation standards will be able to earn allowances that they could use to offset high-emitting fuel tanks after the new standards go into place. The early-allowance program would apply to all marine fuel tanks, including portable fuel tanks, personal watercraft, and other installed fuel tanks. For portable fuel tanks, the tank manufacturer would earn the allowances, whereas the vessel manufacturer would earn the allowances for personal watercraft and other installed fuel tanks. We are not allowing the cross-trading of allowances between portable fuel tanks, personal watercraft, and other installed fuel tanks. Each of these categories includes significantly different tank sizes and installed tanks have different implementation dates and are expected to use different permeation control technology. For portable fuel tanks and personal watercraft, allowances could be earned prior to 2011 and may be used through the 2013 model year. For other installed tanks, allowances could be earned prior to 2012 and used through the 2014 model year.

E. Testing Requirements

Compliance with the evaporative emission standards is determined by following specific testing procedures. This section describes the new test procedures for measuring fuel line permeation, fuel tank permeation, and diurnal emissions. As discussed in Section VI.F.8, we are adopting design-based certification as an alternative to testing for certain standards.

(1) Fuel Line Permeation Testing Procedures

We are requiring that fuel line permeation be measured at a temperature of 23±2°C using a weight-loss method similar to that specified in SAE J30 and J1527 recommended practices (see §1060.515). [102, 103] We are making two modifications to the SAE recommended practice. The first modification is for the test fuel to contain ethanol; the second modification is to require preconditioning of the fuel line through a fuel soak. These modifications are described below and are consistent with our current requirements for recreational vehicles.

(a) Test Fuel

The recommended practice in SAE J30 and J1527 is to use ASTM Fuel C (defined in ASTM D471-98) as a test fuel. We are requiring the use of a test fuel containing 10 percent ethanol. We believe the test fuel must contain ethanol because it is commonly blended into in-use gasoline and because ethanol substantially increases permeation rates for many materials.

Specifically, we are requiring the use of a test fuel consisting of an ASTM Fuel C blended with ethanol such that the blended fuel contains 10 percent ethanol by volume (CE10).[104] Manufacturers have expressed support for this test fuel because it is more consistent than testing with gasoline and because it is widely used today by industry for permeation testing. In addition, most of the data used to develop the new fuel line permeation standards were collected on this test fuel. This fuel is allowed today as one of two test fuels for measuring permeation from fuel lines under the recreational vehicle standards. California ARB also specifies Fuel CE10 as the test for fuel line permeation measurements with small offroad engines.

One exception is for fuel lines on cold-weather handheld products. In this case, the standard is based on a test fuel of IE10, which is EPA certification gasoline blended with 10 percent ethanol by volume.

We are finalizing specifications for fuel ethanol blended into test gasoline based on standard industry practice. Specifically, we are incorporating by reference ASTM D4806-07, which specifies, among other things, acceptable denaturants and maximum water content.[105]

---

[102] Society of Automotive Engineers Surface Vehicle Standard, "Fuel and Oil Hoses," SAE J30, June 1998 (Docket EPA-HQ-OAR-2004-0008-0176).
[103] SAE Recommended Practice J1527, "Marine Fuel Hoses,"1993, (Docket EPA-HQ-OAR-2004-0008-0195-0177).
[104] ASTM Fuel C is a mix of equal parts toluene and isooctane. We refer to gasoline blended with ethanol as E10.
[105] ASTM International, "Standard Specification for Denatured Fuel Ethanol for Blending with Gasoline for Use as Automotive Spark-Ignition Engine Fuel, ASTM D4806-07, 2007.

(b) Preconditioning Soak

The second difference from weight-loss procedures in SAE practices is in fuel line preconditioning. We believe the fuel line should be preconditioned with an initial fuel fill followed by a long enough soak to ensure that the permeation rate has stabilized. Manufacturers may choose one of two alternative specifications for the soak period—either four weeks at 43 ± 5°C or eight weeks at 23 ± 5°C. Either of these approaches should adequately stabilize permeation rates for most materials. However, manufacturers may need a longer soak period to stabilize the permeation rate for certain fuel line designs, consistent with good engineering judgment. For instance, a thick-walled fuel line may take longer to reach a stable permeation rate than a thinner-walled fuel line. After this fuel soak, the fuel reservoir and fuel line must be drained and immediately refilled with fresh test fuel prior to the weight-loss test.

(c) Alternative Approaches

California's regulations, in CCR 2754(a)(1)(C), reference SAE J1737 as the method for measuring permeation from fuel lines. These recommended procedures use a recirculation technique whereby nitrogen flows over the test sample to carry the permeating vapors to adsorption canisters. Permeation is determined based on the weight change of the canisters. This method was intended to provide a greater level of sensitivity than the weight loss method specified in SAE J30 and J1527 so that lower rates of permeation could be measured. As an alternative, we will accept permeation data collected using the methodology in SAE J1737 under §1060.505(c).[106] If this alternative is used, the same test fuel, test temperature, and preconditioning period must be used as for the primary (weight-loss) test method.

We are allowing permeation measurements using alternative equipment and procedures that provide equivalent results (see §1060.505). To use these alternative methods, manufacturers will first need to get our approval. An example of an alternative approach would be enclosure-type testing such as in 40 CFR part 86. In the case of enclosure-type testing, the manufacturer would need to demonstrate that it is correctly accounting for the ethanol content in the fuel. Note that the test fuel, test temperatures, and preconditioning soak described above will still apply. Because permeation increases with temperature we will accept data collected at higher temperatures (greater than 23°C) for a demonstration of compliance.

For portable marine fuel tanks, the fuel line assembly from the engine to the fuel tank typically includes two sections of fuel line with a primer bulb in-between and quick-connect assemblies on either end. We are adopting a provision to allow manufacturers to test a full assembly as a single fuel line to simplify testing for these fuel line assemblies (see §1060.102). This gives manufacturers the flexibility to use a variety of materials as needed for performance reasons while meeting the fuel line permeation standard for the fully assembled product. Measured values will be based on the total measured permeation divided by the total internal surface area of the fuel line assembly. However, where it is impractical to calculate the internal surface area of individual parts of the assembly, such as a primer bulb, we will allow a simplified calculation that treats the full assembly as a straight fuel line. This small inaccuracy will cause reported emission levels (in $g/m^2/day$) to be slightly higher so it will not jeopardize a manufacturer's effort to demonstrate compliance with the applicable standard.

[106] SAE Recommended Practice J1737, "Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation,"1997, (Docket EPA-HQ-OAR-2004-0008-0178).

(2) Fuel Tank Permeation Testing Procedures

The new test procedure for fuel tank permeation includes preconditioning, durability simulation, and a weight-loss permeation test (see §1060.520). The preconditioning and the durability testing may be conducted simultaneously; manufacturers must put the tank through durability testing while the tank is undergoing its preconditioning fuel soak to reach a stabilized permeation level.

(a) Test Fuel

Similar to the new fuel line testing procedures, we are requiring the use of a test fuel containing 10 percent ethanol to help ensure in-use emission reductions with the full range of in-use fuels. Specifically, we are requiring the use of IE10 as the test fuel which is made up of 90 percent certification gasoline and 10 percent ethanol by volume. This is the same test fuel specified for testing fuel tanks for recreational vehicles. In addition, IE10 is representative of in-use test fuels. We are allowing Fuel CE10 as an alternative test fuel. Data in Chapter 5 of the Final RIA suggest that fuel tank permeation tends to be somewhat higher on CE10 than IE10, so testing on CE10 should be an acceptable demonstration of compliance.

We are finalizing specifications for fuel ethanol blended into test gasoline based on standard industry practice. Specifically, we are incorporating by reference ASTM D4806-07 which specifies, among other things, acceptable denaturants and maximum water content.

(b) Preconditioning Fuel Soak

Before permeation testing, the fuel tank must be preconditioned by allowing it to sit with fuel inside until the hydrocarbon permeation rate has stabilized. Under this step, we are requiring that the fuel tank be filled with test fuel and soaked—either for 20 weeks at 28±5°C or for 10 weeks at 43±5°C. Either of these approaches should adequately stabilize permeation rates for most materials. However, manufacturers may need a longer soak period to stabilize the permeation rate for certain fuel tank designs, consistent with good engineering judgment.

The tank will have to be sealed during this fuel soak and any components that are directly mounted to the fuel tank, such as a fuel cap, must be attached. Other openings, such as fittings for fuel lines, openings for grommets, or petcocks, will be sealed with impermeable plugs (or left unmachined so there is no hole in the tested configuration). In addition, if there is a vent path through the fuel cap, that vent path may be sealed. Alternatively, the opening could be sealed for testing and the fuel cap tested separately for permeation (discussed below). If the fuel cap is not directly mounted on the fuel tank (i.e., the fuel tank is designed to have a separate fill neck between the fuel cap and the tank), the tank may be sealed with something other than a production fuel cap.

If the test fuel is dispensed at a temperature below the soak temperature, it would be possible for the fuel tank to pressurize if the tank were sealed prior to the fuel temperature reaching the soak temperature. In this case, it would be acceptable to allow reasonable time for the test fuel to approach the soak temperature, prior to sealing, to prevent over-pressurization of the fuel tank. To prevent gross evaporation of fuel vapors during this period, the venting of the tank should be no greater than needed to prevent over-pressurization of the fuel tank. The regulation specifies that the fuel tank must be sealed within a maximum of eight hours after refueling. Manufacturers should also take steps to minimize vapor losses during the time that the fuel is warming, such as leaving the fuel cap loosely in place or routing vapors through a vent line.

Manufacturers may do the durability testing described below during the time period specified for preconditioning. The time spent in durability testing may count as preconditioning time as long as ambient temperatures are within the specified limits and the fuel tank has fuel inside the entire time. During the slosh testing, a fuel fill level of 40 percent will be considered acceptable for the fuel soak. Otherwise, we are requiring that the fuel tank be filled to nominal capacity during the fuel soak.

(c) Durability Tests

We are adopting three tests for the evaluation of the durability of fuel tank permeation controls: (1) fuel sloshing; (2) pressure-vacuum cycling; and (3) ultraviolet exposure. The purpose of these deterioration tests is to help ensure that the technology is durable under the wide range of in-use operating conditions. For sloshing, the fuel tank must be filled to 40-50 percent capacity with the specified test fuel fuel and rocked for one million cycles. Pressure-vacuum testing must consist of 10,000 cycles between -0.5 and 2.0 psi with a cycle time of 60 seconds. These two new durability tests are based on draft recommended SAE practice.[107] The third durability test is intended to assess potential impacts of ultraviolet sunlight on the durability of surface treatment. In this test, the tank will be exposed to ultraviolet light wavelength ranging from 300 to 400 nanometers with an intensity of at least 0.40 W-hr/m^2/min on the tank surface for 450 hours. Alternatively, the tank could be exposed to direct natural sunlight for an equivalent period of time.

We do not believe the durability testing requirements are necessary for all fuel tank designs. Therefore, we are excluding metal tanks and other tanks using direct material solutions in the molding process from the durability test procedures. However, these durability procedures will apply to fuel tanks using surface treatments or post-processing barrier coatings as a permeation barrier. We are concerned that improperly applied treatments or coatings may deteriorate. The specified durability demonstrations are necessary to ensure that fuel tanks properly control emissions throughout the useful life.

(d) Weight-loss Test

Following the fuel soak, the fuel tank must be drained and refilled with fresh fuel as described above. The permeation rate from the fuel tanks are determined by comparing mass measurements of the fuel tank over during the test period while ambient temperatures are held at 28 ±2°C. Testing may alternatively be performed at 40±2°C, in which case a higher numerical standard applies.

We received several comments that the test procedure should require daily mass measurements similar to the procedures required by CARB in TP-901. We agree with commenters that making daily recordings of the fuel tank weight is consistent with good engineering practices. These daily mass measurements can be used to determine the stability of

[107] Draft SAE Information Report J1769, "Test Protocol for Evaluation of Long Term Permeation Barrier Durability on Non-Metallic Fuel Tanks," (Docket EPA-HQ-OAR-2004-0008-0195).

the permeation rate of the fuel tank and can help identify if anything unusual is occurring during the test such as a lost seal during testing. The test procedures in TP-901 require that the weight loss test continue until the coefficient of determination (r^2), from a plot of the cumulative daily weight loss versus time for 10 consecutive 24-hour cycles, is 95 percent or greater. (California ARB mistakenly refers to the r^2 value as the correlation coefficient.) We believe this approach gives testing facilities flexibility for basing the length of the test on good engineering judgment rather than a fixed time period. We are therefore adopting this general method of using daily measurements to determine the length of the test, with one modification. The CARB method would require test facilities to make measurements over at least one weekend. We believe weight loss measurements can be suspended for short periods of time without a negative impact on the test. We therefore do not require that the 11 weight loss measurements (including the 0-hour measurement) be on consecutive days, provided that measurements are made on at least five different days of any given seven day period of the test. Measurements must be made at roughly the same time on each test day.

A change in atmospheric pressure over the weeks of testing can affect the accuracy of measured weights for testing due to the buoyancy of the fuel tank. The buoyancy effect on emission measurements is proportional to the volume of the fuel tank, so this procedure is appropriate even for testing very small fuel tanks. To address this we are adopting a procedure in which a reference fuel tank filled with an amount of glass bead or some other inert material such that the weight of the reference tank is approximately the same as the total weight of the test tank. The reference tank is used to zero the scale before measuring the weight of the test tank. This will result in measured and reported values representing the change in mass from permeation losses rather than a comparison of absolute masses. This is similar to an approach in which weighing will determine absolute masses with a mathematical correction to account for the effects of buoyancy. We believe the specified approach is better because it minimizes the possibility of introducing or propagating error.

We are allowing permeation measurements for certification using alternative equipment and procedures that provide equivalent results. To use these alternative methods, manufacturers would first need to get our approval. An example of an alternative weight-loss measurement procedure would be to test the fuel tank in a SHED and determine the permeation by measuring the concentration of hydrocarbons in the enclosure. In the case of SHED testing, the manufacturer would need to demonstrate that it is correctly accounting for the ethanol content in the fuel.

(e) Fuel Cap Permeation Testing

As discussed above, manufacturers have the option to test the fuel cap separately from the tank and combine the results to determine the total tank permeation rate. In this case, the permeation test must be performed as described above except that the fuel cap will be mounted on an impermeable reservoir such as a metal or glass tank. The volume of the test reservoir must be at least one liter to ensure sufficient fuel vapor exposure. We are requiring that the “tank” surface area for calculating the results will be the smallest inside cross sectional area of the opening on which the cap is mounted. The fuel cap will need to be tested in conjunction with a representative gasket. In the case where the vent path is through grooves in the gasket, another gasket of the same material and dimensions, without the vent grooves, may be used. In the case where the vent is through the cap, that vent must be sealed for testing. Alternatively, manufacturers may use the default cap permeation rate described in Section IV.F.8.

Handheld equipment manufacturers commented that fuel caps should be subject to durability testing and recommended that the cap should be subjected to 300 on-off cycles as a durability test.[108] For handheld products, data in the Final RIA suggests that rubber fuel cap seals may contribute a significant portion of the permeation measured in the fuel tank permeation test. We are concerned that a coating used on the gaskets to reduce the measured permeation during the test may wear off during in-use operation. We are therefore adopting this additional durability testing for fuel caps on handheld tanks.

Handheld equipment manufacturers also commented that cold-weather products cannot use existing low permeation rubbers for their seals due to potential dynamic cracking issues at very low temperatures. In addition, materials used today degrade after a year of exposure to fuel containing ethanol. While this does not appear to lead to fuel leakage, data in the Final RIA suggest that this degradation may have a large effect on tank permeation. To address this issue, EPA intends to conduct a technical study of cold-weather fuel cap seals. For this final rule we are adopting an allowance for manufacturers to specify rubber fuel cap seals on cold-weather equipment as maintenance items. These seals could therefore be replaced prior to the fuel preconditioning soak when permeation testing is performed on in-use fuel tanks if the seals are more than one year old. If the technical study or other information reveals that a fuel resistant material or other solution can safely be used in cold-weather applications, we will consider removing the provision allowing manufacturers to identify gasket replacement as a scheduled maintenance item in the application for certification.

(3) Diurnal Emission Testing Procedures

The new test procedure for diurnal emissions from installed marine fuel tanks involves placing the fuel tank in a SHED, varying the fuel temperature over a prescribed profile, and measuring the hydrocarbons escaping from the fuel tank (see §1060.525). The final results are reported in grams per gallon where the grams are the mass of hydrocarbons escaping from the fuel tank over 24 hours and the gallons are the nominal fuel tank capacity. The new test procedure is derived from the automotive evaporative emission test with modifications specific to marine applications.[109]

(a) Temperature Profile

We believe it is appropriate to base diurnal measurements on a summer day with ambient temperatures ranging from 72 to 96 °F (22.2 to 35.6 °C). This temperature profile, which is also used for automotive testing, represents a hot summer day when ground-level ozone formation is most prominent. Due to the thermal mass of the fuel and, in some cases, the inherent insulation provided by the boat hull, the fuel temperatures would cover a narrower range. Data presented in Chapter 5 of the Final RIA suggest that the fuel temperature in an installed marine fuel tank will see a total change of about half the ambient temperature swing. We are therefore adopting a test

[108] "OPEI HHPC Comments on EPA Proposed Phase 3 Rule for HH Fuel Tank Permeation," Outdoor Power Equipment Institute, February 5, 2008.
[109] See 40 CFR part 86, subpart B, for the automotive evaporative emission test procedures.

temperature range of 78 to 90°F (25.6 to 32.2°C) for installed marine fuel tanks. This testing is based on fuel temperature instead of ambient temperature.

We are adopting an alternative, narrower temperature range for fuel tanks installed in nontrailerable boats (≥26 ft. in length or >8.5 ft. in width). Data presented in Chapter 5 of the Final RIA suggest that the fuel temperature swing for a boat stored in the water is about 20 percent of the ambient temperature swing. Based on this relationship, we are adopting an alternative temperature cycle for tanks installed in nontrailerable boats of 81.6 to 86.4°F (27.6 to 30.2°C). This alternative temperature cycle is associated with an alternative standard as described in Section VI.C.3.

Diurnal emission measurements for cars include a three-day temperature cycle to ensure that the carbon canister can hold at least three days of diurnal emissions without substantial escape of hydrocarbon vapors to the atmosphere. For marine vessels using carbon canisters as a strategy for controlling evaporative emissions, we are also requiring a three-day cycle in this final rule. In the automotive test, the canister is loaded and then purged by the engine during a warm-up drive before the first day of testing. We are adopting a different approach for marine vessels because we anticipate that canisters on marine applications will be passively purged. Before the first day of testing, the canister would be loaded to its working capacity and then run over the diurnal test temperature cycle, starting and ending at the lowest temperature, to allow one day of passive purging. The test result would then be based on the highest recorded value during the following three days.

For fuel systems using a sealed system, we believe a three-day test will not be necessary. In this case, the fuel tank would be sealed once the fuel reaches equilibrium at the starting temperature for testing. The SHED would then be purged and the test would consist of a single run through the diurnal temperature cycle. We are establishing this one-day test for the following technologies: sealed systems, sealed systems with a pressure-relief valve, limiting flow orifices, bladder fuel tanks, and sealed fuel tanks with a volume-compensating air bag.

(b) Test Fuel

Consistent with the automotive test procedures, we are specifying a gasoline test fuel with a nominal volatility of 9 psi.[110] We are not requiring that the fuel used in diurnal emission testing include ethanol for two reasons. First, we do not believe that ethanol affects the diurnal emissions or control effectiveness other than the effect that ethanol in the fuel may have on fuel volatility. Second, in many areas of the country, in-use fuels containing ethanol are blended in such a way as to control for ethanol effects in order to meet fuel volatility requirements.

Diurnal emissions from vented systems are a function not only of temperature and fuel volatility, but also of the size of the vapor space in the fuel tank. Consistent with the automotive procedures, we are requiring that the fuel tank be filled at the start of the test to 40 percent of its nominal capacity. Nominal capacity is defined as the fuel tank's volume as specified by the fuel tank manufacturer, using at least two significant figures, based on the maximum volume of fuel the tank can hold with standard refueling techniques. The "permanent" vapor space above a fuel tank that has been filled to capacity should not be considered as part of the fuel tank's nominal capacity.

[110] Volatility is specified based on a procedure known as Reid Vapor Pressure (see ASTM D 323-99a).

(c) Fuel Tank Configuration

The majority of marine fuel tanks are made of plastic. Plastic fuel tanks designed to meet our new standards will still be expected to have some amount of permeation. However, the effect of permeation on the test results should be very small if the test tank was a new model that had not been previously exposed to fuel. For fuel tanks that have reached a stabilized permeation rate (such as testing on in-use tanks), we believe it is appropriate to correct for permeation. The regulation specifies that manufacturers may measure the permeation rate and subtract it from the final diurnal test result. The fuel tank permeation rate would be measured with the established procedure for measuring permeation emissions, except that the fuel for testing (including preconditioning) would be the same as that used for diurnal emission testing and the permeation testing must occur at a nominal ambient temperature of 28°C. This test measurement would have to be made just before the diurnal emission test to ensure that the permeation rate does not change significantly over the course of the diurnal emission measurement. In no case will we allow a permeation correction higher than that corresponding to the applicable permeation standard for a tank with a given inside surface area. Because not correcting for permeation represents the worst-case test result, we will accept data from manufacturers in which no permeation correction is applied.

As with the permeation test procedures, a manufacturer may request EPA approval of an alternative method provided that this method provides measurements that are equivalent to the primary method.

F. Certification and Compliance Provisions

Sections VII and VIII of the preamble to the proposed rule describe several general provisions for certifying emission families and meeting other regulatory requirements. This section notes several particulars for applying these general provisions to evaporative emissions.

Marine vessels do not always include installed fuel systems. Manufacturers of vessels without installed fuel systems do not have the ability to control engine or fuel system design parameters. We are therefore excluding vessels that do not have installed fuel systems from the new standards (see §1045.5). As a result, it is necessary for us to treat manufacturers of uninstalled fuel-system components as the equipment manufacturer with respect to evaporative emission standards. This includes manufacturers of outboard engines (including any fuel lines or fuel tanks produced with the engine), portable fuel tanks, and the fuel line assembly (including fuel line, primer bulb, and connectors).

For ease of reference, Small SI equipment manufacturers, Marine SI boat builders, and manufacturers of portable marine fuel tanks (and associated fuel-system components) are all referred to as equipment manufacturers in this section.

(1) Liability for Certification and Compliance

The new standards for fuel lines and fuel tanks apply to any such components that are used with or intended to be used with Small SI engines or Marine SI engines (see §1060.1 and §1060.601). Section VI.C describes for each standard which manufacturer is expected to certify.

In most cases, nonroad standards apply to the manufacturer of the engine or the manufacturer of the nonroad equipment. Here, the products subject to the standards (fuel lines and fuel tanks) are typically manufactured by a different manufacturer. In most cases the engine manufacturers do not produce complete fuel systems and therefore are not in a position to do all the testing and certification work necessary to cover the whole range of products that will be used. We are therefore providing an arrangement in which manufacturers of fuel-system components are in most cases subject to the standards and are subject to certification and other compliance requirements associated with the applicable standards. We are prohibiting the introduction into commerce of noncompliant fuel-system components that are intended for installation in Small SI equipment or Marine SI vessels unless the component manufacturer either certifies the component or has a contractual arrangement with each equipment manufacturer using its products that the equipment manufacturer will certify those components. As a matter of good practice, any components not intended for installation in Small SI equipment or Marine SI vessels should be labeled accordingly to prevent the possibility of improper installation.

As described in Section VI.D, component manufacturers generally certify their products using measured emission levels showing that the components meet the applicable emission standard. In the case of permeation standards for fuel tanks, component manufacturers may alternatively certify to an FEL above or below the standard. If any fuel tank manufacturer certifies using an FEL, the FEL becomes the emission standard for that emission family for all practical purposes. The fuel tank manufacturer will have the option to certify to an FEL above or below the standard, but will not be required to meet any overall average or maintain a positive balance of credits for their products. This is to facilitate the use of ABT by equipment manufacturers, which must balance their positive and negative credits, as discussed below.

Equipment manufacturers are subject to all the new evaporative emission standards. This applies for the general standards described above with respect to fuel caps, miscellaneous fuel-system components, and refueling (see §1060.101(f)). These standards generally depend on design specifications rather than emission measurements, so we believe it is appropriate to simply deem these products to be certified if they are designed and produced to meet the standards we specify. The equipment manufacturer will also need to keep records of the components used (see §1060.210). This will allow us, by operation of the regulation, to have certified products without requiring the paperwork burden associated with demonstrating compliance with these relatively straightforward specifications. Manufacturers could optionally apply for and receive a certificate of conformity with respect to these general standards, but this is not necessary and we will expect this to be a rare occurrence.

Equipment manufacturers will also be subject to all the new permeation, diurnal, and running loss standards that apply. Equipment manufacturers may comply with requirements related to evaporative emission standards in three different situations. First, equipment manufacturers might install only components certified by the component manufacturer, without using emission credits. In this case all the components must meet the emission standard or have an FEL below the standard. Manufacturers of Marine SI vessels will be subject to the fuel line and fuel tank standards (including diurnal standards), but will be able to satisfy their requirements by using certified components. Such a vessel manufacturer will generally need to use certified components, add an emission label, and follow any applicable emission-related installation instructions to ensure that certified components are properly installed. This is similar to an equipment manufacturer that is required to properly install certified engines in its equipment, except that the equipment manufacturer must meet general design standards and shares the liability for meeting emission standards. We are requiring manufacturers of Small SI equipment to certify with respect to evaporative emission standards even if they use certified components, largely because they are still responsible for running loss requirements.

Second, equipment manufacturers may be required to certify certain components based on contractual arrangements with the manufacturer of those components. In this case, the equipment manufacturer's certification causes the component manufacturer to no longer be subject to the standard. This approach might involve the equipment manufacturer relying on test data from the component manufacturer.   The equipment manufacturer might also be producing its own fuel tanks for installation in its equipment, in which case it will be subject to the standards and all requirements related to certification and compliance. In either case, the equipment manufacturer will take on all the responsibilities associated with certification and compliance with respect to those components.

Third, equipment manufacturers may comply with evaporative emission requirements by using certified components, some of which are certified to an FEL above the standard. The equipment manufacturer would then comply based on emission credits. In this case, the equipment manufacturer takes on all the certification and compliance responsibilities with respect to any fuel tanks that are part of the equipment manufacturer's emission credit calculations. Equipment manufacturers will generally use only certified components for meeting evaporative emission requirements, but they might also hold the certificate for such components. For purposes of certification, equipment manufacturers will not need to submit new test data if they use certified components. Equipment manufacturers must make an annual accounting to demonstrate a net balance of credits for the model year. Under this approach, the fuel tank manufacturer will continue to be subject to the standards for its products and be required to meet the certification and compliance responsibilities related to the standard. However, as in the first option, the fuel tank manufacturer will not be required to meet any averaging requirements or be required to use emissions credits. Where equipment manufacturers use ABT with fuel tanks that have already been certified by the component manufacturer, there would be overlapping certifications between the two parties. We address this by specifying that all parties are responsible for meeting applicable requirements associated with the standards to which they have certified, but if any specific requirement is met by one company, we will consider the requirement to be met for all companies (see §1060.5). For example, either the component manufacturer or the equipment manufacturer could honor warranty claims, but we may hold both companies responsible for the violation if there is a failure to meet warranty obligations.

Similarly, if we find that new equipment is sold without a valid certificate of conformity for the fuel lines or fuel tanks, then the equipment manufacturer and all the affected fuel-system manufacturers subject to the standards will be liable for the noncompliance (see §1060.601).

Liability for recall of noncompliant products will similarly fall to any manufacturer whose product is subject to the standard, as described above. If more than one manufacturer is subject to the standards for a noncompliant product, we will have the discretion to assign recall liability to any one of those manufacturers. In assigning this liability, we will generally consider factors such as which manufacturer has substantial manufacturing responsibility and which manufacturer holds the certificate (see §1060.5). However, we may hold equipment manufacturers liable for recall even if they do not manufacture or certify the defective product.

This will generally be limited to cases where the component manufacturer is unavailable to execute any remedial action. For example, if a foreign component manufacturer discontinues their participation in the U.S. market or a component manufacturer goes out of business, we will turn to the equipment manufacturer.

(2) Regulatory Requirements Related to Certification

The established provisions for implementing exhaust emission standards apply similarly for evaporative emission standards; however, because the control technologies are very different, these requirements require further clarification. For example, scheduled maintenance is an important part of certifying engines to exhaust emission standards. However, there is little or no maintenance involved for the expected technologies for controlling evaporative emissions. The regulations still require manufacturers to identify specified maintenance procedures, if there are any, but there are no specific limitations on the maintenance intervals and there is no distinction for emission-related maintenance. Manufacturers may not do any maintenance during testing for certification. (See §1060.125 and §1060.235.) We also do not expect that emission-related warranty claims will be common, but we are requiring a two-year period for emission-related warranties with respect to evaporative emission controls.

Similarly, we do not expect manufacturers to use evaporative emission control technologies that involve adjustable parameters or auxiliary emission control devices. Technologies that control evaporative emissions are generally passive designs that prevent vapors from escaping, in contrast to the active systems engines use to control exhaust emissions. The regulations state the basic expectation that systems must comply with standards throughout any adjustable range without auxiliary emission control devices, but it is clear that these provisions will not apply to most evaporative systems. We also do not allow emission control strategies that cause or contribute to an unreasonable risk to public health or welfare or that involve defeat devices. While these are additional statutory provisions that are meaningful primarily in the context of controlling exhaust emissions, we are including them for evaporative emissions for completeness (see §1060.101). This also addresses the possibility that future technologies may be different in a way that makes these provisions more meaningful.

The testing specified for certifying fuel systems to the evaporative emission standards includes measurements for evaluating the durability of emission control technologies where appropriate. While we adopted evaporative requirements for recreational vehicles relying on a testing approach that used deterioration factors, we believe it is more appropriate to incorporate the durability testing for each family directly. Therefore, no requirement (or opportunity) exists for generating deterioration factors for any evaporative emission standard.

We are requiring that component manufacturers label the fuel lines, fuel tanks, and other fuel-system components that they certify (see §1060.137). These labels generally identify the manufacturer, the applicable emission standard (or Family Emission Limit), and family identification. We are including a provision to allow manufacturers to use an abbreviated code that would allow for referring to the information filed for certification under the engine family name. Manufacturers may also design their fuel lines to include a continuous stripe or other pattern to help identify the particular type or grade of fuel line. This would be in addition to the other labeling requirements.

Engine or equipment manufacturers must also add an emission control information label to identify the evaporative emission controls (see §1060.135). If engine, equipment, or vessel manufacturers also certify fuel-system components separately, they may include that additional information in a combined label. If the equipment is produced by the same company that certifies the engine for exhaust standards, the emission control information label for the engine may include all the appropriate information related to evaporative emissions.

While we are not adopting specific requirements for manufacturers to evaluate production-line or in-use products, we require that manufacturers set up their own quality plan for evaluating their products to ensure compliance. Also, we may pursue testing of certified products to evaluate compliance with evaporative emission standards (see §1060.301).

(3) Emission Families

To certify equipment or components, manufacturers will first define their emission families. This is generally based on selecting groups of products that have similar emission characteristics throughout the useful life (see §1060.230). For example, fuel tanks could be grouped together if they were made of the same material (including consideration of additives such as pigments, plasticizers, and UV inhibitors that are expected to affect emissions) and the same control technology. For running loss control for nonhandheld Small SI engines and equipment, emission families are based on the selected compliance demonstration. For example, certifying manufacturers may have one emission family for all their products that vent fuel vapors to the engine's air intake system.

The manufacturer selects a single product from the emission family for certification testing. This product will be the one that is most likely to exceed the applicable emission standard. For instance, the "worst-case" fuel tank in a family of monolayer tanks will likely be the tank with the thinnest average wall thickness. For fuel lines or co-extruded fuel tanks with a permeation barrier layer, the worst-case configuration may be the one with the thinnest barrier.

Testing with those products, as specified above, will need to meet applicable emission standards. The manufacturer then sends us an application for certification. After reviewing the information in the application to verify that the manufacturer demonstrates compliance with all applicable requirements, we will issue a certificate of conformity allowing equipment manufacturers to introduce into commerce certified components or equipment.

(4) Compliance Provisions from 40 CFR Part 1068

We are applying the provisions of 40 CFR part 1068 to Small SI and Marine SI engines, equipment, and vessels. This section describes how some of the provisions of part 1068 apply specifically with respect to evaporative emissions.

The provisions of §1068.101 prohibit introducing into commerce new nonroad engines and equipment unless they are covered by a certificate of conformity and labeled appropriately. Section VI.F.1 describes the responsibilities for engine manufacturers, equipment manufacturers, and manufacturers of fuel-system components with respect to the prohibition against introducing uncertified products into commerce. In the case of portable marine fuel tanks and outboard engines, there is no equipment manufacturer so we are treating manufacturers of these items as equipment manufacturers relative to this prohibition.

While engine rebuilding or extensive engine maintenance is commonplace in the context of exhaust emission controls, there is very little analogous servicing related to evaporative emission controls. Nevertheless, it can be expected that individual fuel lines, fuel tanks, or other fuel-system components may be replaced periodically. While the detailed rebuilding provisions of §1068.120 have no meaning for evaporative emission controls, the underlying requirement applies generally. Specifically, if someone is servicing a certified system, there must be a reasonable basis to believe that the modified emission control system will perform at least as well as the original system. We are not imposing any recordkeeping requirements related to maintenance of evaporative emission control systems.

There are many instances where we specify in 40 CFR part 1068, subparts C and D, that engines (and the associated equipment) are exempt from emission standards under certain circumstances, such as for testing, national security, or export. Our principle objective in applying these provisions to evaporative emission standards is to avoid confusion. We are therefore adding a provision that any exemption from exhaust emission standards automatically triggers a corresponding exemption from evaporative emission standards for the same products. We believe it is unlikely that an equipment manufacturer will need a separate exemption from evaporative emission standards, but the exemptions related to national security, testing, and economic hardship will apply if such a situation were to occur. We believe the other exemptions available for engines would not be necessary for equipment manufacturers with respect to evaporative emissions.

Given the extended times required to precondition fuel-system components, we have no plans to initiate selective enforcement audits to test for compliance with products coming off the assembly line. On the other hand, we may require certifying manufacturers to supply us with production equipment or components as needed for our own testing or we may find our own source of products for testing.

The defect-reporting requirements of §1068.501 apply to certified evaporative systems. This requires the certifying manufacturer to maintain information, such as warranty claims, that may indicate an emission-related defect. The regulations describe when manufacturers must pursue an investigation of apparent defects and when to report defects to EPA. These provisions apply to every certifying manufacturer and their certified products, including component manufacturers.

(5) Interim Standards and Provisions for Small SI Equipment

Most Small SI equipment manufacturers are currently certifying products to evaporative emission requirements in California. However, these standards and their associated test procedures differ somewhat from those contained in this final rule. Although the standards are different, we believe evaporative emission control technologies are available to meet the California ARB's standards and our new emission standards. To help manufacturers transition to selling low-emission equipment nationwide, we are accepting California ARB certification of equipment and components in the early years of the new federal program.

As discussed above, we are accepting California ARB certification for nonhandheld equipment and fuel tanks for the purposes of the early-allowance program (see §§1045.145 and 1054.145). We are also accepting California ARB certification of handheld fuel tanks through the 2011 model year (see §90.129).

We are accepting California ARB certification or certain SAE specifications through the 2010 model year for Class II engines and through the 2010 model year for Class I engines (see §90.127). These SAE specifications include SAE J30 R11A, SAE J30 R12, and SAE J2260 Category 1.

(6) Replacement Parts

We are applying the tampering prohibition in §1068.101(b)(1) for evaporative systems. This means that it will be a violation to replace compliant fuel tanks or fuel lines with noncompliant products that effectively disable the applicable emission controls. Low-cost replacement products would be easy to make available and it would be difficult to prevent or control their use. We are therefore adopting several provisions to address this concern. In §1060.610 we clarify the meaning of tampering for evaporative systems and finalize specific labeling requirements. First, for the period from January 1, 2012 to December 31, 2019, we require that manufacturers, distributors, retailers, and importers of replacement parts clearly label their products with respect to the applicable requirements. For example, a package might be labeled as compliant with the requirements in 40 CFR part 1060 or it might be labeled as noncompliant and appropriately used only for applications not covered by EPA standards. Unless the packaging clearly states otherwise, the product is presumed to be intended for applications that are subject to EPA standards. Second, starting in 2020 we are establishing a provision stating that it is presumed that all replacement parts that could be used in applications covered by EPA standards will in fact be installed in such equipment. This presumption significantly enhances our ability to enforce the tampering prohibition because the replacement part is then noncompliant before it is installed in a vessel or a piece of equipment. We believe shifting to a blanket presumption in 2020 is appropriate since in-use vessels and equipment will be almost universally meeting EPA's evaporative emission standards by that time.

The obligation for owners who replace certified fuel tanks or fuel lines with new components is to use components that have been certified under the applicable regulations. We have made a change from the proposal to remove the requirement for owners to use certified tanks that meet or exceed the FEL from the component being replaced, if applicable. Commenters emphasized that the proposed approach would be unworkable. We agree that the best approach for ensuring that we preserve emission controls without adopting unreasonable requirements is to specify simply that new replacement components need to be certified.

(7) Certification Fees

Under our current certification program, manufacturers pay a fee to cover the costs associated with various certification and other compliance activities associated with an EPA issued certificate of conformity. These fees are based on the projected costs to EPA per emission family. For the fees rule published May 2004, we conducted a cost study to assess EPA's costs associated with conducting programs for the industries that we certify (69 FR 26222, May 11, 2004).[111] We are establishing a new fees category for certification related to the new evaporative emission standards. The costs for this category will be determined using the same method used in conducting the previous cost study.

[111] A copy of the cost worksheets that were used to assess the fees per category may be found on EPA's fees website at http://www.epa.gov/otaq/proprule.htm.

As under the current program, this depends on an assessment of the anticipated number of emission families and the corresponding EPA staffing necessary to perform this work. At this time, EPA plans to perform a basic level of certification review of information and data submitted to issue certificates of conformity for the evaporative emission standards, as well as conducting some testing to measure evaporative emissions. This is especially the case for equipment manufacturers that use only certified components for meeting applicable emission standards. We are establishing a fee of $241 based on Agency costs for half of a federal employee's time and three employees hired through the National Senior Citizens Education and Research Center dedicated to the administration of the evaporative certification program, including the administrative, testing, and overhead costs associated with these people. The total cost to administer the program is estimated to be $362,225. We divided this cost by the estimated number of certificates, 1,503, to calculate the fee.

The fee of $241 per certificate applies through the 2014 model year. Starting in 2015, we will update the fees related to evaporative emission certificates each year when we update the fees for all categories. The fees update will be based upon EPA's costs of implementing the evaporative category multiplied by the consumer price index (CPI), then divided by the average of the number of certificates received in the two years prior to the update. The CPI will be applied to all of EPA's costs except overhead. This is a departure from EPA's current fees program wherein the CPI is applied only to EPA's labor costs. In the most recent fees rulemaking, commenters objected to applying the CPI to EPA's fixed costs. In the new fee program for the evaporative category, however, there are no fixed costs. EPA expects all its costs to increase with inflation and we therefore think it is appropriate to apply the inflation adjustment to all the program costs.

Where a manufacturer holds the certificates for compliance with exhaust emission standards and includes certification for evaporative emissions for the same engine/equipment model, we will assess an additional charge related to compliance with evaporative emission standards to that for the exhaust emission certification.

EPA believes it appropriate to charge less for a certificate related to evaporative emissions relative to the existing charge for certificates of conformity for exhaust emissions from the engines in these same vessels and equipment. The amount of time and level of effort associated with reviewing the latter certificates is higher than that projected for the certificates for evaporative emissions.

(8) Design-Based Certification

Certification of equipment or components that are subject to performance-based emission standards depends on test data showing that products meet the applicable standards. We are adopting a variety of approaches that reduce the level of testing needed to show compliance. As described above, we allow manufacturers to group their products into emission families so that a test on a single worst-case configuration can be used to show that all products in the emission family are compliant. Also, test data from a given year could be "carried over" for later years for a given emission control design (see §1060.235). These steps help reduce the overall cost of testing.

Design-based certification is another method that may be available for reducing testing requirements (see §1060.240). To certify their products using design-based certification, manufacturers will describe, from an engineering perspective, how their fuel systems meet the applicable design specifications. We believe there are several designs that use established technologies that are well understood to have certain emission characteristics that ensure compliance with applicable emission standards. At the same time, while design-based certification is a useful tool for reducing the test burden associated with certification, this does not remove a manufacturer's liability for meeting all applicable requirements throughout the useful life of the engine, equipment, vessel, or component.

The following sections describe how we propose to implement design-based certification for each of the different performance standards. We are adopting design-based certification provisions for fuel tank permeation and diurnal emissions. The emission data we used to develop these new design-based certification options are presented in Chapter 5 of the Final RIA.

We are not adopting design-based certification provisions for fuel lines. This contrasts with the approach we adopted for recreational vehicles, where we specified that fuel lines meeting certain SAE specifications could be certified by design. That decision was appropriate for recreational vehicles, because we did not include provisions for component certification. Fuel line manufacturers will need to conduct testing anyway to qualify their fuel lines as meeting the various industry ratings for Small SI and marine applications so any testing burden to demonstrate compliance with EPA standards should be minimal. We will allow test data used to meet industry standards to be used to certify to the new standards provided that the data were collected in a manner consistent with this final rule and that the data are available to EPA upon request.

(a) Fuel Tank Permeation

A metal fuel tank automatically meets the design criteria for a design-based certification as a low-permeation fuel tank, subject to the restrictions on fuel caps and seals described below.[112] There is also a body of existing test data showing that co-extruded fuel tanks from automotive applications have permeation rates that are well below the new standard. We are allowing design-based certification for co-extruded high-density polyethylene fuel tanks with a continuous ethylene vinyl alcohol (EVOH) barrier layer. The EVOH barrier layer is required to be at least 2 percent of the wall thickness of the fuel tank. In addition, the ethylene content of the EVOH can be no higher than 40 mole percent.

To address the permeability of the gaskets and seals used on metal and co-extruded tanks, the design criteria include a specification that seals (such as gaskets and O-rings) not made of low-permeability materials must have a total exposed surface area less than 0.25 percent of the total inside surface area of the fuel tank. For example, consider a four-gallon fuel tank with an inside surface area of 0.40 square meters. The total exposed surface area of seals on this fuel tank must be smaller than 1000 mm^2 ($= 0.25\%/100 \times 0.40 m^2 \times 1{,}000{,}000\ mm^2/m^2$). This is consistent with the proposed rule and the current requirements for recreational vehicles, but allows for larger seals for larger tanks. In addition, if a non-metal fuel cap not made of low-permeability material is directly mounted to the fuel tank, the surface area of the fuel cap

[112] Manufacturers may also consider metal fuel tanks meeting the gasket- and cap-related specifications to be "deemed certified," in which case no application for certification is necessary. Such a fuel tank is considered compliant independent of any test results from emission measurements. While this would be the most straightforward path, may prefer instead to go through the certification process for their tanks.

(determined by the cross-sectional area of the fill opening) may not exceed 3.0 percent of the total inside surface area of the fuel tank.

A metal or co-extruded fuel tank with a fuel cap and seals that meet these design criteria would be expected to reliably pass the standard. However, we believe it is not appropriate to assign an emission level to fuel tanks using design-based certification such that they can generate emission credits. Given the uncertainty of emission rates from the seals and gaskets, we will not consider these tanks to be any more effective than other fuel tanks meeting emission standards for purposes of emission credits.

In the case where the fuel cap is directly mounted on the fuel tank, we consider the cap and associated seals to be part of the fuel tank. As discussed above, we allow fuel caps to be tested either mounted on the fuel tank, or individually. As an alternative to testing the fuel cap, the manufacturer may opt to use a default permeation rate of 30 g/m^2/day (or 50 g/m^2/day for testing at 40°C). To be eligible for this default rate, the seal on the fuel cap must be made of a low-permeability material, such as a fluoroelastomer. The surface area associated with this default value is the smallest inside cross-sectional area of the opening on which the cap is mounted. If manufacturers use this default value, they would seal the fuel fill area with a non-permeable plug during the tank permeation test and the default permeation rate would be factored into the final result.

(b) Diurnal Emissions

For portable marine fuel tanks, we are establishing a design standard based on automatically sealing the tank to prevent fuel venting while fuel temperatures are rising. The options described below for design-based certification therefore deal only with installed marine fuel tanks (including personal watercraft).

A fuel system sealed to 1.0 psi will meet the criteria for design-based certification relative to the new diurnal emission standards. Such sealed systems reliably ensure that total diurnal emissions over the specified test procedure will be below the new standard. This type of system will allow venting of fuel vapors only when pressures exceed 1.0 psi or when the fuel cap is removed for refueling. Note that systems with anti-siphon valves will have to be designed to prevent fuel releases when the system is under pressure to meet U.S. Coast Guard requirements.

Bladder fuel tanks and tanks with a volume-compensating air bag are specialized versions of tanks that may meet the specifications for systems that remain sealed up to positive pressures of 1.0 psi. In each of these designs, volume changes within a sealed system prevent pressure buildup.

Fuel tanks equipped with a passively purged carbon canister may be certified by design, subject to several technical specifications. To ensure that there is enough carbon to collect a sufficient mass of hydrocarbon vapors, we specify a minimum butane working capacity of 9.0 g/dL based on the test procedures specified in ASTM D5228. The carbon canister will need a minimum carbon volume of 0.040 liters per gallon of nominal fuel tank capacity. For fuel tanks certified to the optional standards for tanks in nontrailerable boats (≥26 ft. in length or >8.5ft. in width), we are requiring a minimum carbon volume of 0.016 liters per gallon of nominal fuel tank capacity.

We are adopting three additional specifications for the quality of the carbon. We believe these specifications are necessary to ensure that the canister continues to function effectively over the full useful life. First, the carbon must meet a moisture adsorption capacity maximum of 0.5 grams of water per gram of carbon at 90 percent relative humidity and a temperature of 25±5°C. Second, the carbon must pass a dust attrition test similar to that in ASTM D3802. Third, the carbon granules must have a minimum mean diameter of 3.1 mm based on the procedures in ASTM D2862. These procedures are described in more detail in Chapter 5 of the Final RIA.

We are also requiring that the carbon canister must be properly designed to ensure proper in-use diurnal emission control. The canisters will need to be designed using good engineering judgment to ensure structural integrity. They must include a volume compensator or other device to hold the carbon pellets in place under vibration and changing temperatures and the vapor flow will need to be directed so that it reaches the whole carbon bed rather than just passing through part of the carbon. We are also requiring that the geometry of the carbon canister must have a length-to-diameter ratio of at least 3.5.

(c) Additional Designs

We may establish additional design-based certification options where we find that new test data demonstrate that the use of other technologies will ensure compliance with applicable emission standards. These designs will need to produce emission levels comfortably below the emission standards after considering variability in emission control performance. In addition, all aspects of these designs would need to be publicly available and quantifiable. For instance, we would not create a design-based certification for a material or process without full public disclosure of all the characteristics of that material or process relevant to its emission control characteristics. We would also not include products whose emission control performance is highly variable due to tolerances in materials or manufacturing processes. For instance, barrier treatments and post-processing coatings would generally not be eligible for design-based certification.

Manufacturers wanting to use designs other than those discussed here will have to perform the applicable testing for certification. However, once an additional technology is proven to be inherently low-emitting such that it will without question meet emission standards, we may consider approving its use under the regulations for design-based certification. For example, if several manufacturers were to pool resources to test a diurnal emission control strategy and submit the data to us, we could consider this particular technology, with any appropriate design specifications, as one that qualifies to be considered compliant under design-based certification. We intend to revise the regulations to include any additional technologies we decide are suitable for design-based certification, but we may also approve the use of additional design-based certification with these technologies before changing the regulations.

(9) Coordination with Coast Guard

As part of its compliance assurance program for safety standards, the U.S. Coast Guard regularly visits boat builders to perform inspections on the production of new boats. The frequency of these inspections is such that each boat builder is visited approximately once every two years. The U.S. Coast Guard has indicated a willingness to consider environmental compliance assurance as part of these inspections. For example, the inspections could include checking for certification labels and proper installation of emission control components. We will continue to work with the U.S. Coast Guard to coordinate these efforts.

G. Small-Business Provisions

(1) Small Business Advocacy Review Panel

On May 3, 2001, we convened a Small Business Advocacy Review Panel under section 609(b) of the Regulatory Flexibility Act (RFA) 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 the proposal 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 re-convened the Panel on August 17, 2006 to update our findings for this final rule. The Panel report has been placed in the rulemaking record for this final rule. Section 609(b) of the Regulatory Flexibility Act directs the Panel to report on the comments of small entity representatives and make findings as to issues related to certain 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 rule will apply;
- A description of projected reporting, recordkeeping, and other compliance requirements of the 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 rule; and
- A description of any significant alternative to the rule that accomplishes the stated objectives of applicable statutes and that minimizes any significant economic impact of the 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.

EPA used the size standards provided by the Small Business Administration (SBA) at 13 CFR part 121 to identify small entities for the purposes of its regulatory flexibility analysis. Companies that manufacture internal-combustion engines and that employ fewer than 1000 people are considered small businesses for the purpose of the RFA analysis for this rule. Equipment manufacturers, boat builders, and fuel-system component manufacturers that employ fewer than 500 people are considered small businesses for the purpose of the RFA analysis for this rule. 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. These companies represented a cross-section of engine manufacturers, equipment manufacturers, and fuel-system component manufacturers.

With input from small-entity representatives, the Panel drafted a report which provides findings and recommendations to us on how to reduce potential burdens on small businesses that may occur as a result of this final rule. The Panel Report is included in the rulemaking record for this final rule. We are adopting all the recommendations as presented in the Panel Report. The flexibility options recommended to us by the Panel, and any updated assessments, are described below.

(2) Burden Reduction Approaches for Small Businesses Subject to the Final Evaporative Emission Standards

The SBAR Panel Report includes six general recommendations for regulatory flexibility for small businesses affected by the new evaporative emission standards. This section discusses the provisions being established based on each of these recommendations plus one additional provision for small-volume boat builders. In these industry sectors, we believe the burden reduction approaches presented in the Panel Report should be applied to all businesses with the exception of the general economic hardship provision and the marine diurnal allowances, both of which are described below and are designed specifically for small businesses. The majority of fuel tanks produced for the Small SI equipment and Marine SI vessel market are made by small businesses or by companies producing small volumes of these products. The purpose of these options is to reduce the potential burden on companies for which fixed costs cannot be distributed over a large product line. For this reason, we often also consider production volumes when making decisions regarding provisions to reduce compliance burden.

(a) Consideration of Appropriate Lead Time

Small businesses commented that they would need to make significant changes to their plastic fuel tank designs and molding practices to meet the new fuel tank permeation standards. For blow-molded tank designs with a molded-in permeation barrier, new blow-molding machines would be needed that could produce multi-layer fuel tanks. One small business commented that, due to the lead time needed to install a new machine and to perform quality checks on the tanks, they would not be ready to sell multi-layer blow-molded fuel tanks until 2011 for the Small SI and Marine SI markets.

Small businesses that make rotation-molded fuel tanks were divided in their opinion of when they would be ready to produce low-permeation fuel tanks. One manufacturer stated that it is already producing fuel tanks with a low-permeation inner layer that are used in Small SI applications. This company also sells marine fuel tanks, but not with low-permeation technology. However, they have successfully performed Coast Guard durability testing on a prototype 40-gallon marine tank using their low-permeation technology. Two other small businesses that make rotation-molded fuel tanks stated that they have not been able to identify and demonstrate a low-permeation technology that would meet their cost and performance needs. They commented that developing and demonstrating low-permeation technology is especially an issue for the marine industry because of the many different tank designs and Coast Guard durability requirements.

Consistent with the Panel recommendations and in response to the above comments, we are adopting an implementation schedule that we believe provides sufficient lead time for blow-molded and marine rotation-molded fuel tanks. We are establishing tank permeation implementation dates of 2011 for Class II equipment and 2012 for Class I equipment. We are implementing the permeation standards in 2011 for portable marine fuel tanks and for personal watercraft and in 2012 for other installed fuel tanks, which are typically rotation-molded (see §1060.1).

There was no disagreement on the technological feasibility of the Marine SI diurnal emission standard EPA is considering. The marine industry has expressed a commitment to developing consensus standards for the installation of carbon canisters in boats. However, they have noted that the development of these consensus standards will take time and that time would be needed for an orderly transition to installing the diurnal emission controls to their boat models. Therefore, as noted earlier, we are giving an additional 18 months of lead time, compared to the proposal, which means that the diurnal standard will apply starting on July 31, 2011. In addition, in response to concerns that there are many small boat builders that may need additional time to become familiar with carbon canister technology and learn how to install canisters in their boats, we are adopting interim allowances that will give additional time for a limited number of new boats. Small boat builders could choose between a percentage-based phase-in for one year or an allowance to produce up to 1,200 vessels without diurnal systems over the first two years. The options available to boat builders are described in more detail in Section VI.C.3 and Section VI.G.2.f.

In developing the proposal, the majority of large nonhandheld equipment manufacturers indicated that they would be using low-permeation fuel lines in the near term as part of their current product plans. In addition, the Panel expressed concern that small equipment manufacturers who do not sell products in California may not necessarily be planning on using low-permeation fuel lines in 2008. Therefore, we proposed that the fuel line permeation standards would take effect in 2008 for most nonhandheld equipment manufacturers and in 2009 for small-volume equipment manufacturers. Given that we are not adopting the final rule until mid-2008, we have delayed the implementation of the low-permeation fuel line requirement until January 1, 2009 for nonhandheld equipment. We are keeping the 2009 implementation date for low-permeation fuel line for small businesses producing Small SI nonhandheld equipment. We believe the 2009 date is feasible for all equipment manufacturers, given that fuel line meeting the low permeation standards is already widely available and manufacturers selling most types of nonhandheld equipment in California were required to use such fuel lines starting in 2007 or 2008.

(b) Fuel Tank ABT and Early-Incentive Program

The Panel recommended that we propose ABT and early-allowance programs for fuel tank permeation. We are adopting these programs in this final rule. The provisions of the ABT and early-allowance programs are described above in Section VI.D.

(c) Broad Definition of Emission Family

The Panel recommended that we propose broad emission families for fuel tank emission families similar to the existing provisions for recreational vehicles. As described earlier in Section VI.F.3, we are adopting provisions that allow fuel tank emission families to be based on type of material (including additives such as pigments, plasticizers, and UV inhibitors that are expected to affect control of emissions), emission control strategy, and production methods.

This would allow fuel tanks of different sizes, shapes, and wall thicknesses to be grouped into the same emission family (see §1060.230). In addition, Small SI and Marine SI fuel tanks could be allowed in the same emission family if the tanks meet these criteria. Manufacturers therefore will be able to broadly group similar fuel tanks into the same emission family and then test only the configuration most likely to exceed the emission standard.

(d) Compliance Progress Review for Marine Fuel Tanks

During the development of the proposed rule, we worked closely with the recreational marine fuel tank industry to understand their products, business practices, and production processes. Information gathered from these interactions was used to craft the proposed regulatory provisions related to controlling gasoline fuel tank permeation emissions. During these discussions, important issues were identified with respect to concerns regarding the technical feasibility of controlling permeation emissions from rotation-molded tanks made from cross-link polyethylene (XLPE).

Manufacturers asserted that the availability of rotation-molded fuel tanks is critical to the marine industry. This type of fuel tank is installed in many recreational marine vessels powered by SD/I and outboard engines. The rotation-molding process, which has low capital costs relative to injection molding, facilitates the economical production of fuel tanks in the low production volumes required by boat builders. Furthermore, plastic fuel tanks offer advantages over metal fuel tanks, both in terms of cost and corrosion resistance. The advantages of XLPE over other plastics used in fuel tanks today, such as HDPE, are its compatibility with the rotation-molding process and the ability of XLPE fuel tanks to meet the U.S. Coast Guard safety tests, especially the flame-resistance test. Nearly all manufacturers of rotation-molded marine fuel tanks qualify as small businesses under this rule.

We have concluded that the 2012 fuel permeation standards are technologically feasible for rotation-molded marine fuel tanks. This conclusion is supported by data presented in the Final RIA. As can be seen from the comments on the proposed rule and related information in the public docket, several rotation-molded tank manufacturers support EPA's proposed standards and implementation dates and have provided information to support their positions. We originally proposed tank permeation standards for these fuel tanks in 2002. Since that time, several manufacturers have shown progress in the development of low-permeation, rotation-molded tanks. In addition, this rule provides about 36 months of lead time for these manufacturers to address remaining technology issues, certify their products, and prepare for production of certified fuel tanks.

However, several other rotation-molded tank manufacturers are not as far along in their technological progress toward meeting the standards and are not certain about their ability to meet EPA requirements in 2012. To address this situation, these manufacturers have requested that EPA perform a technical review in 2010 to determine whether the compliance dates should be adjusted. However, for the reasons discussed above, we believe that the tank permeation standards have been demonstrated to be technologically feasible in the 2012 time frame and do not look favorably upon the request for a technology review of the permeation standard.

Nevertheless, we are concerned about the potential long-term impacts on the small businesses that have not yet developed technologies that meet the new emission standards. Although marine fuel tanks must comply with Coast Guard safety regulations, marine fuel tank manufacturers have never been required to certify to permeation standards. The rotation-molded tank manufacturers are generally small businesses with limited engineering staffs and are dependent on materials suppliers for their raw materials.

During the next few years, EPA intends to hold periodic progress reviews with small businesses that make rotation-molded fuel tanks. The purpose of these progress reviews will be to monitor the progress of individual companies towards compliance with the tank permeation standards and to provide feedback as needed. Rather than conducting a broad program with the entire industry, we plan to conduct separate, voluntary reviews with each interested company. These sessions will be instrumental to EPA in following the progress for these companies and assessing their efforts and potential problems.

To help address small business concerns, we are relying on the small-volume manufacturer hardship relief provisions in 40 CFR 1068.250. These provisions are described below. In the event that a small business is unsuccessful in the 2012 model year and seeks hardship relief, the progress reviews described above would provide an important foundation in determining whether a manufacturer has taken all possible steps to comply with the permeation standards in a timely manner.

(e) Design-based Certification

For recreational vehicles, manufacturers using metal fuel tanks may certify by design to the tank permeation standards. Tanks using design-based certification provisions are not included in the ABT program because they are assigned a certification emission level equal to the standard. The Panel recommended that we propose to allow design-based certification for metal tanks and plastic fuel tanks with a continuous EVOH barrier. The Panel also recommended that we propose design-based certification for carbon canisters. A detailed description of the new design-based certification options we are adopting is presented earlier in Section VI.F.8 of this document.

The National Marine Manufacturers Association (NMMA), the American Boat and Yacht Council (ABYC), and the Society of Automotive Engineers (SAE) have industry-recommended practices for boat designs that must be met as a condition of NMMA membership. NMMA stated that they are working to update these recommended practices to include installation instructions for carbon canisters and design specifications for low-permeation fuel lines. The Panel recommended that EPA accept data used for meeting the voluntary requirements as part of the EPA certification. We will allow this data to be used as part of EPA certification as long as it is collected consistent with the test procedures and other requirements described in this final rule.

(f) Marine Diurnal Allowances

As described above, manufacturers expressed concern that many small-volume boat builders may need additional time to develop installation procedures and install carbon canisters in their boats. To address this, we are establishing an interim allowance program that will give additional time for these manufacturers for a certain number of boats. Under this program, each small-volume boat builder will be allowed to sell these boats without the diurnal emission controls that would otherwise be required. These allowances are intended to help small boat builders engage in an orderly transition to the new standards and will only be available for boats produced in the first two years of the program. This allowance program applies only to boats with installed fuel tanks that are expected to use carbon canisters to meet the diurnal emission standards. Therefore, it does not apply to portable fuel tanks, personal watercraft, or outboard engines with under-cowl fuel tanks. If a small-volume boat builder chooses to use this allowance provision, then the 50 percent phase-in for the first year, as described in Section VI.C.3, would not apply.

Specifically, each small-volume boat builder will have a total of 1,200 allowances that may be used, at the manufacturer's discretion, for boats produced from July 31, 2011 through July 31, 2013. [113] For instance, a small boat builder could produce 800 boats in the first year and 400 in the second year without diurnal emission controls. For most small boat builders, we expect that this allowance program will result in an additional year, or even two years, of lead time for them to address potential installation issues related to carbon canisters.

Under this diurnal allowance approach for small-volume boat builders, such boat builders will only need to place a label on the vessel with a statement acknowledging that an allowance is being used. In addition, the small-volume boat builder must notify EPA of its intent to use the allowances prior to producing any exempted vessels. The small-volume boat builder must also maintain records of the number of allowances used and submit a report to EPA showing the number of allowances used in each year. Note that boats exempted from diurnal requirements must still use fuel lines and fuel tanks that meet permeation standards.

(g) Hardship Provisions

We are adopting two types of hardship provisions consistent with the Panel recommendations. EPA used the SBA size standards for purposes of defining "small businesses" for its regulatory flexibility analysis. The eligibility criteria for the hardship provisions described below reflect EPA's consideration of the Panel's recommendations and a reasonable application of existing hardship provisions. As has been our experience with similar provisions already adopted, we anticipate that hardship mechanisms will be used sparingly. First, under the unusual circumstances hardship provision, any manufacturer subject to the new standards may apply for hardship relief if circumstances outside its control cause the failure to comply and if failure to sell the subject engines or equipment or fuel system component would have a major impact on the company's solvency (see §1068.245). An example of an unusual circumstance outside a manufacturer's control may be an "Act of God," a fire at the manufacturing plant, or the unforeseen shutdown of a supplier with no alternative available. The terms and time frame of the relief will depend on the specific circumstances of the company and the situation involved. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards. This hardship provision will be available to all manufacturers of engines, equipment, boats, and fuel system components subject to the new standards, regardless of business size.

Second, an economic hardship provision allows small businesses subject to the new standards to petition EPA for limited additional lead time to comply with the standards (see §1068.250). A small business must make the case that it has taken all possible business, technical, and economic steps to comply, but the burden of compliance costs would have a significant impact on the company's solvency. Hardship relief could include requirements for

[113] In this context, the date of production means the date on which the engine is installed in the vessel. In the case of boats using outboard engines, it is the date on which the fuel tank is installed.

interim emission reductions and/or the purchase and use of emission credits. The length of the hardship relief decided during review of the hardship application will be up to one year, with the potential to extend the relief as needed. We anticipate that one to two years will normally be sufficient. As part of its application for hardship, a company will be required to provide a compliance plan detailing when and how it will achieve compliance with the standards.

The criteria for determining which manufacturers are eligible for the economic hardship (as well as other small-volume manufacturer flexibilities described in this section) are presented in Sections III.F.2 and IV.G for Marine SI engine manufacturers; in Section V.F.2 for nonhandheld engine manufacturers; and in Section V.F.3 for nonhandheld equipment manufacturers. For handheld equipment manufacturers, EPA is using the existing small-volume manufacturer criterion, which relies on a production cut-off of 25,000 pieces of handheld equipment per year. For boat builders and fuel-system component manufacturers, EPA is basing the determination of whether a company is a small business eligible for the hardship provision on the SBA size standards at 13 CFR 121. Under SBA size standards, a boat builder or fuel-system component manufacturer is a small business if it has 500 or fewer employees.

The criteria for determining which manufacturers are eligible for the economic hardship (as well as other small-volume manufacturer flexibilities described in this section) are presented in Sections III.F.2 and IV.G for Marine SI engine manufacturers; in Section V.F.2 for nonhandheld engine manufacturers; and in Section V.F.3 for nonhandheld equipment manufacturers. For handheld equipment manufacturers, EPA is using the existing small-volume manufacturer criterion, which relies on a production cut-off of 25,000 pieces of handheld equipment per year. For boat builders and fuel-system component manufacturers, EPA is basing the determination of whether a company is a small business on the SBA definition. Under SBA regulations, a boat builder or fuel-system component manufacturer is a small business if it has 500 or fewer employees.

Because many boat builders, nonhandheld equipment manufacturers, and handheld equipment manufacturers will depend on fuel tank manufacturers and fuel line manufacturers to supply certified products in time to produce complying vessels and equipment, we are also establishing a hardship provision for all Marine SI vessel manufacturers and Small SI equipment manufacturers, regardless of size. The hardship provision allows the boat builder or equipment manufacturer to request more time if they are unable to obtain a certified fuel-system component and they are not at fault and would otherwise face serious economic hardship (see §1068.255).

H. Technological Feasibility

We believe there are several strategies that manufacturers can use to meet the new evaporative emission standards. We have collected and will continue to collect emission test data on a wide range of technologies for controlling evaporative emissions. The design-based certification levels discussed above rely on this test data and we may amend the list of approved designs and emission levels as more data become available.

In the following sections we briefly describe how we selected specific emission standards and implementation dates, followed by a more extensive discussion of the expected emission control technologies. A more detailed discussion of the feasibility of the new evaporative requirements, including all the underlying test data, is included in Chapter 5 of the Final RIA. See Table VI-1 for a summary of the new evaporative emission standards.

(1) Level of Standards

The fuel line and fuel tank permeation standards for Small SI equipment and Marine SI vessels are based on the standards already adopted for recreational vehicles. These applications use similar technology in their fuel systems. In cases where the fuel systems differ we have identified technological approaches that could be used to meet these same emission levels. The control strategies are discussed below. For fuel lines used with cold-weather equipment, we are adopting a relaxed set of standards based on available permeation data. In addition, we have new higher numerical standards for fuel tank permeation for tests performed at higher temperature (40°C vs. 28°C). These higher numerical standards are based on data described in Chapter 5 of the Final RIA.

For fuel tanks installed in personal watercraft and for portable marine fuel tanks, we are adopting diurnal emission standards based on the current capabilities of these systems. We are basing the new standard for other installed marine fuel tanks on the capabilities of passive systems that store emitted vapors in a carbon canister. The Final RIA describes the test results on passively purged canisters and other technologies that led us to the level of the diurnal emission standard.

We measured running loss emissions and found that some Small SI products have very high emission levels. The large variety of manufacturers and equipment types makes it impractical to design a measurement procedure, which means that we are unable to specify a performance standard. We are instead adopting a design standard for running losses from nonhandheld Small SI equipment by specifying that manufacturers may use any of a variety of specified design solutions, as described in Section VI.C.5. Several of these design options are already in common use today.

We are requiring that equipment and vessel manufacturers use good engineering practices in their designs to minimize refueling spitback and spillage. In general, the regulation simply requires manufacturers to use system designs that are commonly used today. Several refueling spitback and spillage control strategies are discussed in Chapter 5 of the Final RIA.

(2) Implementation Dates

Low-permeation fuel line is widely available today. Many Small SI equipment manufacturers certifying to permeation standards in California are selling products with low-permeation fuel line nationwide. In addition, many boat builders have begun using low-permeation marine fuel lines to feed fuel from the fuel tank to the engine. For this reason, we are implementing the fuel line permeation standards in 2009 for nonhandheld Small SI equipment and for Marine SI vessels. The dates provide more than two years additional lead time beyond the California requirements for Small SI equipment. For handheld equipment, there are no fuel line permeation requirements in California. In addition, injection molded fuel lines are common in many applications rather than straight-run extruded fuel line. For this reason we are delaying implementation of fuel line permeation standards for handheld equipment until 2012 (or 2013 for small volume emission families). Primer bulbs and many of the fuel line segments used under the cowl of outboard marine engines are also injection molded. In addition, these fuel lines are not subject to standards in California. We are providing additional lead time for manufacturers to address emissions from these fuel lines as well. The permeation standard begins in 2011 for primer bulbs used with marine fuel lines; permeation standards for under-cowl fuel lines phase in between 2010 and 2015.

Similar to fuel line technology, low-permeation fuel tank constructions are used today in automotive and portable fuel tank applications. This technology has been developed for use in recreational vehicles and for Small SI equipment sold in California. The available technology options include surface treatment and multi-layer constructions, though rotation-molding presents some unique design challenges. Based on discussions with fuel tank manufacturers, and our own assessment of the lead time necessary to change current industry practices, we believe low-permeation fuel tank technology can be applied in the 2011-2012 model years for Small SI and Marine SI fuel tanks. We are implementing the fuel tank permeation standards in 2011 for Class II equipment, portable marine fuel tanks and personal watercraft. For Class I equipment and other installed marine fuel tanks, the implementation date is 2012. We are phasing in the handheld fuel tank standards on the following schedule: 2009 for equipment models certifying in California, 2011 for structurally integrated nylon tanks, 2013 for small-volume families, and 2010 for the remaining fuel tanks used with handheld equipment. We believe this will facilitate an orderly transition from current fuel tank designs to low-permeation fuel tanks.

We are allowing until 2012 for large marine fuel tanks to meet permeation standards largely due to concerns raised over the application of low-permeation rotation-molded fuel tank technology in marine applications. The majority of these fuel tanks are typically rotation-molded by small businesses. Although low-permeation technology has emerged for these applications, we believe the allotted lead time will be necessary for all manufacturers to be ready to implement this technology. This will give these manufacturers time to make changes to their production processes to comply with the standards and to make any tooling changes that may be necessary. We are similarly implementing the fuel tank permeation standards for Class I fuel tanks installed in Small SI equipment in 2012, mostly to align with the implementation date for the Phase 3 exhaust emission standards. This is especially important for Class I engines where most of the engine manufacturers will also be responsible for meeting evaporative emission standards.

We are implementing the running loss standards for nonhandheld Small SI equipment in the same year as the exhaust emission standards. We believe this is appropriate because the running loss vapor will in some cases be routed to the intake manifold for combustion in the engine. Manufacturers will need to account for the effect of the additional running loss vapor in their engine calibrations.

We are implementing the new diurnal standards for portable marine fuel tanks on January 1, 2010 and for personal watercraft beginning with the 2010 model year. We believe these requirements will not result in a significant change from current practice so the dates will provide sufficient lead time for manufacturers to comply with standards. For other installed fuel tanks, however, we are adopting a later implementation date beginning in mid-2011. The development of canisters as an approach to control diurnal emissions without pressurizing the tanks has substantially reduced the expected level of effort to redesign and retool for making fuel tanks. However, canister technology has not yet been applied commercially to marine applications and the final rule includes added lead time for manufacturers to work out various technical parameters associated with the large variety of boat models and tanks.

(3) Technological Approaches

We believe several emission control technologies can be used to reduce evaporative emissions from Small SI equipment and Marine SI vessels. These emission control strategies are discussed below. Chapter 5 of the Final RIA presents more detail on these technologies and Chapter 6 provides information on the estimated costs.

(a) Fuel Line Permeation

Fuel lines produced for use in Small SI equipment and Marine SI applications are generally extruded nitrile rubber with a cover for abrasion resistance. Fuel lines used in Small SI applications often meet SAE J30 R7 specifications, including a permeation limit of 550 g/m^2/day at 23°C on ASTM Fuel C. Fuel lines for personal watercraft are typically designed to meet SAE J2046, which includes a permeation limit of 300 g/m^2/day at 23°C on ASTM Fuel C.[114] Marine fuel lines subject to Coast Guard requirements under 33 CFR part 183 are designated as either Type A or Type B and either Class 1 or Class 2. SAE J1527 provides detail on these fuel line designs. Type A fuel lines pass the U.S. Coast Guard fire test while Type B designates fuel lines that have not passed this test. Class 1 fuel lines are intended for fuel-feed lines where the fuel line is normally in contact with liquid fuel and has a permeation limit of 100 g/m^2/day at 23°C. Class 2 fuel lines are intended for vent lines and fuel fill necks where liquid fuel is not continuously in contact with the fuel line; it has a permeation limit of 300 g/m^2/day at 23°C. Recently, SAE J1527 has been modified to include a "-15" designation for fuel lines meeting a permeation limit of 15 g/m^2/day at 23°C on fuel CE10. In general practice, most boat builders use Class 1 fuel lines for both vent lines and fuel-feed lines to avoid carrying two types of fuel lines. Most fuel fill necks, which have a much larger diameter and are constructed differently, use materials meeting specifications for Class 2 fuel lines.

Low-permeability fuel lines are in production today. One fuel line design, already used in some marine applications, uses a thermoplastic layer between two rubber layers to control permeation. This thermoplastic barrier may be either nylon or ethyl vinyl acetate. Barrier approaches in automotive applications include fuel lines with fluoroelastomers such as FKM and fluoroplastics such as Teflon and THV. In addition to presenting data on low-permeation fuel lines, Chapter 5 of the Final RIA lists several fuel-system materials and their permeation rates. Molded rubber fuel line components, such as conventional primer bulbs and some handheld fuel lines, could meet the standard by using a fluoroelastomer such as FKM. The Final RIA also discusses low-permeation materials that retain their flexibility at low temperatures.

Automotive fuel lines made of low-permeation plastic tubing are generally made from fluoroplastics. An added benefit of these low-permeability fuel lines is that some fluoropolymers can be made to conduct electricity and therefore prevent the buildup of static charges. This type of fuel line can reduce permeation by more than an order of magnitude below the level associated with barrier-type fuel lines, but it is relatively inflexible and will need to be molded in specific shapes for each equipment or vessel design. Manufacturers have commented that they need flexible fuel lines to fit their many designs, resist vibration, prevent kinking, and simplify connections and fittings. An alternative to custom molding is to manufacture fuel lines with a corrugated profile (like a vacuum hose). Producing flexible fluoropolymer fuel lines is

[114] Society of Automotive Engineers Surface Vehicle Standard, "Personal Watercraft Fuel Systems," SAE J2046, Issues 1993-01-19 (Docket EPA-HQ-OAR-2004-0008-0179).

somewhat more expensive but the result is a product that meets emission standards without compromising in-use performance or ease of installation.

(b) Fuel Tank Permeation

Blow-molding is widely used for the manufacture of Small SI, portable marine, and PWC fuel tanks. Typically, blow-molding is performed by creating a hollow tube, known as a parison, by pushing high-density polyethylene (HDPE) through an extruder with a screw. The parison is then pinched in a mold and inflated with an inert gas. In highway applications, low-permeation plastic fuel tanks are produced by blow molding a layer of ethylene vinyl alcohol (EVOH) or nylon between two layers of polyethylene. This process is called coextrusion and requires at least five layers: the barrier layer, adhesive layers on either side of the barrier layer, and two outside layers of HDPE that make up most of the thickness of the fuel tank walls. However, multi-layer construction requires additional extruder screws, which significantly increases the cost of the blow-molding process. One manufacturer has developed a two-layer barrier approach using a polyarylamide inner liner. This technology is not in production yet but appears to be capable of permeation levels similar to the traditional EVOH barrier designs. This approach will enable blow-molding of low-permeation fuel tanks with only one additional extruder screw.

Multi-layer fuel tanks can also be formed using injection molding. In this method a low-viscosity polymer is forced into a thin mold to create the two sides of the fuel tank (e.g., top and bottom), which are then fused together. To add a barrier layer, a thin sheet of the barrier material is placed inside the mold before injecting the poleythylene. The polyethylene, which generally has a much lower melting point than the barrier material, bonds with the barrier material to create a shell with an inner liner.

A less expensive alternative to coextrusion is to blend a low-permeation resin with the HDPE and extrude it with a single screw to create barrier platelets. The trade name typically used for this permeation control strategy is Selar. The low-permeability resin, typically EVOH or nylon, creates noncontinuous platelets in the HDPE fuel tank to reduce permeation by creating long, tortuous pathways that the hydrocarbon molecules must navigate to escape through the fuel tank walls. Although the barrier is not continuous, this strategy can still achieve greater than a 90 percent reduction in permeation of gasoline. EVOH has much higher permeation resistance to alcohol than nylon so it will likely be the preferred material for meeting the new standard based on testing with a 10 percent ethanol fuel.

Many fuel tanks for Small SI equipment are injection-molded out of either HDPE or nylon. Injection-molding can be used with lower production volumes than blow-molding due to lower tooling costs. In this method, a low-viscosity polymer is forced into a thin mold to create the two sides of the fuel tank; these are then fused together using vibration, hot plate or sonic welding. A strategy such as Selar has not been demonstrated to work with injection-molding due to high shear forces.

An alternative to injection-molding is thermoforming, which is also cost-effective for lower production volumes. In this process, sheet material is heated and then drawn into two vacuum dies. The two halves are then fused while the plastic is still molten to form the fuel tank. Low-permeation fuel tanks can be constructed using this process by using multi-layer sheet material. This multi-layer sheet material can be extruded using materials similar to those used with multi-layer blow-molded fuel tank designs. A typical barrier construction includes a thin

EVOH barrier, adhesion layers on both sides, a layer of HDPE regrind, and outside layers of pure virgin HDPE.

Regardless of the molding process, another type of low-permeation technology for HDPE fuel tanks will be to treat the surfaces with a barrier layer. Two ways of achieving this are known as fluorination and sulfonation. The fluorination process causes a chemical reaction where exposed hydrogen atoms are replaced by larger fluorine atoms, which creates a barrier on the surface of the fuel tank. In this process, batches of fuel tanks are generally processed post-production by stacking them in a steel container. The container is then voided of air and flooded with fluorine gas. By pulling a vacuum in the container, the fluorine gas is forced into every crevice in the fuel tanks. Fluorinating with this process treats both the inside and outside surfaces of the fuel tank, thereby improving the reliability and durability of the permeation-resistance. As an alternative, blow-molded fuel tanks can be fluorinated during production by exposing the inside surface of the fuel tank to fluorine during the molding process. However, this method may not prove as effective as post-production fluorination.

Sulfonation is another surface treatment technology where sulfur trioxide is used to create the barrier by reacting with the exposed polyethylene to form sulfonic acid groups on the surface. Current practices for sulfonation are to place fuel tanks on a small assembly line and expose the inner surfaces to sulfur trioxide, then rinse with a neutralizing agent. However, sulfonation can also be performed using a batch method. Either of these sulfonation processes can be used to reduce gasoline permeation by more than 95 percent.

A fourth method for molding plastic fuel tanks is called rotation-molding. Rotation-molding is a lower-cost alternative for smaller production volumes. In this method, a mold is filled with a powder form of polyethylene with a catalyst material. While the mold is rotated in an oven, the heat melts the plastic. When cross-link polyethylene (XLPE) is used, this heat activates a catalyst in the plastic, which causes a strong cross-link material structure to form. This method is often used for relatively large fuel tanks in Small SI equipment and for installed marine fuel tanks. The advantages of this method are low tooling costs, which allows for smaller production volumes, and increased strength and flame resistance. Flame resistance is especially important for installed marine fuel tanks subject to 33 CFR part 183. At this time, the barrier treatment approaches discussed above for HDPE have not been demonstrated to be effective for XLPE.

We have evaluated two permeation control approaches for rotation-molded fuel tanks. The first is to form an inner layer during the molding process. Historically, the primary approach for this is to use a drop-box that opens after the XLPE tank begins to form. However, processes have been developed that eliminate the need for a drop box. With this construction a low-permeation inner liner can be molded into the fuel tank. Manufacturers are currently developing acetyl copolymer, nylon, and polybutylene terephthalate inner liners for this application. In fact, one fuel tank manufacturer is already selling tanks with a nylon inner liner into Class II Small SI equipment applications. Initial testing suggests that these barrier layers could be used to achieve the new standards.

The second approach to creating a barrier layer on XLPE rotation-molded fuel tanks is to use an epoxy barrier coating. One manufacturer has demonstrated that a low-permeation barrier coating can adhere to an XLPE fuel tank resulting in a permeation rate below the new standard.

In this case, the manufacturer used a low level of fluorination to increase the surface energy of the XLPE so the epoxy will adhere properly.

Marine fuel tanks are sometimes also fabricated out of either metal or fiberglass. Metal does not permeate so tanks that are constructed and installed properly to prevent corrosion should meet the new standards throughout their full service life. For fiberglass fuel tanks, one manufacturer has developed a composite that has been demonstrated to meet the new fuel tank permeation standard. Permeation control is achieved by incorporating fillers into a resin system and coating the assembled tank interior and exterior. This filler is made up of nanocomposites (very small particles of treated volcanic ash) which are dispersed into a carrier matrix. These particles act like the barrier platelets discussed above by creating a tortuous pathway for hydrocarbon migration through the walls of the fuel tank.

(c) Diurnal

Portable marine fuel tanks are currently equipped with a valve that can be closed by the user when the tank is stored to contain vapor within the fuel tank. These fuel tanks are designed to hold the pressure that builds up when a sealed fuel tank undergoes normal daily warming. This valve must be opened when the engine is operating to prevent a vacuum from forming in the fuel tank as the fuel level in the tank decreases. A vacuum in the fuel tank could prevent fuel from being drawn into the engine. Because the valve is user-controlled, any emission control is dependent on user behavior. This can be corrected by replacing the user-controlled valve with a simple one-way valve in the fuel cap. For instance, a diaphragm valve that is common in many automotive applications seals when under positive pressure but opens at low-vacuum conditions.

Personal watercraft currently use sealed systems with pressure-relief valves that start venting vapors when pressures reach a threshold that ranges from 0.5 to 4.0 psi. We believe the new standard can be met through the use of a sealed fuel system with a 1.0 psi pressure-relief valve. Personal watercraft should therefore be able to meet the new standard with little or no change to current designs.

For other vessels with installed fuel tanks, manufacturers have commented that even 1.0 psi of pressure would be too high for their applications.[115] They expressed concern that their fuel tanks had large, flat surfaces that would deform or leak at pressures of 0.5 psi or higher. This concern led us to consider several technologies for controlling diurnal emissions without pressurizing the tank, including carbon canisters, volume-compensating air bags, and bladder fuel tanks.

The primary evaporative emission control device used in automotive applications is a carbon canister. With this technology, vapor generated in the tank is vented to a canister containing activated carbon. The fuel tank must be sealed such that the only venting that occurs is through the carbon canister. This prevents more than a minimal amount of positive or negative pressure in the tank. The activated carbon collects and stores the hydrocarbons. The activated carbon bed in automotive canisters is refreshed by drawing air over the carbon to purge

[115] U.S. Coast Guard regulations in 33 CFR 183.586 require that marine fuel tanks must be designed to withstand 25,000 pressure cycles from 0-3 psi. Even though marine fuel tanks typically can withstand this pressure cycling without damage to the tank, the tanks tend to deform significantly when under pressure.

the hydrocarbon vapors and route them to the engine's air intake where they are eventually burned as fuel for the engine.

In a marine application, routing purged vapors to the engine's intake is not practical because of the potential complications with the engine and tank created by the variety of manufacturers and engine/tank configurations in the fleet each year. Therefore, canisters were not originally considered to be a practical technology for controlling diurnal vapor from boats. Since that time, however, we have collected information showing that the canister is purged sufficiently during cooling periods to substantially reduce diurnal emissions. When the fuel in the tank cools, fresh air is drawn back through the canister into the fuel tank. This fresh air partially purges the canister and returns hydrocarbons to the fuel tank. This creates open sites in the carbon so the canister can again collect vapor during the next heating event. Test data presented in Chapter 5 of the Final RIA show that a canister starting from empty is more than 90 percent effective until it reaches the point of saturation. Once it reaches saturation, a canister is still capable of reducing diurnal emissions by more than 60 percent due to the normal airflow across the canister bed during cooling periods. Adding active purging to route vapors to the engine's air intake during engine operation would improve the level of control somewhat, depending on how often the engine is operated.

Manufacturers have raised the concern that it is common for fuel to pass out the vent line during refueling. If there were a canister in the vent line it would become saturated with fuel. While this would not likely cause permanent damage to the canister, we believe marine fuel systems should prevent liquid fuel from exiting the vent line for both environmental and safety reasons. A float valve or small orifice in the entrance to the vent line from the fuel tank would prevent liquid fuel from reaching the canister or escaping from the tank. Any pressure build-up from such a valve would cause fuel to back up the fill neck and shut off the fuel dispensing nozzle as it now does in automotive applications. In addition, a vapor space should be included to account for fuel expansion. Manufacturers have also expressed concerns for canister durability in marine applications due to vibration, shock, and humidity. However, there are now marine grades of activated carbon that are harder and more moisture-resistant than typical automotive carbon. Manufacturers installed canisters equipped with the marine grade carbon on 14 boats in a pilot program and encountered no problems. This is discussed in more detail in Chapter 5 of the Final RIA.

Another concept for minimizing pressure in a sealed fuel tank is through the use of a volume-compensating air bag. The purpose of the bag is to fill up the vapor space above the liquid fuel. By minimizing the vapor space, the equilibrium concentration of fuel vapors occupies a smaller volume, resulting in a smaller mass of vapors. As the equilibrium vapor concentration increases with increasing temperature, the vapor space expands, which forces air out of the bag through the vent to atmosphere. Because the bag volume decreases to compensate for the expanding vapor space, total pressure inside the fuel tank stays very close to atmospheric pressure. Once the fuel tank cools in response to cooling ambient temperatures the resulting vacuum in the fuel tank would make the bag expand again by drawing air from the surrounding environment. Our test results show that pressure could be kept below 0.8 psi using a bag with a capacity equal to 25 percent of the fuel tank capacity. The use of a volume-compensating air bag, in conjunction with a pressure-relief valve, would be very effective in controlling diurnal emissions.

Probably the most effective technology for reducing diurnal emissions from marine fuel tanks is through the use of a collapsible fuel bladder. In this concept, a low-permeation bladder is installed in the fuel tank to hold the fuel. As fuel is drawn from the bladder the vacuum created collapses the bladder. There is, therefore, no vapor space and no pressure build-up from fuel heating. No vapors would be vented to the atmosphere since the bladder is sealed. This option could also eliminate running loss emissions and significantly reduce emissions during refueling that would normally result from dispensed fuel displacing vapor in the fuel tank. We have received comments that this would be cost-prohibitive because it could increase costs from 30 to 100 percent, depending on tank size. However, bladder fuel tanks have safety advantages and they are already sold by at least one manufacturer to meet market demand in niche applications.

(d) Running Loss

Running loss emissions can be controlled by sealing the fuel cap and routing vapors from the fuel tank to the engine intake. In doing so, vapors generated by heat from the engine will be burned in the engine's combustion chamber. It may be necessary to use a valve or limited-flow orifice in the purge line to prevent too much fuel vapor from reaching the engine and to prevent liquid fuel from entering the line if the equipment turns over. Depending on the configuration of the fuel system and purge line, a one-way valve in the fuel cap may be desired to prevent a vacuum in the fuel tank during engine operation. We anticipate that a system like this will eliminate running loss emissions. However, higher temperatures during operation and the additional length of vapor line will slightly increase permeation. Considering these effects, we still believe that the system described here will reduce running losses from Small SI equipment by more than 90 percent.

We are not adopting requirements to control running loss emissions from marine vessels. For portable marine fuel tanks and fuel tanks installed in vessels other than personal watercraft we expect the significant distance from the engine and the cooling effect of operating the vessel in water to prevent significant heating of the fuel tanks during engine operation. For personal watercraft, fuel tanks have a sealed system with pressure relief that should help contain running loss emissions. For other installed fuel tanks, we expect the system for controlling diurnal emissions will capture about half of any running losses that would occur.

(e) Diffusion

A secondary benefit of the running loss control described above for Small SI equipment relates to diffusion emissions. In a system that vents running loss vapors to the engine, venting vapors will be routed through the vapor line to the engine intake, rather than through open vents in the fuel cap. This approach should therefore eliminate diffusion emissions.

In the case of marine vessels, diffusion emissions are generally minimal due to long vent lines on the fuel tanks or the use of sealed fuel tanks. Further, the addition of diurnal emission controls will effectively control diffusion emissions.

(4) Regulatory Alternatives

We considered both less and more stringent evaporative emission control alternatives for fuel systems used in Small SI equipment and Marine SI vessels. Chapter 11 of the Final RIA presents details on this analysis of regulatory alternatives. The results of this analysis are summarized below. We believe the new permeation standards are reflective of available technology and represent a step change in emission performance. Therefore, we consider the same permeation control scenario in the less stringent and more stringent regulatory alternatives.

For Small SI equipment, we considered a less stringent alternative without running loss emission standards for Small SI engines. However, we believe controlling running loss emissions from nonhandheld equipment is feasible at a relatively low cost. Running loss emissions can be controlled by sealing the fuel cap and routing vapors from the fuel tank to the engine intake. Not requiring these controls is inconsistent with section 213 of the Clean Air Act. For a more stringent alternative, we considered applying a diurnal emission standard for all Small SI equipment. We believe passively purging carbon canisters could reduce diurnal emissions by 50 to 60 percent from Small SI equipment. However, we believe there would be significant costs to add carbon canisters to all Small SI equipment nationwide, especially when taking packaging and vibration into account. The cost sensitivity is especially noteworthy given the relatively low emissions levels (on a per-equipment basis) from such small fuel tanks.

For marine vessels, we considered a less stringent alternative, where there would be no diurnal emission standard for vessels with installed fuel tanks. However, installed fuel tanks on marine vessels have much higher capacities than those used in Small SI applications. Our analysis indicates that carbon canisters are feasible for boats at relatively low cost. While packaging and vibration are also issues with marine applications, we believe these issues have been addressed. Manufacturers installed carbon canisters in fourteen boats in a pilot program. The results demonstrated the feasibility of this technology. The new standards are achievable through engineering design-based certification with canisters that are much smaller than the fuel tanks. In addition, sealed systems, with pressure-control strategies will be accepted under the provisions for design-based certification. For a more stringent scenario, we considered a standard that would require boat builders to use an actively purged carbon canister. This means that the engine would draw air through the canister during operation to purge the canister of stored hydrocarbons. However, we rejected this option because marine engines operate too infrequently to consistently purge the canister to allow for increased storage of further vapor loading from the fuel tank. The gain in overall efficiency would be quite small relative to the complexity of integrating engine purge strategies and hardware into a vessel-based control strategy. The additional benefit of an actively purged diurnal control system is small in comparison to its cost and complexity.

(5) Our Conclusions

We believe the new evaporative emission standards reflect what manufacturers can achieve through the application of available technology. We believe the lead time is necessary and adequate for fuel tank manufacturers, fuel line manufacturers, engine manufacturers, equipment manufacturers, and boat builders to select, design, and produce evaporative emission control strategies that will work best for their product lines. We expect that meeting these requirements will pose a challenge, but one that is feasible when taking into consideration the availability and cost of technology, lead time, noise, energy, and safety. The role of these factors is presented in detail in Chapters 5 and 6 of the Final RIA. As discussed in Section VII, we do not believe the new standards will have negative effects on energy, noise, or safety and may lead to some positive effects.

VII. Energy, Noise, and Safety

Section 213 of the Clean Air Act directs us to consider the potential impacts on safety, noise, and energy when establishing the feasibility of emission standards for nonroad engines. Furthermore, section 205 of EPA's 2006 Appropriations Act requires us to assess potential safety issues, including the risk of fire and burn to consumers in use, associated with the new emission standards for nonroad spark-ignition engines below 50 horsepower.[116] As detailed in the following sections, we expect that the new exhaust and evaporative emission standards will either have no adverse affect on safety, noise, and energy or will improve certain aspects of these important characteristics. A more in depth discussion of these topics relative to the new exhaust and evaporative emission standards is contained in Chapters 4 and 5 of the Final RIA, respectively. Also, our conclusions relative to safety are fully documented in our comprehensive safety study which is discussed in the next section.

A. Safety

We conducted a comprehensive, multi-year safety study of spark-ignition engines that focused on the four areas where we are adopting new emission standards.[117] These areas are:

- New catalyst-based HC+NOx exhaust emission standards for Class I and Class II nonhandheld spark-ignition engines;
- New fuel evaporative emission standards for nonhandheld and handheld equipment;
- New HC+NOx exhaust emission standards for outboard and personal watercraft engines and vessels, and a new CO exhaust emission standard for nonhandheld engines used in marine auxiliary applications; and
- New fuel evaporative emission standards for outboard and personal watercraft engines and vessels.

Each of these four areas is discussed in greater detail in the next sections.

(1) Exhaust Emission Standards for Small Spark-Ignition Engines

The technology approaches that we assessed for achieving the new Small SI engine standards included exhaust catalyst aftertreatment and improvements to engine and fuel system designs. In addition to our own testing and development effort, we also met with engine and equipment manufacturers to better understand their designs and technology and to determine the state of technological progress beyond EPA's Phase 2 emission standards.

The scope of our safety study included Class I and Class II engine systems that are used in residential walk-behind and ride-on lawn mower applications, respectively. Residential lawn mower equipment was chosen for the following reasons.

[116] Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006, Pub. L. No. 109-54, Title II, sec. 205, 119 Stat. 499, 532 (August 2, 2005).
[117] "EPA Technical Study on the Safety of Emission Controls for Nonroad Spark-Ignition Engines < 50 Horsepower," Office of Transportation and Air Quality, U.S. Environmental Protection Agency, Washington, DC, EPA420-R-06-006, March 2006. This document is available in Docket EPA-HQ-OAR-2004-0008. This report was also subject to peer review, as described in a peer review report that is also available in the docket.

- Lawn mowers and the closely-related category of lawn tractors overwhelmingly represent the largest categories of equipment using Class I and Class II engines.
- Consumer Product Safety Commission (CPSC) data indicate that more thermal burn injuries are associated with lawn mowers than occur with other nonhandheld equipment; lawn mowers therefore represent the largest thermal burn risk for these classes of engines.
- General findings regarding advanced emission control technologies for residential lawn and garden equipment carry over to commercial lawn and turf care equipment as well as to other nonhandheld equipment using Class I and Class II engines.

We conducted the technical study of the incremental risk on several fronts. First, working with CPSC, we evaluated their reports and databases and other outside sources to identify those in-use situations which create fire and burn risk for consumers. The outside sources included meetings, workshops, and discussions with engine and equipment manufacturers. From this information, we identified ten scenarios for evaluation that covered a comprehensive variety of in-use conditions or circumstances which potentially could lead to an increased risk in burns or fires.

Second, we conducted extensive laboratory and field testing of both current technology (Phase 2) and prototype catalyst-equipped advanced-technology engines and equipment (Phase 3) to assess the emission control performance and thermal characteristics of the engines and equipment. This testing included a comparison of exhaust system, engine, and equipment surface temperatures using still and full motion video thermal imaging equipment.

Third, we conducted a design and process Failure Mode and Effects Analyses (FMEA) comparing current Phase 2 and Phase 3 compliant engines and equipment to evaluate incremental changes in risk probability as a way of evaluating the incremental risk of upgrading Phase 2 engines to meet Phase 3 emission standards.[118] This is an engineering analysis tool to help engineers and other professional staff to identify and manage risk. In an FMEA, potential failure modes, causes of failure, and failure effects are identified and a resulting risk probability is calculated from these results. This risk probability is used by the FMEA team to rank problems for potential action to reduce or eliminate the causal factors. Identifying these causal factors is important because they are the elements that a manufacturer can consider to reduce the adverse effects that might result from a particular failure mode.

Our technical work and subsequent analysis of all the data and information strongly indicate that effective catalyst-based standards can be implemented without an incremental increase in the risk of fire or burn to the consumer either during or after using the equipment. Similarly, we did not find any increase in the risk of fire during refueling or in storage near typical combustible materials. For example, our testing program demonstrated that properly designed catalyst-mufflers could, in some cases, actually result in systems that were significantly cooler than many current original equipment mufflers. A number of design elements appear useful to properly managing heat loads including: 1) the use of catalyst designs that minimize CO oxidation through careful selection of catalyst size, washcoat composition, and precious metal loading; 2) positioning the catalyst within the cooling air flow of the engine fan or redirecting some cooling air over the catalyst area with a steel shroud; 3) redirecting exhaust

[118] "EPA Technical Study on the Safety of Emission Controls for Nonroad Spark-Ignition Engines < 50 Horsepower," Office of Transportation and Air Quality, U.S. Environmental Protection Agency, Washington, DC, EPA420-R-06-006, March 2006. This document is available in Docket EPA-HQ-OAR-2004-0008.

flow through multiple chambers or baffles within the catalyst-muffler; and 4) larger catalyst-muffler volumes than the original equipment muffler.

(2) Fuel Evaporative Emission Standards for Nonhandheld and Handheld Engines and Equipment

We reviewed the fuel line and fuel tank characteristics for nonhandheld and handheld equipment and evaluated control technology which could be used to reduce evaporative emissions from these two subcategories. The available technology is capable of achieving reductions in fuel tank and fuel line permeation without an adverse incremental impact on safety. For fuel lines and fuel tanks, the applicable consensus safety standards, manufacturer specific test procedures and EPA requirements are sufficient to ensure that there will be no increase in the types of fuel leaks that lead to fire and burn risk during in-use operation. Instead, these standards will reduce vapor emissions both during operation and in storage. That reduction, coupled with some expected equipment redesign, is expected to lead to reductions in the risk of fire or burn without affecting component durability.

The Failure Mode and Effects Analyses, which was described in the previous section, also evaluated permeation and running loss controls on nonhandheld engines. We found that these controls will not increase the probability of fire and burn risk from those expected with current fuel systems, but could in fact lead to directionally improved systems from a safety perspective. Finally, the running loss control program being promulgated for nonhandheld equipment will lead to changes that are expected to reduce risk of fire during in-use operation. Moving fuel tanks away from heat sources, improving cap designs to limit leakage on tip over, and requiring a tethered cap will all help to eliminate conditions which lead to in-use problems related to fuel leaks and spillage. Therefore, we believe the application of emission control technology to reduce evaporative emissions from these fuel lines and fuel tanks will not lead to an increase in incremental risk of fires or burns and in some cases is likely to at least directionally reduce such risks.

(3) Exhaust Emission Standards for Outboard and Personal Watercraft Marine Engines and Vessels and Marine Auxiliary Engines

Our analysis of exhaust emission standards for OB/PWC engines and marine auxiliary engines found that the U. S. Coast Guard (USCG) has comprehensive safety standards that apply to engines and fuel systems used in these vessels. Additionally, organizations such as the Society of Automotive Engineers, Underwriters Laboratories, and the American Boat and Yacht Council (ABYC) also have safety standards that apply in this area. We also found that the four-stroke and two-stroke direct injection engine technologies which are likely to be used to meet the exhaust emission standards contemplated for OB/PWC engines are in widespread use in the vessel fleet today. These more sophisticated engine technologies are replacing the traditional two-stroke carbureted engines. The four-stroke and two-stroke direct injection engines meet applicable USCG and ABYC safety standards and future products will do so as well. The new emission standards must be complementary to existing safety standards and our analysis indicates that this will be the case. There are no known safety issues with the advanced technologies compared with two-stroke carbureted engines. The newer-technology engines arguably provide safety benefits due to improved engine reliability and range in-use. Based on the applicability of USCG and ABYC safety standards and the good in-use experience with advanced-technology engines in the current vessel fleet, we believe new emission standards will not create an incremental increase in the risk of fire or burn to the consumer.

(4) Fuel Evaporative Emission Standards for Outboard and Personal Watercraft Engines and Vessels

We reviewed the fuel line and fuel tank characteristics for marine vessels and evaluated control technology which could be used to reduce evaporative emissions from boats. With regard to fuel lines, fuel tanks, and diurnal controls, there are rigorous USCG, ABYC, United Laboratories, and Society of Automotive Engineers standards which manufacturers will continue to meet for fuel system components. All these standards are designed to address the in-use performance of fuel systems, with the goal of eliminating fuel leaks. The low-permeation fuel lines and tanks needed to meet the Phase 3 requirements will need to pass these standards and every indication is that they will pass.[119]

Furthermore, the EPA permeation certification requirements related to emissions durability will add an additional layer of assurance. Low-permeation fuel lines are used safely today in many marine vessels. Low-permeation fuel tanks and diurnal emission controls have been demonstrated in various applications for many years without an increase in safety risk. Furthermore, a properly designed fuel system with fuel tank and fuel line permeation controls and diurnal emission controls will reduce the fuel vapor in the boat, thereby reducing the opportunities for fuel related fires. In addition, using improved low-permeation materials coupled with designs meeting USCG and ABYC requirements should reduce the risk of fuel leaks into the vessel. We believe the application of emission control technologies on marine engines and vessels for meeting the new fuel evaporative emission standards will not lead to an increase in incremental risk of fires or burns, and in many cases may incrementally decrease safety risk in certain situations.

B. Noise

As automotive technology demonstrates, achieving low emissions from spark-ignition engines can correspond with greatly reduced noise levels. Direct-injection two-stroke and four-stroke OB/PWC have been reported to be much quieter than traditional carbureted two-stroke engines. Catalysts in the exhaust act as mufflers which can reduce noise. Additionally, adding a properly designed catalyst to the existing muffler found on all Small SI engines can offer the opportunity to incrementally reduce noise.

C. Energy

(1) Exhaust Emission Standards

Adopting new technologies for controlling fuel metering and air-fuel mixing, particularly the conversion of some carbureted engines to advanced fuel injection technologies, will lead to improvements in fuel consumption. This is especially true for OB/PWC engines where we expect the new standards to result in the replacement of old technology carbureted two-stroke

[119] "EPA Technical Study on the Safety of Emission Controls for Nonroad Spark-Ignition Engines < 50 Horsepower," Office of Transportation and Air Quality, U.S. Environmental Protection Agency, Washington, DC, EPA420-R-06-006, March 2006. This document is available in Docket EPA-HQ-OAR-2004-0008.

engines with more fuel-efficient technologies such as two-stroke direct injection or four-stroke engines. Carbureted crankcase-scavenged two-stroke engines are inefficient in that 25 percent or more of the fuel entering the engine may leave the engine unburned. EPA estimates that conversion to more fuel efficient recreational marine engines will save 61 million gallons of gasoline per year in 2030. The conversion of some carbureted Small SI engines to fuel injection technologies is also expected to improve fuel economy. We estimate approximately 18 percent of the Class II engines will be converted to fuel injection and that this will result in a fuel savings of about 10 percent for each converted engine. This translates to a fuel savings of about 56 million gallons of gasoline in 2030 when all the Class II engines used in the U.S. will comply with the Phase 3 standards. By contrast, the use of catalyst-based control systems on Small SI engines is not expected to change their fuel consumption characteristics.

(2) Fuel Evaporative Emission Standards

We anticipate that the new fuel evaporative emission standards will have a positive impact on energy. By capturing or preventing the loss of fuel due to evaporation, we estimate that the lifetime average fuel savings will be about 1.6 gallons for an average piece of Small SI equipment and 32 gallons for an average boat. This translates to a fuel savings of about 41 million gallons for Small SI equipment and 30 million gallons for Marine SI vessels in 2030 when most of the affected equipment used in the U.S. will be expected to have evaporative emission controls.

VIII. Requirements Affecting Other Engine and Vehicle Categories

We are making several regulatory changes that will affect other engines, equipment, vehicles, and vessels in our nonroad and highway programs. These changes are described in the following subsections. As noted in these subsections, those changes that were not proposed are being made in response to the comments we received.

A. State Preemption

Section 209(e) of the Clean Air Act prohibits states and their political subdivisions from adopting or enforcing standards and other requirements relating to the control of emissions from nonroad engines or vehicles. Section 209(e) authorizes EPA to waive this preemption for California for standards and other requirements for nonroad engines and vehicles, excluding new engines that are smaller than 175 horsepower used in farm or construction equipment or vehicles and new locomotives or new engines used in locomotives. States other than California may adopt and enforce standards identical to California standards authorized by EPA.

EPA promulgated regulations implementing section 209(e) on July 20, 1994 (59 FR 36987). EPA subsequently promulgated revised regulations implementing section 209(e) on December 30, 1997 (62 FR 67733). See 40 CFR part 85, subpart Q. As proposed, we are creating a new part 1074 that describes the federal preemption of state and local emission requirements. This is being done as part of EPA's ongoing effort to write its regulations in plain language format in subchapter U of title 40 of the CFR. The final regulations are based directly on the existing regulations in 40 CFR part 85, subpart Q. With the exception of the specific changes described in this section, we are not changing the meaning of these regulations.

Pursuant to section 428 of the 2004 Consolidated Appropriations Act, we are adding regulatory language to implement the legislative restriction on states other than California adopting, after September 1, 2003, standards or other requirements applicable to spark-ignition engines smaller than 50 horsepower. We are also adding, pursuant to that legislation, criteria for EPA's consideration in authorizing California to adopt and enforce standards applicable to such engines.[120]

In addition, on July 12, 2002, the American Road and Transportation Builders Association (ARTBA) petitioned EPA to amend EPA's rules implementing section 209(e) of the Act.[121] In particular, ARTBA petitioned EPA to amend its regulations and interpretive rule regarding preemption of state and local requirements "that impose in-use and operational controls or fleet-wide purchase, sale or use standards on nonroad engines."[122] ARTBA believes such controls should be preempted.

As we were already planning to revise the preemption provisions to a certain extent in this rule, we determined that it was appropriate to respond to ARTBA's petition in the context of this rule, and noticed our review in the proposal for this rule, giving the public the ability to respond to provide comments regarding ARTBA's petition. After reviewing ARTBA's petition and the comments received regarding the petition, EPA is not adopting the changes requested by ARTBA in its petition. While EPA is in agreement with ARTBA regarding some of the observations it makes in the petition regarding preemption of state standards, particularly state fleet average standards, we believe the current regulatory language is sufficient regarding preemption of such standards. In addition, we believe that it would be inappropriate to grant ARTBA's request that we amend the existing regulations to find that restrictions on the use and operation of nonroad engines are preempted under section 209(e) of the Act. For a full discussion and response to ARTBA's petition and the comments we received on the petition, please review "Response to the Petition of American Road and Transportation Builders Association to Amend Regulations Regarding the Preemption of State Standards Regulating Emissions from Nonroad Engines," which has been placed in the docket for this rulemaking.

B. Certification Fees

Under our current certification program, manufacturers pay a fee to cover the costs associated with various certification and other compliance activities associated with an EPA issued certificate of conformity. These fees are based on the actual and/or projected cost to EPA per emission family. We are establishing a new fees category for certification related to the new evaporative emission standards. Sections III and VI describe how the fees apply to

[120] See section 428 of the Appropriations Act for 2004.

[121] "Petition to Amend Rules Implementing Clean Air Act section 209(e)," American Road and Transportation Builders Association (ARTBA), July 12, 2002. Also, EPA received an additional communication from ARTBA urging EPA to grant the petition after the decision of the U. S. Supreme Court in EMA v. SCAQMD, 541 U.S. 246 (2004). See "ARTBA Petition," L. Joseph, ARTBA, to D. Dickinson & R. Doyle, EPA, April 30, 2004. These documents are available in Docket EPA-HQ-OAR-2004-0008.

[122] In 1994, EPA promulgated an interpretive rule at Appendix A to subpart A of 40 CFR part 89. This interpretive rule was amended as part of the rule promulgated on December 30, 1997 (62 FR 67733). The appendix provides, among other things, that state restrictions on the use and operation of nonroad engines are not preempted under section 209.

sterndrive/inboard marine engines and equipment and vessels subject to evaporative emission standards since manufacturers are not currently required to pay certification fees for these products.

In addition, as proposed, we are creating a new part 1027 in title 40 that incorporates the new and existing fee requirements under a single part in the regulations. This is being done as part of EPA's ongoing effort to write its regulations in plain language format in subchapter U of title 40 of the CFR. The final regulations are based directly on the existing regulations in 40 CFR part 85, subpart Y. Aside from a variety of specific changes, moving this language to part 1027 is not intended to affect the substance of the existing fee provisions. We are making the following adjustments and clarifications to the existing regulations:

- Establishing a new fees category for new evaporative emission standards.
- Eliminating one of the paths for applying for a reduced fee. The existing regulations specify that applications covering fewer than six vehicles or engines, each with an estimated retail sales price below $75,000, shall receive a certificate for five vehicles or engines. Holders of these certificates are required to submit an annual model year reduced fee payment report adjusting the fees paid. We are eliminating this pathway and the associated report, as they are complex and have been rarely used.
- Clarifying the obligation to make additional payment on a reduced fee certificate if the actual final sales price is more than the projected retail sales price for a reduced fee vehicle or engine. As before, the final fee payment must also reflect the actual number of vehicles.
- Applying the calculated fee changes for later years, which are based on the Consumer Price Index and the total number of certificates, only after the change in the fee's value since the last reported change has reached $50. The fee change for the "Other" category for calendar year 2005 to 2006 changed from $826 to $839 and for non-road compression-ignition engines from $1822 to $1831. Under the final rule, the fee will not change until such time as the fee increase will be $50.00 or greater. This might not occur after one year, but after two or more years the calculated increase in a fee based on the change in the Consumer Price Index might be more than $50.00. The same applies if the price goes up or down. For example, if the fee published in EPA guidance for a category of engine was $1,000 in 2011 and the calculated fee for 2012 is $990 and in 2013 is $1040, the fee in 2013 will remain at $1,000 since the change from the 2011 fee is only $40. This will minimize confusion related to changing fees where the calculated fee is very close to that already established for the previous year. It will also lessen paperwork and administrative burdens for manufacturers and EPA in making adjustments for small fees changes for applications that are completed around the change in a calendar year. The number of certificates may go up or down in any given year, while the Consumer Price Index will generally increase annually. As a result, this change will be revenue-neutral or will perhaps slightly decrease overall revenues.
- Clarifying that all fee-related records need to be kept, not just those related to the "final reduced fee calculation and adjustment."
- Adding www.Pay.gov or other methods specified in guidance as acceptable alternative methods for payment and filing of fee forms.
- Establishing a single deadline for all types of refunds: total, partial for reduced fees, and partial for corrections. In all cases, refund requests must be received within six months of the end of the model year. A common type of request is due to an error in the fee amount paid as a result of changed fees for a new calendar year. We frequently apply these overpayments to other pending certification applications. This is less burdensome than applying for a simple

refund, both for EPA and for most manufacturers. Applications to apply such refunds to other certification applications must also be received within six months of the end of the model year of the original engine family or test group.

- Emphasizing with additional cross references that the same reduced fee provisions that apply to Independent Commercial Importers also apply to modification and test vehicle certificates under 40 CFR 85.1509 and 89.609: the number of vehicles covered is listed on the certificate, a revision of the certificate must be applied for and additional reduced fee payments made if additional vehicles are to be covered, and the certificate must be revised to show the new total number of vehicles to be covered.
-

We are making one additional change in the regulations based on comments regarding the limits on fees that apply for locomotive and marine diesel remanufacturing systems or kits. We are specifying that certified remanufacturing systems or kits under these programs are eligible for reduced fees based on the value of the remanufacturing system or kit rather than the value of the whole locomotive or vessel. This is analogous to existing provisions for fuel-conversion kits in which the regulation specifies that the basis for evaluating the one-percent threshold is the value of the kit alone. We are therefore modifying the regulation to allow for reduced fees where the assessed fee is more than one percent of the value of the remanufacturing system or kit. This applies equally to locomotives and marine diesel engines, which are now also subject to remanufacturing certification provisions.

C. Amendments to General Compliance Provisions in 40 CFR Part 1068

We have adopted final rules to apply the provisions of part 1068 for locomotives regulated under part 1033, nonroad diesel engines regulated under 40 CFR part 1039, marine diesel engines regulated under 40 CFR part 1042, Large SI engines regulated under 40 CFR part 1048, and recreational vehicles regulated under 40 CFR part 1051. In this final rule we are applying these provisions for Small SI and Marine SI engines, equipment, and vessels. Any changes we make to part 1068 will apply equally for these other types of engines and vehicles.

The following paragraphs describe several amendments we are making to part 1068, including several changes and clarifications subsequent to the proposed rule. We summarize several of the most important changes since the proposal in Section X.

(3) Partially complete engines

We proposed to revise our definition of “engine” to be clear that it includes those engines that are only partially complete. We received many comments regarding the impact of this clarification. The final approach described in this subsection includes revisions from the proposal to address these comments.

We are aware that in some cases manufacturers produce nonroad engines by starting with a complete or partially complete engine from another manufacturer and modify it as needed for the particular application. This is especially common for Marine SI and Large SI engines and equipment, but it may also occur for other types of nonroad engines and equipment. We are aware that an interpretation of the prohibited acts in §1068.101 would disallow this practice because the original engine manufacturer is arguably selling an engine that is not covered by a certificate of conformity even though emission standards apply. We are also concerned that some manufacturers might choose to exploit this ambiguity by importing partially complete engines, contending that these are not subject to standards, where the company receiving the shipment would assemble the engines and sell them without going through the certification process. It would be very difficult to monitor or enforce requirements with this kind of business activity.

We are addressing this first by defining “engine” for the purposes of the regulations (see §1068.30). To do this, we differentiate between complete engines and partially complete engines, both of which need to be covered by a valid certificate or an exemption. An engine block becomes an “engine” subject to standards when a crankshaft is installed. This represents a substantial step in the manufacturing process. Selecting a later point in the assembly process would only create the potential for loopholes for companies wanting to sell products that fall just short of what it would take to be subject to standards.

Partially complete engines include any engine that has not been fully assembled or is not yet in its final configuration. This might include short blocks that are shipped to another location for final assembly. It might also include full assembled engines that will be installed in all-terrain vehicles (which are subject to equipment-based standards). Even though these engines are still subject to further assembly or modification, they are subject to standards and certification requirements and therefore may not be introduced into U.S. commerce without an exemption. We are adopting provisions to accommodate various assembly paths reflecting current business practices. For example, we are specifying that manufacturers may ship partially complete engines between two of their facilities (see §1068.260). We would require manufacturers to notify us that this practice is occurring and get our approval, but they would not need to take any additional steps.

We have greater concerns about ensuring that engines always reach their certified configuration when engines are shipped from one company to another, or anytime a company that is not a certificate holder is introducing partially complete engines into U.S. commerce. To address this, we are adopting detailed provisions in §1068.262. These provisions clarify and expand on the provisions adopted earlier in §1068.330 for imported engines. The original engine manufacturer needs a written request from a secondary engine manufacturer who already holds a valid certificate of conformity for the engine based on its final configuration and application. The request from the secondary engine manufacturer would also identify an engine family name. This engine family name could be any valid family name for that engine model and would not necessarily need to be the actual family name for that engine in its final configuration. For example, a secondary engine manufacturer might sell a single engine model into stationary, marine, and industrial applications, each of which might have a different engine family name. As long as there is a valid family name, the original engine manufacturer could be confident that the secondary engine manufacturer will be modifying the engine to be in a certified configuration. The original engine manufacturer would apply a removable label identifying their corporate name and stating that the engines are exempt under these provisions for partially complete engines. The label or the accompanying bill of lading would also name the secondary engine manufacturer as the certificate-holder and identify the destination for the engines being shipped. The labels may be applied to individual engines or they may be applied to the packaging for engines that are shipped together.

We are accommodating the need to start assembling products while the application for certification is pending. We would treat these shipments the same as we would treat early production for a manufacturer building its own engine blocks, as described in Section VIII.C.2.

There are also situations in which a secondary manufacturer would build engines that will continue to be exempt after the point of final assembly. For example, some engines may be intended only for export, for national security, or for developmental or testing purposes. In these cases where the secondary engine manufacturer is unable to identify a valid family name, they would simply inform the original manufacturer of the regulatory cite that allows them to produce exempted engines. Note that this process is generally permitted only in the case where the original engine manufacturer and the secondary engine manufacturer are certificate holders, which means that they have at least one certificate of conformity with EPA (even if that is for a different type of engine).

The regulation includes language to clarify that the original manufacturer is liable for shipment of properly labeled engines to a manufacturer who has applied for or received a valid certificate of conformity or who has an exemption for the engines being shipped. The original engine manufacturer would be in violation if (1) the engines and their labels are separated before reaching the secondary engine manufacturer, (2) if the engines are shipped to the wrong destination, or (3) if the secondary engine manufacturer does not in fact have the certification or exemption in place as prescribed. We expect original engine manufacturers to have a clear relationship with their associated secondary engine manufacturers so they can readily verify the status of any particular certification or exemption; due diligence on the part of the original engine manufacturer should allow for a high degree of confidence that all the applicable conditions are met.

Another situation involving partially complete engines involves the engine block as a replacement part where, for example, the original engine had major structural damage. In this case the engine manufacturer will typically sell an engine block with piston, crankshaft, and other internal components to allow the user to repower with many of the components from the original engine. Under the new definitions, these short blocks or three-quarter blocks are considered new engines subject to emission standards. We have addressed this situation in the regulations with the replacement engine provisions in §1068.240. This may involve one of two basic situations. In cases where the short block is no different than what is being produced for complete, certified engines in the current model year, there is no need for demonstrations or approval for an exemption from emission standards. We are adding clarifying language that these partially complete engines may be sold to repower failed engines without restriction. We do, however, require that these engines be labeled to prevent someone from circumventing the regulations by using these short blocks to build new noncompliant engines. These labels would serve as a preventive measure and make it easier for EPA inspectors to detect a violation. In cases where the short block is from a previous model year when less stringent emission standards apply, we would want to treat this under the same replacement-engine provisions that apply to complete engines. Section VIII.C.5 describes these provisions related to replacement engines in greater detail.

We are also further clarifying the requirement for engine manufacturers to sell engines in their certified configuration (see §1068.260). The existing provisions in part 1068 describe how manufacturers may use delegated assembly to arrange for equipment manufacturers to separately source aftertreatment components for engines that depend on aftertreatment to meet emission standards. We are including language to clarify that we will consider an engine to be in its certified configuration in certain circumstances even if emission-related components are not assembled to the engine. This is intended to reflect common practice that has developed over the years. We are also clarifying that engines may be shipped without radiators or other components that are unrelated to emission controls, and that we may approve requests to ship engines without emission-related components in some circumstances. This will generally be limited to equipment-related components such as vehicle-speed sensors. We may specify conditions that we determine are needed to ensure that shipping the engine without such components will not result in the engine being operated outside of its certified configuration.

(4) Provisions related to model year and date of manufacture

We proposed definitions of "model year" and "date of manufacture" in conjunction with our proposed definition of "engine". We received a number of comments regarding these definitions. As a result of these comments, we are finalizing the approach described below.

Until now, the regulations have not specified the point in the assembly or procurement process that should serve as the basis for establishing an engine's date of manufacture for purposes of deciding which standards apply. For the large majority of engines, this is not an issue, since total assembly time from start to finish is measured in hours or perhaps days. As a result, it is relatively uncommon for there to be any uncertainty regarding an engine's date of manufacture. Nevertheless, we have learned that there are widely diverging practices for establishing an engine's date of manufacture in several special situations, which means there is a different effective date of new emission standards for different manufacturers. This is especially of interest for larger engines, which are more likely to have longer assembly times and to be assembled in multiple stages at different facilities. We believe it is important to establish a clear requirement in this regard to avoid ambiguity and different interpretations. A consistent approach preserves a level playing field and may prevent some manufacturers from manipulating their build dates to circumvent the regulations.

We expected that the proposed definition of "date of manufacture," based on reaching a final, running configuration, was the most straightforward and logical interpretation. The comments received and the ensuing discussions made clear that this interpretation was not universally held. The diversity of views underscores the need for the regulations to establish a clear and uniform requirement.

We recognize the concern that manufacturers need a high degree of certainty regarding applicable emission standards when they initiate assembly of an engine. Any number of variables in the production process could affect how long it takes to finish building an engine. We therefore believe it is most appropriate to match up the definitions for "date of manufacture" and "engine" by specifying that an engine's date of manufacture should be based on the date that the crankshaft is installed in the engine. This provides manufacturers with the control they need to determine which emission standards apply when they start to build the engine.

We are aware that secondary engine manufacturers may have inventory and assembly procedures that are not tied to the actual date of crankshaft installation by the original engine manufacturer. We are therefore specifying for this situation that the date of manufacture is generally the date the secondary engine manufacturer receives shipment of the partially complete engine. Alternatively, where the manufacturer knows the date the crankshaft was actually installed in the engine and receives the engine within 30 days of that date, it may use the actual date of crankshaft installation as the date of manufacture. This puts the secondary engine manufacturer in a similar position relative to companies with sole responsibility for assembling complete engines, without placing unreasonable expectations on secondary engine manufacturers to know how engines were assembled by their supplier.

Some manufacturers may want to name a date of manufacture that is later than we specify in the regulation. This may be for marketing purposes, managing inventories of engine components, or for other recordkeeping or product-development reasons. There is no risk of manufacturers gaining an advantage of being subject to less stringent standards by delaying the date of manufacture for an engine, so we would have no objection to that. However, we limit the selection of date of manufacture to a later point <u>in the assembly process</u>. Selecting a date of manufacture after the end of the assembly process for an engine would raise concerns about the risk for manipulating emission credits for a given model year and about ensuring that engine assembly and dates of manufacture are always within the production period established for a given engine family, as described in the certificate of conformity or the manufacturer's records. We see no legitimate reason to select a date of manufacture after completing assembly for an engine. Note that since the entire assembly process is complete within no more than a few days for most engines, we would expect this allowance to rarely affect the date of manufacture significantly.

This approach to defining "date of manufacture" addresses manufacturers' concerns for knowing which standards apply to an engine, but we are also concerned that manufacturers could ramp up production of engine blocks with installed crankshafts as a method to delay compliance with new emission standards. EPA regulations have always included provisions describing limits on inventory and stockpiling practices for nonroad equipment manufacturers. The regulations until now do not clearly address issues related to stockpiling for engine manufacturers. We agree with the suggestion from commenters that anti-stockpiling provisions that are specific to engine manufacturers would be appropriate. The Clean Air Act contemplates the need for such provisions in section 202(b)(3), where there is direction for EPA to consider establishing a definition of model year that prevents stockpiling. At the same time, we received other comments related to production periods and model year, leading us to adopt a collection of related provisions in §1068.103.

The new text in §1068.103 includes three main provisions that are already in place for motor vehicles and heavy-duty highway engines in §§85.2304 and 85.2305. First, we are clarifying that the scope of a certificate of conformity may be limited to established engine models, production periods, or production facilities. Any such limits would be included in the manufacturer's application for certification or in the certificate of conformity. Second, we are defining the limits on selecting production periods for purposes of establishing the model year. Third, we are clarifying that engine manufacturers may start producing engines after they submit an application for certification and before the certification is approved. This includes provisions to address the manufacturers' responsibility to ensure (1) that engines are not introduced into U.S. commerce until the certification is approved; (2) that all engines are assembled consistent with the certification, including any changes that may come from the certification review process; and (3) that manufacturers make these early-production engines available for production-line testing or selective enforcement audits, as appropriate.

In addition, we are adding provisions to establish limits on stockpiling for engine manufacturers. We are doing this by stating that manufacturers must use their normal inventory and assembly processes for initiating assembly of their engines. We include a clarifying expectation that we would expect normal assembly processes to involve no more than one week to complete engine assembly once the crankshaft is installed. We understand that assembly processes in some special cases are more complicated, and that engine manufacturers may be unable to complete engine assembly in some cases based on delivery of certain components or other extenuating factors. To put some boundaries on these exceptional situations, the regulation specifies a presumption that the engine manufacturer has violated the stockpiling prohibition if engine assembly is complete more than 30 days after the end of the model. This presumption date is 60 days after the end of the model year for engines with per-cylinder displacement above 2.5 liters. This generally distinguishes engines that may have relatively high sales volumes (including heavy-duty highway engines) from bigger engines that are sold in much lower sales volumes.

Note that the potential burden and disruption related to these provisions is limited in two important ways. First, the restrictions related to date of manufacture and model year in §1068.103(f) apply only when there is a change in emission standards for the coming model year. We would still expect manufacturers to take this approach in years when there is no change in emission standards, but these requirements would not strictly apply. We are also including hardship provisions to allow manufacturers to request approval to extend the final assembly deadline for their engines if circumstances outside their control prevent them from completing engine assembly in time. We would approve such a request only if the manufacturer could not have avoided the situation and took all possible steps to minimize the extent of the delay.

(5) Restrictions on naming model years relative to calendar year

We proposed restrictions to naming model years for Small SI engines. In response to the comments we received, we are finalizing these restrictions for all engines subject to 40 CFR part 1068.

Exhaust emission standards apply based on the date of engine assembly. We similarly require that equipment manufacturers use engines meeting emission standards in the same model year as equipment based on the equipment assembly date. For example, starting January 1, 2009, an equipment manufacturer must generally use a 2009 model year engine. However, we allow equipment manufacturers to deplete their normal inventories of engines from the previous model year as long as there is no stockpiling of those earlier engines. Note that this restriction does not apply if emission standards are unchanged for the current model year. We have found many instances where companies will import new engines usually installed in equipment and claim that the engine was built before emission standards took effect, even if the start date for emission standards was several years earlier. We believe many of these engines were in fact built later than the named model year, but it is difficult to prove the date of manufacture, which then makes it difficult to properly enforce these requirements. Now that emission standards have been in place for most engines for several years, we believe it is appropriate to implement a provision that prevents new engines manufactured several years previously to be imported when more recent emission standards have been adopted. This will prevent companies from importing noncompliant products by inappropriately declaring a manufacture date that precedes the point at which the current standards started to apply. This also puts a time limit on our existing provisions that allow for normal inventory management to use the supply of engines from previous model years when there has been a change in standards.

We are specifying that engines and equipment will be treated as having a model year at most one year earlier than the calendar year in which the importation occurs when there is a change in emission standards (see §90.615 and §1068.360). This requirement will start January 1, 2009 for Small SI engines and it will start immediately when the final rule becomes effective for engines/equipment subject to part 1068. For example, for new standards starting in the 2009 or earlier model years, beginning January 1, 2010, all imported new engines will be considered to have a model year of 2009 or later and will need to comply with new 2009 standards, regardless of the actual build date of the engines or equipment. (Engines or equipment will be considered new unless the importer demonstrates that the engine or equipment had already been placed into service, as described below.) This will allow a minimum of twelve months for manufactured engines to be shipped to equipment manufacturers, installed in equipment and imported into the United States. This time interval will be substantially longer for most engines because the engine manufacturer's model year typically ends well before the end of the calendar year. Also, engines produced earlier in the model year will have that much more time to be shipped, installed, and imported.

Manufacturers have expressed concern that the one-year limitation on imported products may be too short since there are often delays related to shipping, inventory, and perhaps most significantly, unpredictable fluctuations in actual sales volumes. We do not believe it is appropriate to maintain long-term inventories of these products outside the United States for eventual importation when it is clear ahead of time that the new standards are scheduled to take effect. Companies may be able to import these products shortly after manufacturing and keep their inventories in a U.S. distribution network to avoid the situation of being unable to sell these products in the United States.

In years where the standards do not change, this provision will have no practical effect because, for example, a 2004 model year engine meets the 2006 model year standards. We will treat such an engine as compliant based on its 2004 emission label, any emission credit calculations for the 2004 model year, and so on. These engines can therefore be imported anytime until the end of the calendar year in which new standards take effect.

We do not intend for these provisions to delay the introduction of the new emission standards by one year. It is still a violation to produce an engine in the 2011 calendar year and call it a 2010 model year engine to avoid being subject to 2011 standards.

Importation of equipment that is not new is handled differently. These products will not be required to be upgraded to meet new emission standards that started to apply after the engine and equipment were manufactured. However, to avoid the situation where companies simply declare that they are importing used equipment to avoid new standards, we are requiring that they provide clear and convincing evidence that such engines have been placed into service prior to importation. Such evidence will generally include documentary evidence of purchase and maintenance history and visible wear that is consistent with the reported manufacture date. Importing products for resale or importing more than one engine or piece of equipment at a time will generally call for closer evaluation to determine that this degree of evidence has been met. Note that the regulations generally treat engines converted to a different category as new engines, even if they have already been placed into service. For example, if a motor vehicle is modified such that it no longer fits under the definition of motor vehicle, its engine generally become a new nonroad engine and is subject to emission standards and other requirements based on its model year as specified in the regulation.

(6) Liability for causing violations

In the last few years, there has been a surge in the number of illegal nonroad engines, vehicles and equipment, such as tractors, lawn mowers, generators and all-terrain vehicles, imported into the United States. A significant number of the imported nonroad engines, vehicles and equipment fail to meet EPA requirements and standards under the Clean Air Act. The manufacturers of these illegal goods often are out of the effective reach of United States jurisdiction and enforcement. In 2007, the recall of lead-contaminated toys and more than 5,300 melamine-laced pet food products resulted in heightened interest in what the U.S. government is doing to safeguard the health of its citizens with regard to imported consumer products.

In July 2007, President Bush signed Executive Order 13439 establishing an Interagency Working Group on Import Safety. This Working Group consists of over ten government agencies including EPA and the Departments of Health and Human Services, Homeland Security, State, Treasury, Justice, Agriculture, and Transportation. The wide range of agencies involved in this Working Group illustrates the breadth of import issues.

One of the recommendations of the Interagency Working Group on Import Safety was to consider a strategic focus or initiative, using existing statutory and regulatory authorities, and, based upon Agency priorities, increase enforcement actions against foreign and domestic manufacturers, as well as importers, brokers, distributors, and retailers who introduce illegal goods into the stream of commerce. This rulemaking will help clarify for all regulated parties, including retailers, that liability for the importation of nonroad vehicles, engines and equipment in violation of the Clean Air Act and/or its implementing regulations extends beyond the manufacturer and direct importer of the product.

We requested comments regarding revisions to §1068.101 to clarify the types of actions for which EPA may pursue enforcement proceedings. In this rule we are finalizing such clarifying provisions in §1068.101. Section 203 of the Act states that performing certain acts, “and the causing thereof,” constitutes a prohibited act. We are adding a new paragraph (c) in §1068.101 to specifically include this prohibition on the “causing” of any of the prohibited acts listed in the statute and the regulations. Adding this clarification will help people who are subject to the regulations to more fully understand what actions are prohibited and may potentially subject them to enforcement proceedings under the Act. The revisions themselves do not add new enforcement authorities beyond what is already specified in the statute.

Since we consider it a violation to cause someone to commit a specified prohibited act, persons causing any such prohibited act would also be subject to the full administrative and judicial enforcement actions allowable under the Act and the regulations. The prohibition on “causing” a prohibited act would apply to all persons and would not be limited to manufacturers or importers of regulated engines or equipment.

EPA interprets the “causation” aspect of section 203 broadly. In assessing whether a person has caused a prohibited act, EPA will evaluate the totality of the circumstances. For example, in certain circumstances EPA believes that a retailer may be responsible for causing the importation of engines or equipment not covered by a valid certificate of conformity or otherwise in violation of our regulations, such as the emission labeling requirements. In addition to the prohibitions that apply to manufacturers and importers under section 203, EPA will also consider many factors in assessing whether a manufacturer, importer, retailer, distributor or other person has caused a prohibited act. For example, contractual (or otherwise established) business relationships of those persons involved in producing and/or selling new engines and equipment could be evidence of the ability of the person to cause a violation. In addition, we would consider the particular efforts or influence of the alleged violator contributing to, leading to, or resulting in the prohibited act. On the other hand, we would also consider a person's efforts to prevent such a violation as evidence that they did not cause the violation.

EPA will evaluate the entire circumstances in determining whether a person caused another person to commit a prohibited act such as importing engines or equipment in violation of our regulations.

To assist importers, distributors, retailers, and the general public to determine whether the products they are buying or selling comply with EPA regulations, EPA is expanding its compliance assistance efforts. Imports compliance assistance information is available at http://www.epa.gov/otaq/imports/index.htm and http://www.bordercenter.org/chem/vehicles.htm. Additionally, general certification information may also be found at www.epa.gov/otaq/nonroad.

(7) Engine rebuilding and replacement engines

We are finalizing the proposed changes to §1068.240. In addition, we are also making other changes to that section to address manufacturers' concerns for producing short blocks from previous-tier engines as replacement components for engines needing service in the field. (See Section VIII.C.1 for additional discussion.) The current provisions for the replacement-engine exemption in §1068.240 require that manufacturers take possession of the old engine (or confirm that it has been destroyed) and take steps to confirm that the exemption is needed for each new replacement engine. We acknowledge that these requirements could limit the manufacturers' ability in some cases to respond quickly for operators that would depend on minimizing their downtime.

The most significant change being made in response to the manufacturers comments is the allowance for limited use of partially complete engines as replacement components without the administrative requirements and oversight provisions that currently apply under §1068.240. We have created a streamlined approach for manufacturers to produce and sell a certain number of replacement engines, including partially complete engines, based on production volumes from preceding years. We are adopting a threshold of 1.0 percent of annual production through 2013 and 0.5 percent for 2014 and later. To calculate the number of engines under this provision, manufacturers would first determine their U.S.-directed production volumes of certified engines each year. This information is generally submitted as part of the reporting for production-line testing or in separate annual reports. The manufacturer would consider the preceding three model years to select the highest total production volume of certified engines across all their models in a given year. Multiplying this production volume by 0.01 (or 0.005 starting in 2014) would give the number of engines that the manufacturer could produce without triggering the administrative requirements currently specified in §1068.240. (We may approve the use of calculations based on earlier model years in unusual circumstances, such as the case where a manufacturer opts out of a broad category of engine production but continues to supply service parts for those models.) These threshold values should allow manufacturers the flexibility to meet the demand for partially complete replacement engines, but at production levels that clearly will not undermine the expected benefits of the emission standards that otherwise apply to new engines. For any number of noncompliant replacement engines exceeding the specified threshold, manufacturers would need to meet all the requirements that currently apply under §1068.240.

The engine grouping includes fairly broad aggregation of products to keep similar engines together. For example, all outboard engines, all snowmobiles, and all handheld engines would be counted together as separate groups. Diesel engines are generally sold to distributors in a configuration that could be adapted for use in nonroad applications, either land-based or marine, or in stationary applications. Engine manufacturers should therefore aggregate their sales of these engines without regard to their eventual deployment in any of these applications. However, we are aware that the very wide range in sizes and sales volumes makes it necessary to prevent aggregating large and small engines. Without this, the high sales volumes associated with small engines could allow for unlimited production of high-power replacement engines. Since it is not possible to establish a power rating for a partially complete engine, it is necessary instead to rely on engine displacement to differentiate these products. The selected per-cylinder cutpoints reflect existing regulatory requirements and production and marketing characteristics related to current engine offerings. The situation is similar for spark-ignition engines that may be used in stationary or nonroad applications (including marine), except that there is a much less pronounced range in engine sizes. The engine groupings for calculating allowable numbers of engines under this approach are shown in Table VIII.C-1.

We are also applying the replacement-engine exemption provisions to heavy-duty highway engines. There have been no such exemption provisions in the past; however, we are expecting engine technologies to change significantly in the coming years such that vehicle owners may be unable to replace engines that fail prematurely without being able to access replacement engines that are specifically built to match the earlier configuration. We believe these engines can be accounted for separately from nonroad and stationary engines with respect to production volumes, but we are otherwise applying all the provisions of §1068.240 equally to heavy-duty highway engines.

Table VIII.C-1 Aggregating Sets for Streamlined Replacement-Engine Provisions

Engine category	Standard-setting part	Engine subcategories
Highway CI	40 CFR part 86	disp. < 0.6 L/cyl
		0.6 ≤ disp. < 1.2 L/cyl
		disp. ≥ 1.2 L/cyl
Nonroad CI Stationary CI and Marine CI	40 CFR part 1039 or 40 CFR part 1042	disp. < 0.6 L/cyl
		0.6 ≤ disp. < 1.2 L/cyl
		1.2 ≤ disp. < 2.5 L/cyl
		2.5 ≤ disp. < 7.0 L/cyl
Marine SI	40 CFR part 1045	outboard
		personal watercraft
Large SI, Stationary SI, and Marine SI (sterndrive/ inboard only)	40 CFR part 1048 or 40 CFR part 1045	all engines
Recreational vehicles	40 CFR part 1051	off-highway motorcycle
		all-terrain vehicle
		snowmobile
Small SI and Stationary SI	40 CFR part 1054	handheld
		Class I
		Class II

There are two special situations to note. First, the replacement-engine provisions do not apply to locomotives, which have already been established in previous rulemakings. Second, the provisions for a streamlined approach for replacement engines do not apply for engines with per-cylinder displacement over 7.0 liters. These are generally very large, custom-built engines with low production volumes, so we believe it is not necessary or appropriate for engine manufacturers to maintain an inventory of these engines (complete or partially complete) on the assumption that someone wanting a replacement engine could not install an engine certified to emission standards for the current model year.

We are making an additional change to the replacement-engine exemption in §1068.240 to clarify what provisions apply for short blocks from a currently certified engine family. These are considered engines under the new regulatory definitions, so they need to be covered by a certificate of conformity or an exemption. We are specifying that short blocks from an engine model certified for the current model year are exempt under the replacement-engine exemption. These engines do not need an exemption based on their level of emission control since they are identical to certified engines meeting current standards. Rather, these engines need an exemption simply because they are shipped before they reach a certified configuration. Final assembly would typically be performed by the owner or a local service facility rather than an equipment manufacturer. We are therefore applying no conditions or restrictions on the sale of these replacement engines, other than the need for being part of a certified engine family and being labeled appropriately. The regulation specifies how to label the engine blocks to ensure that they can be clearly identified as replacement components. The regulation also clarifies that anyone completing the assembly of such an engine in violation of applicable requirements is a manufacturer who has committed a prohibited act. For example, installing such an engine in a new piece of equipment would violate the conditions of the replacement engine exemption and we may hold responsible any parties involved in assembling or installing the engine.

Simplified labeling requirements apply to current-tier short blocks used as replacement engines and to previous-tier short blocks falling under the streamlined approach for replacement engines described above. The general expectation is that the final, assembled engines continue to have a label describing their certification status (unless they were built before emission standards started to apply). For engines in which the certification label is on the short block or another component that is part of the short-block assembly, we require that the short block includes a permanent label identifying the name of the manufacturer, the part number of the short-block assembly, and a short statement describing this as a replacement engine. For engines in which the certification label is mounted on the equipment or on a part of the engine that will likely be preserved as part of the final assembly, we require similar labeling except that the label does not need to be permanent.

In addition, manufacturers have expressed a concern that the engine rebuilding provisions in §1068.120 and the replacement engine provisions in §1068.240 do not clearly address the situation in which rebuilt engines are used to repower equipment where the engine being replaced meets alternate emission standards (such as those produced under the Transition Program for Equipment Manufacturers). These engines are not certified to the emission standards that otherwise apply for the given model year, so there may be some confusion regarding the appropriate way of applying these regulatory requirements. We are therefore adopting clarifying language to make sure the required statements on engine labels and the underlying regulatory requirements reflect this scenario.

(8) Delegated assembly

We understand that engine manufacturers have competing interests both to maintain the ability to arrange flexible assembly procedures and agreements, and to ensure that their engines are introduced into commerce only after being assembled in the certified configuration. We share those objectives and believe the regulations related to delegated assembly serve the purpose of creating a framework for balancing these different concerns. These regulatory provisions will help manufacturers by defining practices that prevent a situation where competitiveness concerns cause them to take steps to reduce costs at the risk of producing noncompliant products.

We proposed special delegated assembly provisions for Small SI engines, rather than applying the delegated assembly provisions of part 1068. In this final rule, however, we are consolidating the various approaches for different types of engines and integrating them into a single framework that will apply generally for heavy-duty highway engines and for nonroad engines. The main difference between these previously existing programs is the allowance for heavy-duty highway engines to rely either on pricing engines and aftertreatment components together or auditing vehicle manufacturers, but not necessarily both, to ensure that installed engines are in a certified configuration. While we are concerned about the incentive for vehicle and equipment manufacturers to gain a financial advantage if aftertreatment components are not priced together with the engine, we believe requiring engine manufacturers to perform audits of vehicle or equipment manufacturers is generally sufficient to provide the proper assurances that engines are being properly assembled and installed. Conversely, we believe that pricing aftertreatment and engines together is a strong enough assurance of proper assembly and installation procedures that audits are generally not necessary as an additional oversight measure. We note that these provisions spell out a minimum level of oversight for engine manufacturers. There may be instances, such as a new relationship with a vehicle or equipment manufacturer or some other reason to have less confidence in proper assembly procedures, where the engine manufacturer would want or need to take steps beyond what the regulations require to ensure that engines are assembled properly.

We believe there is a strong advantage in implementing requirements uniformly across all the engine programs, both for EPA and for manufacturers. Aside from the pricing and auditing requirements described above, we are making the following provisions part of the final program, which were part of one or more of the programs adopted earlier in parts 85 and 1068, :

- Auditing rates are generally set at four equipment (or vehicle) manufacturers per year, or enough to rotate through all the equipment manufacturers over a four-year period, whichever is less. A reduced rate may apply after several years of successful implementation of these requirements.
- We are continuing the approach already adopted to provide for a streamlined demonstration for integrated manufacturers where the auditing would effectively be an internal practice.
- Engine manufacturers remain responsible for the in-use compliance of engines sold using the delegated-assembly provisions. This means, for example, that these engines would be subject to recall if we find that there are a substantial number of nonconforming engines.

In addition, we are including the following provisions in the unified approach to delegated assembly that were initiated as part of the proposal for Small SI engines:

- Distributors may participate in delegated assembly, but only to the extent that they act as equipment manufacturers, adding aftertreatment devices before shipping the engines to vehicle or equipment manufacturers. Allowing distributors to further delegate engine assembly to another set of companies raises fundamental questions about the ability of engine manufacturers to adequately ensure proper final assembly of their engines. We are making a temporary allowance for this for Small SI engines to accommodate the transitional provisions allowing equipment manufacturers to gradually work toward making Phase 3 products. Starting in 2015, Small SI manufacturers may rely on distributors to act as their agents only with our approval. Note that this restriction on distributors does not apply in cases where the distributor has a financial or administrative role in facilitating a transaction between engine and equipment manufacturers where the engine and equipment manufacturers meet all the requirements that apply under §1068.261(d).
- If engine manufacturers design their air-intake systems such that they depend on specific parts (identifiable by part number) to achieve proper air flow through the engine, that raises concerns that are similar to aftertreatment devices. In fact, we are currently pursuing an enforcement case where an equipment manufacturer did not follow the engine manufacturer’s directions to use a specific air filter. We are specifying that air filters identified by part number must be included in delegated assembly, though we require audits

related to air filters only if audits are already occurring for exhaust systems. If manufacturers specify intake air systems by performance parameters such as maximum pressure drop across the air filter, the delegated-assembly provisions do not apply. This is similar to the way we have treated exhaust components for systems not requiring exhaust aftertreatment. See §1068.260(a).

- Vehicle or equipment manufacturers submitting annual affidavits must include a count of aftertreatment devices received to verify that there were enough of the right models of aftertreatment devices for the number of engines involved.
- Engines need to be labeled to identify their status as delegated-assembly engines, either with a removable label or with "Delegated Assembly" noted on the engine's permanent label. This ensures that engines will not be introduced into commerce without an indication of their status relative to the certified configuration.
- Engine manufacturers must confirm that vehicle or equipment manufacturers have ordered aftertreatment devices corresponding to an engine order, but this confirmation is limited to the initial shipment of engines for a new certification and may occur up to 30 days after the engines have been ordered.
- For engines subject to requirements for production-line testing or selective enforcement audits, we specify that aftertreatment components must be randomly procured. We agree with the suggestion in the comments to broaden the allowance for randomly procuring components. As long as manufacturers use a method to randomly select components that are appropriate for the particular engine configuration, these components may come from any point in the normal distribution chain.

Manufacturers raised a concern regarding the possibility that they may inappropriately be paying Customs duties based on the value of aftertreatment devices that were priced with the engine even though they would be shipped separately. We have confirmed with the U.S. Customs and Border Protection that such an inappropriate payment of import duties can be avoided with documentation showing that the price of the engine includes a charge for components that are not included in that particular shipment. This also applies for importing aftertreatment devices alone where the import duty should not apply based on the value of the engine and aftertreatment together. This could most easily be accomplished by itemizing the invoice to identify the value of the missing components relative to the value of the rest of the engine. The regulations now include these specific instructions regarding invoicing with respect to import duties.

We understand that there may be companies complying with the delegated assembly provisions in §85.1713 or §1068.260 today. The changes included in this final rule generally expand the flexibility of complying with regulatory requirements. These regulatory changes generally apply immediately with the effective date of the final rule. However, there may be some need to modify current practices to conform to the revised regulation. If a manufacturer needs additional time to comply, we would expect to use the provisions of §1068.40 to work out an arrangement under which the manufacturer would be able to make an orderly transition toward complying with the new requirements.

(9) Miscellaneous changes

The most noticeable change we are making to part 1068 is the proposed clarification to the language throughout to make necessary distinctions between engines, equipment, and fuel-system components--and particularly between equipment using certified engines and equipment that has been certified to meet equipment-based standards. This becomes necessary because the evaporative emission standards apply in some cases to equipment manufacturers and boat builders, while the exhaust emission standards apply only to engine manufacturers. Some provisions in part 1068 apply to equipment manufacturers differently if they hold a certificate of conformity rather than merely installing certified engines (or certified fuel-system components). The changes in regulatory language are intended to help make those distinctions. See §1068.2 for a description of the new terminology that we intend to use throughout part 1068.

We previously adopted a definition of "nonroad engine" that continues to apply today (see §1068.30). This definition distinguishes between portable or transportable engines that may be considered either nonroad or stationary, depending on the way they will be used. The distinction between nonroad and stationary engines is most often relevant for new engines in determining which emission standards apply. However, we have received numerous questions related to equipment whose usage has changed so that the original designation no longer applies. The text of that original definition did not clearly address these situations. We are therefore adopting the proposed provisions that apply when an engine previously used in a nonroad application is subsequently used in an application other than a nonroad application, or when an engine previous used in a stationary application is moved (see §1068.31). In response to comments, we are also including language in the final rule to clarify that switching between nonroad and stationary does not change the engine's model year for purposes of establishing applicable standards. The engine would need to meet applicable requirements for its new application (or status), but this would not involve certifying the engine as new for the current model year. Note that the purpose of these changes to regulatory language is to clarify existing provisions rather than change which requirements apply for specific situations.

We are adopting the proposed changes to the thresholds for determining whether to investigate or report emission-related defects. These changes are intended to more carefully reflect the level of investigation and reporting that should apply for very high-volume engine families. In particular, we specify that manufacturers should investigate defects if potential (unscreened) emission-related defects exceed 4 percent for sales volumes between 50,000 and 550,000, with a threshold of 25,000 for all families with sales volumes above 550,000. Similarly, we specify that manufacturers should send a report if confirmed emission-related defects exceed 1 percent for sales volumes between 50,000 and 550,000, with a threshold of 6,000 for all families with sales volumes above 550,000.

Several of the new provisions in part 1068 address fundamental issues for complying with emission standards. Defining "engine" and "date of manufacture," clarifying the timing of the transition to new model years, adding requirements for shipping partially complete engines to secondary engine manufacturers, and creating a new path for exempting replacement engines could lead manufacturers to make significant changes in the way they comply with the regulations. However, in many cases we would expect the new regulations to generally reflect current business practices. We are therefore amending the regulatory requirements to part 1068 without identifying a certain lead time before the requirements apply. Instead, to address those situations where manufacturers need time to make a transition toward complying with new requirements, we are adding a general provision allowing us to approve a manufacturer's request to delay implementation of the new requirements in part 1068 for up to 12 months from the effective date of the final rule (see §1068.40). The changes to part 1068 have a legal effective date of **[insert date 60 days after publication in the FEDERAL REGISTER**]. We will generally approve these requests if manufacturers can demonstrate that it would be impractical to comply with the new requirements in the given time frame. We may consider the potential for adverse environmental impacts in our decision.

In addition, we proposed several amendments to part 1068 to clarify various items. These are being finalized, including:

- §1068.101(a)(1): Revising the prohibited act to specify that engines must be "covered by" a certificate rather than "having" a certificate. The revised language is more descriptive and consistent with the Clean Air Act.
- §1068.101(a)(1)(i): Clarifying that engines or equipment are considered to be uncertified if they are not in a configuration that is included in the applicable certificate of conformity. This applies even if the product had an emission label stating that it complies with emission standards.
- §1068.101(a)(2): Clarifying the prohibition on recordkeeping to apply also to submission of records to the Agency.
- §1068.101(b)(1): Clarifying the prohibition against using engines in a way that renders emission controls inoperative to emphasize that it includes misfueling or failing to use additives that the manufacturer specifies as part of the engine's certified configuration. This is more likely to apply for compression-ignition engines than spark-ignition engines.
- §1068.101(b)(7): Clarifying the prohibitions related to warranty to require the submission of specified information in the application for certification; adding language to identify obligations related to recall and installation and maintenance instructions; and preventing the manufacturer from communicating to users that warranty coverage is conditioned on using authorized parts or service facilities. These provisions are consistent with requirements that apply in other EPA programs.
- §1068.105(a): Revising the regulation to allow equipment manufacturers to use up normal inventories of previous model year engines only if it is a continuation of ongoing production with existing inventories. These provisions do not apply for an equipment manufacturer starting to produce a new equipment model.
- §1068.105: Eliminating paragraph (b) related to using highway certification for nonroad engines or equipment since these provisions are spelled out specifically for each nonroad program where appropriate.
- §1068.105(b): Clarifying the requirement to follow emission-related installation instructions to include installation instructions from manufacturers that certify components to evaporative emission standards.
- §1068.120: Clarifying that the rebuilding provisions apply to maintenance related to evaporative emissions.
- §1068.240: Clarifying that the scope of the exemption for new replacement engines is limited to certain engines.
- §1068.250: Revising the applicability of the small-business hardship provisions to address a situation where the standard-setting part does not define criteria for establishing which companies qualify as small-volume manufacturers; where we do not already specify such criteria, we will rely on the criteria established by the Small Business Administration.
- §1068.250: Clarifying the timing related to hardship approvals and the ability to get extensions under appropriate circumstances.

- §1068.305: Clarifying that that the requirement to submit importation forms applies to all engines, not just nonconforming engines; also adding a requirement to keep these records for five years. Both of these changes are consistent with the Customs regulations at 19 CFR 12.74.
- Part 1068, Appendix I: Defining emission-related components related to evaporative emission controls.
-

D. Amendments Related to Large SI Engines (40 CFR Part 1048)

We are making a variety of technical amendments to the regulations in 40 CFR part 1048 for Large SI engines, as described in this section.

As described in Section V.E.1, we are establishing a provision to allow for assigned deterioration factors for small-volume engine families for Small SI engines. We requested comment on applying this kind of provision to Large SI engines, for which manufacturers do more extensive testing to demonstrate compliance over a useful life of 5,000 hours. We are therefore including in the final rule an allowance for manufacturers to use an assigned deterioration factor for engine families with U.S.-directed production volumes up to 300 units. This should provide significant relief in the testing burden for certifying very small engine families.

We are adopting the proposed changes to the provisions related to competition engines to align with the final rule for Small SI engines. Any Small SI engine that is produced under the competition exemption will very likely exceed 19 kW. As a result, we believe it is appropriate to make these provisions identical to avoid confusion.

Manufacturers have notified us that the transient test for constant-speed engines does not represent in-use operation in a way that significantly affects measured emission levels. This notification is required by §1065.10(c)(1). In particular, manufacturers have pointed out that the specified operation involves light engine loads such that combustion and exhaust temperatures do not rise enough to reach catalyst light-off temperatures. As a result, meeting the standard using the constant-speed transient test will require the use of significantly oversized catalysts, which will add significant costs without a commensurate improvement for in-use emission control. We faced a similar dilemma in the effort to adopt transient standards for nonroad diesel engines, concluding that the transient standards should not apply until we develop a suitable duty cycle that more appropriately reflects in-use operation. As proposed, we are taking this same approach for Large SI engines, waiving the requirement for constant-speed engines to meet the transient standards until we are able to develop a more appropriate duty cycle. We are clarifying that manufacturers certifying constant-speed engines should describe their approach to controlling emissions during transient operation in their application for certification. Manufacturers must continue to meet the standards for steady-state testing and the field-testing standards continue to apply. See Section 1.8 of the Summary and Analysis of Comments for a discussion of the methods for demonstrating compliance with the field-testing standards for certification.

Manufacturers have also pointed out that a multiplicative deterioration factor is problematic for engines with very low emission levels. While the standard allows that HC+NOx emissions may be as high as 2.7 g/kW-hr, manufacturers are certifying some engine families with deteriorated emission levels below 0.1 g/kW-hr. These very low emission levels are so far below the standard that measurement variability and minor engine-to-engine variability can lead to small absolute differences in emission levels that become magnified by a deterioration factor that reflects the extremely small low-hour measurement. We are therefore finalizing the proposed specification that manufacturers may use an additive deterioration factor if their low-hour emission levels are below 0.3 g/kW-hr for HC+NOx or 0.5 g/kW-hr for CO. This change accommodates the mathematical and analyzer effects of very low emission levels without changing the current practice for the majority of engines that are certified with emission levels closer to the standard (we increased the threshold from the proposed level of 0.3 g/kW-hr for CO to a level of 0.5 g/kW-hr to reflect the greater variability in CO emissions at this level of control). This change removes the incentive for manufacturers to increase their engine's emission levels to avoid an artificially large deterioration factor. The only exception is for cases in which good engineering judgment dictates that a multiplicative deterioration factor will nevertheless be appropriate for engines with very low emissions. This may be the case if an engine's deterioration can be attributed, even at very low emission levels, to proportionally decreased catalyst conversion of emissions from an aged engine. It is important to note that Large SI engine manufacturers are subject to in-use testing to demonstrate that they meet emission standards throughout the useful life. Should such testing indicate that an additive deterioration factor does not appropriately reflect actual performance, we will require manufacturers to revise their deterioration factors appropriately, as required under the regulations. If such discrepancies appear for multiple manufacturers, we will revise the regulation to again require multiplicative deterioration factors for all aftertreatment-based systems.

Most Large SI engines are installed in equipment that has metal fuel tanks. This formed the basis of the regulatory approach to set evaporative emission standards and certification requirements. Manufacturers have raised questions about the appropriate steps to take for systems that rely on plastic fuel tanks. We have determined that the current emission standards and test procedures do not require manufacturers to account for permeation emissions from plastic fuel tanks. To address this concern, we are revising the regulations to reference the test procedures in part 1060, where preconditioning and measurement procedures clarify how to test plastic fuel tanks. We are also specifying that the design-based certification for plastic fuel tanks meeting the diurnal emission standards must incorporate the technologies specified in 40 CFR 1060.240. For other technologies, the certifying manufacturer must perform tests to demonstrate compliance with the diurnal emission standards. Since manufacturers will need some time to meet these requirements, we are implementing this change starting with the 2010 model year. As a related matter, we are also changing the regulation to allow for component certification of fuel tanks (see 40 CFR 1060.5). This will be necessary to accommodate the situation described above for plastic fuel tanks. This administrative adjustment does not affect the underlying requirement to design and certify products to meet applicable emission standards. We changed the final rule in response to comments, mainly to include more careful specification of canister preconditioning procedures for those systems that certify by testing rather than by design.

In the proposal we requested comment on updating the reference standard for specifying low-permeation fuel lines. The current permeation standards for Large SI equipment references Category 1 fuel lines as defined in the version of SAE J2260 that was issued November 1996. We are adopting by reference the updated version of SAE J2260, which was finalized in November 2004 by the Society of Automotive Engineers. The new procedures have two primary differences related to fuel line permeation. First, the test fuel was changed from CM15 to CE10.[123] Second, the associated limits for the different categories of fuel line permeation were revised. Data presented in Chapter 5 of the Final RIA suggest that permeation rates from low-permeation fuel line materials can be less than half on CE10 than on CM15. The permeation specification for Category 1 fuel line was revised by SAE from 0-25 g/m^2/day to 3-10 g/m^2/day. (A new Category 0 was added at 0-3 g/m^2/day.) Directionally, the new Category 1 permeation limits seem to account for the change in the test fuel. In addition, ethanol fuel blends are common with in-use fuels while methanol fuel blends are much less common. We are revising the regulation to specify that fuel lines must meet the Category 1 specification in the 2004 version of SAE J2260.

We are making several additional technical amendments to part 1048. Many of these simply correct typographical errors or add references to the regulatory cites in part 1054 for Small SI engines. Several changes are intended merely to align regulatory language with that of other programs, including those that are subject to new standards under this final rule. In addition, we are making the changes described below. Note that the changes being made to the production-line and in-use testing requirements are being made in response to comments. As noted, a few others are also being made in response to comments. However, most of these changes are being finalized as proposed.

- §1048.5: Clarifying that locomotive propulsion engines are not subject to Large SI emission standards, even if they use spark-ignition engines. This is based on the separate provisions that apply to locomotives in Clean Air Act section 213 (including those that use spark-ignition engines).
- §1048.101: Clarifying manufacturer’s responsibility to meet emission standards for different types of testing, especially to differentiate between field-testing standards and duty-cycle standards.
- §1048.105: Clarifying that only the permeation standards of SAE J2260 apply to fuel lines used with Large SI engines.
- §1048.105: Clarifying that the requirement to prevent fuel boiling is affected by the pressure in the fuel tank. The regulation currently characterizes the boiling point of fuel only at atmospheric pressure. Pressurizing the fuel tank increases the boiling point of the fuel. We are also adding clarifying language to describe how engine manufacturers may meet their requirements related to fuel boiling by describing appropriate steps or limitations in their installation instructions.
- §1048.105: Reorganizing the regulatory provisions to align with the new language in 40 CFR part 1060, and relying on those test procedures. This will help to provide uniformity across our nonroad programs.
- §1048.110: (1) Clarifying that “malfunctions” relate to engines failing to maintain emission control and not to diagnostic systems that fail to report signals. (2) Clarifying that the malfunction indicator light needs to stay illuminated for malfunctions or for system errors. (3) Limiting the scope of diagnostic requirement to engines with closed-loop controls and three-way catalysts. This limitation is consistent with the conclusion we have reached for Marine SI engines.

[123] “C” refers to fuel C as specified in ASTM D 412, E10 refers to 10 percent ethanol, and M15 refers to 15 percent methanol.

- §1048.120: Clarifying that the emission-related warranty covers only those components from 40 CFR part 1068, Appendix I, whose failure will increase emissions of regulated pollutants.
- §1048.125: Giving examples of noncritical emission-related maintenance, such as changing spark plugs and re-seating valves.
- §1048.135: Revising the engine labeling requirements to allow omission of the manufacturing date only if the date is stamped, engraved or otherwise permanently applied on the engine, rather than allowing manufacturers to keep records of engine build dates. This is important for verifying that engines comply with standards based on their build date. This requirement takes effect starting with the 2010 model year. See Section 1.3 of the Summary and Analysis of Comments for further discussion of issues related to this requirement.
- §1048.205: Removing detailed specifications for describing auxiliary emission control devices in the application for certification. This responds to the concern expressed by manufacturers that the existing, very prescriptive approach requires much more information than is needed to adequately describe emission control systems. We are leaving in place a broad requirement to describe emission control systems and parameters in sufficient detail to allow EPA to confirm that no defeat devices are employed. Manufacturers should be motivated to include substantial information to make such determinations in the certification process, rather than being subject to this type of investigation for emission control approaches that are found to be outside of the scope of the application for certification. We may require manufacturers to submit additional information if the description submitted with the application is not adequate for evaluating the appropriateness of the design.
- §1048.205: Adding a requirement to align projected production volumes with actual production from previous years. This does not imply additional reporting or recordkeeping requirements. It is intended simply to avoid situations where manufacturers intentionally mis-state their projected production volumes to gain some advantage under the regulations.
- §1048.205: Specifying that manufacturers must submit modal emission results rather than just submitting a weighted average. Since this information is already part of the demonstration related to the field-testing standards, this should already be common practice.
- §1048.220: Clarifying that if manufacturers change their maintenance instructions after starting production for an engine family, they may not disqualify engines for in-use testing or warranty claims based on the fact that operators did not follow the revised maintenance instructions.
- §1048.225: Clarifying the terminology to refer to "new or modified engine configurations" rather than "new or modified nonroad engines." This is necessary to avoid using the term "new nonroad engine" in a way that differs from the definition in §1048.801.
- §1048.230: Clarifying that engine families relate fundamentally to emission certification and that we will expect manufacturers to suggest a tailored approach to specifying engine families under §1048.230(d) to occur only in unusual circumstances.
- §1048.250: Adding a requirement for manufacturers to report their production volumes for an engine family separate from reports for production-line testing. For example, by excluding small-volume families from production-line testing, the reports of those production volumes would otherwise no longer be available to us. Also, we are clarifying that manufacturers must report total production volumes for an engine family for any production that occurs after submission of the final PLT report for the model year.
- §1048.301: Allowing small-volume emission families to be exempted from production-line testing requirements. This applies for engine families with sales volumes below 150 units.

This level of production does not allow for adequate testing to use the statistical techniques before exceeding specified maximum testing rates.

- §1048.301: Specifying that manufacturers may use an alternate method for production-line testing by using field-grade analyzers (instead of lab-grade) without prior approval, as long as they double the specified minimum sampling rate.
- §1048.305: Clarifying that (1) tested engines should be built in a way that represents production engines and (2) the field-testing standards apply for any testing conducted (this may involve simply comparing modal results to the field-testing standards). We are also revising the provision related to repeat testing after an invalidated test to specify that manufacturers do not need our approval before retesting, except that we may require this if we find that tests have been improperly invalidated.
- §1048.310: Clarifying the relationship between quarterly testing and compliance with the annual testing requirements.
- §1048.315: Correcting the equation for the CumSum statistic to prevent negative values.
- §1048.345: Changing the PLT reporting deadline from 30 to 45 days after the end of each calendar quarter. This aligns with change we are making in other programs.
- §1048.350: Allowing manufacturers to keep electronic records related to production-line testing rather than paper records.
- §1048.405: Adding a provision allowing for an adjustment of in-use testing plans if unforeseen circumstances prevent completion of the testing effort. This aligns with the change described in Section IV for Marine SI engines.
- §1048.410: Clarifying that repeat tests with an in-use test engine are acceptable, as long as the same number of repeat tests are performed for all engines.
- §1048.415: Clarifying that the provisions related to defect reporting in 40 CFR 1068.501 apply for in-use testing.
- §1048.501: Removing specified mapping procedures, since these are addressed in 40 CFR part 1065.
- §1048.501: Clarifying the evaporative testing procedures, mainly by describing preconditioning procedures for engines equipped with carbon canisters (loading with vapors, then operating the engine to purge the canister appropriately). These procedures are consistent with the requirements we specify for light-duty vehicles in part 86 and for nonroad equipment in part 1060.
- §1048.505: (1) Removing redundant text and removing sampling times specified in Table 1, since these are already addressed in §1048.505(a)(1); (2) correcting the mode sequence listed in the table for ramped-modal testing; (3) clarifying that cycle statistics for discrete-mode testing are defined in §1065.514. This involves treating the series of modes as if it were continuous operation; and (4) referring to §1065.510 for idle specifications. These idle specifications provide more detailed instructions; we do not intend to change the way manufacturers test at idle.
- §§1048.605 and 1048.610: Requiring some demonstration that the sales restrictions that apply for these sections are met, and clarifying the provisions related to emission credits for vehicles that generate or use emission credits under 40 CFR part 86.
- §1048.801: (1) Revising several definitions to align with updated definitions adopted for other programs; (2) Expanding the definition of small-volume engine manufacturer to also include companies with annual U.S. production volumes of no more than 2,000 Large SI engines. This aligns with the provisions already adopted by California ARB. (3) Revising (in response to comments) the provision for emission-data engines to specify that the low-

hour test result should generally occur after no more than 125 hours of engine operation. The regulations separately specify that engines may be presumed stabilized after 50 hours, so this would allow at least 75 hours to perform testing on various fuels and configurations before the engine is no longer eligible for testing low-hour results. (4) Clarifying that an imported motor vehicle (or motor vehicle engine) that has been converted for nonroad use retains its original model year, but only if it was originally certified under part 86. Converted vehicles and engines that were not certified under part 86 have an assigned model year based on the date of conversion for nonroad use and must therefore meet nonroad standards based on the new model year.

E. Amendments Related to Recreational Vehicles (40 CFR Part 1051)

We are making a variety of technical amendments to the regulations in 40 CFR part 1051 for recreational vehicles, as described in this section.

In the proposal we requested comment on revising the regulation to allow for manufacturers of fuel-system components to certify that their products meet emission standards. For recreational vehicles we adopted a program in which the exhaust and evaporative emission standards apply to the vehicle so we did not set up a process for certifying fuel-system components. We continue to believe that evaporative emission standards should apply to the vehicle. However, we are revising the final rule to include a process by which manufacturers of fuel-system components can opt into this program by certifying their fuel tanks or fuel lines to the applicable standards. While this is a voluntary step, any manufacturer opting into the program in this way will be subject to all the requirements that apply to certificate holders. While manufacturers of recreational vehicles will continue to be responsible for meeting standards and certifying their vehicles, it may be appropriate to simplify their compliance effort by allowing them to rely on the certification of the fuel line manufacturer or fuel tank manufacturer.

We are making several additional technical amendments to part 1051. Many of these simply correct typographical errors or add references to the regulatory cites in part 1054. Several changes are intended merely to align regulatory language with that of other programs, including those that are subject to the standards in this final rule. In addition, we are making the changes described below. Note that the changes being made to the production-line and other testing requirements are being made in response to comments. As noted, a few others are also being made in response to comments or as clarifications of existing text. However, most of these changes are being finalized as proposed.

- §1051.1: Revising the speed threshold for offroad utility vehicles to be subject to part 1051. Changing from “25 miles per hour or higher” to “higher than 25 miles per hour” aligns this provision with the similar threshold for qualifying as a motor vehicle in 40 CFR 85.1703.
- §1051.5: Clarifying the status of very small recreational vehicles to reflect the provisions in the current regulations in 40 CFR part 90 to treat such vehicles with a dry weight under 20 kilograms as Small SI engines.
- §1051.25: Clarifying that manufacturers of recreational vehicles that use engines certified to meet exhaust emission standards must still certify the vehicle with respect to the evaporative emission standards.

- §1051.120: Clarifying that the emission-related warranty covers only those components from 40 CFR part 1068, Appendix I, whose failure will increase emissions of regulated pollutants.
- §1051.125: Giving examples of noncritical emission-related maintenance, such as changing spark plugs and re-seating valves.
- §1051.135: Revising the labeling requirements to allow omission of the manufacturing date only if the date is stamped, engraved, or otherwise permanently applied on the vehicle, rather than allowing manufacturers to keep records of vehicle build dates. This is important for verifying that vehicles comply with standards based on their build date. This requirement takes effect starting with the 2010 model year. See Section 1.3 of the Summary and Analysis of Comments for further discussion of issues related to this requirement.
- §1051.135: Adding a requirement to label vehicles as described in part 1060 for evaporative emission controls. Since this change may involve some time for manufacturers to comply, we are applying this requirement starting with the 2010 model year.
- §1051.137: Clarifying how the labeling requirements apply with respect to the averaging program and selected family emission limits.
- §1051.140: Allowing (in response to comments) for identification of engine displacement to the nearest whole cubic centimeter (rather than the nearest 0.5 cubic centimeter). This level of precision is adequate for implementing regulatory provisions related to engine displacement.
- §1051.145: Allowing the continued use of part 91 test procedures (instead of part 1065 procedures) for snowmobiles subject to Phase 2 or Phase 2 standards. We will revisit this provision in the context of adopting revised Phase 3 standards.
- §1051.205: Removing detailed specifications for describing auxiliary emission control devices in the application for certification. This responds to the concern expressed by manufacturers that the existing, very prescriptive approach requires much more information that is needed to adequately describe emission control systems. We are leaving in place a broad requirement to describe emission control systems and parameters in sufficient detail to allow EPA to confirm that no defeat devices are employed. Manufacturers should be motivated to include substantial information to make such determinations in the certification process, rather than being subject to this type of investigation for emission control approaches that are found to be outside of the scope of the application for certification. We may require manufacturers to submit additional information if the description submitted with the application is not adequate for evaluating the appropriateness of the design.
- §1051.205: Requirements to align projected production volumes with actual production from previous years. This does not imply additional reporting or recordkeeping requirements. It is intended simply to avoid situations where manufacturers intentionally mis-state their projected production volumes to gain some advantage under the regulations.
- §1051.220: Clarifying that if manufacturers change their maintenance instructions after starting production for an engine family, they may not disqualify vehicles for warranty claims based on the fact that operators did not follow the revised maintenance instructions.
- §1051.225: Clarifying the terminology to refer to "new or modified vehicle configurations" rather than "new or modified vehicles." This is necessary to avoid confusion with the term "new vehicle" as it relates to introduction into commerce.
- §1051.225: Clarifying the provisions related to changing an engine family's Family Emission Limit after the start of production.
- §1051.255: Adopting a different SAE standard for specifying low-permeability materials to allow for design-based certification of metal fuel tanks with gaskets made of polymer

materials. The previous language does not adequately characterize the necessary testing and material specifications.

- §1051.230: Clarifying that engine families relate fundamentally to emission certification and that we will expect manufacturers to suggest a tailored approach to specifying engine families under §1051.230(e) to occur only in unusual circumstances.
- §1051.245: Revising the specification for fuel lines meeting the specifications of SAE J 2260 to include the 2004 version of this standard as described in Section VIII.D.
- §1051.250: Adding a requirement for manufacturers to report their production volumes for an engine family separate from reports for production-line testing. For example, by excluding small-volume families from production-line testing, the reports of production volumes would otherwise no longer be available to us. Also, we are clarifying that manufacturers must report total production volumes for an engine family for any production that occurs after submission of the final PLT report for the model year.
- §1051.301: Allowing small-volume emission families to be exempted from production-line testing requirements. This applies for engine families with production volumes below 150 units. This level of production does not allow for adequate testing to use the statistical techniques before exceeding specified maximum testing rates.
- §1051.301: Specifying that manufacturers may use an alternate method for production-line testing by using field-grade analyzers (instead of lab-grade) without prior approval, as long as they double the specified minimum sampling rate.
- §1051.305: Clarifying that tested vehicles should be built in a way that represents production vehicles.
- §1051.305: Revising the provision related to repeat testing after an invalidated test to specify that manufacturers do not need our approval before retesting, except that we may require this if we find that tests have been improperly invalidated.
- §1051.310: Clarifying the relationship between quarterly testing and compliance with the annual testing requirements; and clarifying the testing provisions that apply for engine families where the production period is substantially less than a full year.
- §1051.315: Correcting the equation for the CumSum statistic to prevent negative values.
- §1051.325: Clarifying the basis on which we will approve retroactive changes to the Family Emission Limit for an engine family that has failed under production-line testing.
- §1051.345: Changing the PLT reporting deadline from 30 to 45 days after the end of each calendar quarter. This aligns with change we are making in other programs.
- §1051.350: Allowing manufacturers to keep electronic records related to production-line testing rather than paper records.
- §1051.501: Adding a specified test fuel for diesel-fueled recreational vehicles that certify under part 1051. This would generally involve either low-sulfur diesel fuel (< 500 ppm sulfur) or ultra low-sulfur diesel fuel (< 15 ppm sulfur).
- §1051.505: (1) Clarifying that cycle statistics for discrete-mode testing on an engine dynamometer are defined in §1065.514. This involves treating the series of modes as if it involved continuous operation. (2) Specifying that manufacturers may choose between discrete-mode and ramped-modal measurements for production-line testing if the application for certification includes testing conducted with both types of testing. (3) Referring to §1065.510 for idle specifications. These idle specifications provide more detailed instructions; we do not intend to change the way manufacturers test at idle.
- §§1051.605 and 1051.610: Requiring a demonstration that the sales restrictions that apply for these sections are met.

- §1051.650: Adding a requirement to certify vehicles that are converted to run on a different fuel. We expect this is a rare occurrence, but one that we should make subject to certification requirements.
- §1051.701: Clarifying that manufacturers using emission credits to meet emission standards must base their credit calculations on their full product line-up, rather than considering only those engine families with Family Emission Limits above or below the emission standard.
- §§1051.710 – 1051.735: Making various minor revisions to align with regulatory specifications in other programs.
- §1051.735: Adding a requirement to keep records related to banked emission credits for as long as a manufacturer intends for those credits to be valid. This is necessary for us to verify the appropriateness of credits used for demonstrating compliance with emission standards in later model years.
- §1051.801: Revising several definitions to align with updated definitions adopted for other programs.
- §1051.801: Clarifying that an engine's "maximum engine power" does not change if it is installed in a vehicle or piece of equipment that limits the engine's operation. For example, adding a speed limiter to a vehicle does not affect the engine's "maximum engine power" as determined by the engine manufacturer for the engine as it would be tested using the specified procedures.
- §1051.801: Clarifying that an imported motor vehicle that has been converted for nonroad use retains its original model year, but only if it was originally certified under part 86. Converted vehicles that were not certified under part 86 have an assigned model year based on the date of conversion for nonroad use and must therefore meet nonroad standards based on the new model year.
-

F. Amendments Related to Heavy-Duty Highway Engines (40 CFR Part 85)

We proposed to make several adjustments to the provisions related to delegated assembly specified in §85.1713. These proposed adjustments include:

- Removing the provision related to auditing outside the United States since equipment manufactured in other countries will not be subject to these provisions
- Clarifying that the exemption expires when the equipment manufacturer takes possession of the engine, but not before it reaches the point of final assembly
- Clarifying the prohibition related to following installation instructions to ensure that engines are in their certified configuration when installed in a piece of equipment.

We are adopting these proposed provisions as part of a bigger effort to harmonize delegated-assembly across engine categories. See Section VIII.C.6 for further discussion of the changes in delegated assembly in the harmonized approach we are adopting in §1068.261. Note that the new labeling requirements we are adopting take effect for heavy-duty highway engines starting in the 2010 model year.

Manufacturers also submitted comments describing technical and practical challenges related to the transition to using part 1065 test procedures for heavy-duty highway engines. We have agreed to delay the mandatory use of part 1065 procedures until July 2010. However, there are several areas where part 1065 specifies procedures or methods that are already well established, where those methods represent substantial improvements over the existing procedures specified in part 86. We are therefore not extending the deadline for these specific provisions. See §86.1305-2010 for additional information.

We have revised the final rule to include new provisions allowing for a replacement-engine exemption for heavy-duty highway engines under §1068.240 as described in Section VIII.C.5.

G. Amendments Related to Stationary Spark-Ignition Engines (40 CFR Part 60)

On January 18, 2008 we promulgated final emission standards for stationary spark-ignition engines (73 FR 3567). The final rule specified that stationary spark-ignition engines at or below 19 kW would be subject to all the same emission standards and certification requirements that apply to Small SI engines. Since we are promulgating new standards for Small SI engines in this rule, these requirements should apply automatically to those stationary engines. However, since the Phase 3 standards are in 40 CFR part 1054, as described in Section V, we are revising the regulatory language for stationary spark-ignition engines in 40 CFR part 60, subpart JJJJ, to directly reference the Phase 3 standards in part 1054, as proposed.

H. Amendments Related to Locomotive, Marine, and Other Nonroad Compression-Ignition Engines (40 CFR Parts 89, 92, 94, 1033, 1039, and 1042)

In response to comments, we are making a variety of technical amendments to regulatory provisions for nonroad compression-ignition engines. Several of these changes are intended to align with the changes we are adopting in this rule for spark-ignition engines, either to be consistent with those standard-setting parts, or to fit with changes we are making to the general compliance provisions in part 1068. There are also a variety of changes to correct paragraph references and other typographical errors. We are making the following additional adjustments and clarifications to the regulations:

- Modifying the labeling statement for replacement engines under part 89 to clarify what applies when manufacturer replace an engine that was originally exempted from emission standards.
- Correcting a typographical error to define the alternate emission standard for switch locomotives in §1033.101(b) to be the same as that for line-haul locomotives, as described in the preamble to that final rule.
- Revising the start date for the certification requirement for automatic engine stop/start in §1033.115 to provide sufficient lead time following publication of the final rule establishing part 1033. Note that this revision addresses only administrative requirements and does not delay the introduction of the emission control technology.
- Clarifying provisions related to assigned deterioration factors for locomotive remanufacturers in §1033.150 to be consistent with the description in the preamble to the final rule establishing part 1033.
- Clarifying the need for prior approval of adjustments for automatic shutdown features to be consistent with the description in the preamble to the final rule establishing part 1033 (see §1033.530).

- Clarifying the definition of "new" in §1033.801 for remanufactured engines that have been certified.
- Revising the definition of "hobby engine" in §1039.5 and §1042.5 to rely on vehicle characteristics (reduced-scale models that are not capable of transporting a person) rather than engine characteristics (less than 50 cc per cylinder). See Section 1.2 of the Summary and Analysis of Comments for further information.
- Clarifying that compression-ignition engines used in recreational vehicles and certified under part 1051 are not required to certify under part 1039.
- Clarifying the labeling requirements that apply for engines meeting the alternate PM standard specified in §1039.101(c) (see §1039.102 and §1039.135).
- Adding a provision allowing manufacturers to specify scheduled maintenance for crankcase vent filters. This is analogous to servicing PCV valves for engines that have closed crankcases (see §1039.125).
- Revising the Transition Program for Equipment Manufacturers in §1039.625 and §1039.626 to (1) require manufacturers to send only a single report to EPA, (2) allow manufacturers to identify their contact information in their reports or on a publicly accessible website rather than on their equipment labels, (3) specify a notification deadline based on the start of using these provisions, rather than tying the deadline only to the start of the year, (4) allow manufacturers to omit the FEL from the engine label if the FEL is below the emission standard that would otherwise apply, (5) identify specific asset thresholds for avoiding bond payments for importing exempted products, (6) clarify the types of penalties and judgments that would be subject to payment from the posted bond, and (7) specify that manufacturers may identify an agent for service anywhere in the United States (rather than specifically in Washington, DC).
- Correcting an error for marine compression-ignition engines in §1042.101 by noting that the Tier 3 NOx+HC standards do not apply for engines between 2000 and 3700 kW that have a power density above 35 kW per liter. The footnote in Table 1 of this section denoting this distinction was inadvertently omitted for the high power-density engines.
- Revising the requirements related to evaporative emissions in §1042.105 to align with the new provisions that apply for Marine SI applications as described in Section VI.
- Removing §1042.601(g) since this provision is being codified in this rule at §1068.101(b)(1).

IX. Projected Impacts

A. Emissions from Small Nonroad and Marine Spark-Ignition Engines

As discussed in previous sections, this final rule will reduce exhaust emissions from specific sizes of nonhandheld Small SI and Marine SI engines. It will also reduce evaporative emissions from the fuel systems used on nonhandheld and handheld Small SI equipment and Marine SI vessels (for simplicity we collectively include the evaporative emission requirements from equipment or vessels when referring to Small SI or Marine SI engines in the remainder of this section). The new exhaust and evaporative emission standards will directly affect volatile organic hydrocarbon compounds (VOC), oxides of nitrogen (NOx), and to a lesser extent carbon monoxide (CO). Also, we anticipate that the emission control technology which is likely to be used to meet the exhaust emission standards will affect directly emitted particulate matter, most importantly particles with diameters of 2.5 micrometers or less (PM2.5). It will also incrementally reduce air toxic emissions. A detailed analysis of the effects of this final rule on emissions and emission inventories can be found in Chapter 3 of the Final RIA.

The contribution of exhaust and evaporative emissions from Small SI and Marine SI engines to total 50-state mobile-source emission inventories is significant and will remain so into the future. Table IX-1 presents the nationwide inventory for these engines for both 2002 and 2030. (The inventories cover all Small SI and Marine SI engines including the portion of Small SI engines regulated by the California ARB.) Table IX-1 shows that for the primary pollutants affected by this final rule, these engines contribute about 25 to 35 percent of the nationwide VOC emissions from all mobile sources. The nationwide contribution to the total mobile source NOx inventory is about 5 percent or less. Finally, for PM2.5, the contribution is about 10 percent.

Table IX-1: Contribution of Small Nonroad and Marine SI Engines to National (50-State) Mobile Source Emission Inventories

Pollutant	2002		2030	
	Small SI/Marine SI Inventory, tons	% of Mobile Source Inventory	Small SI/Marine SI Inventory, tons	% of Mobile Source Inventory
VOC	2,169,000	26	1,430,000	35
NOx	169,700	1	311,300	6
PM2.5	41,960	8	44,040	12
CO	19,607,000	23	15,605,000	30

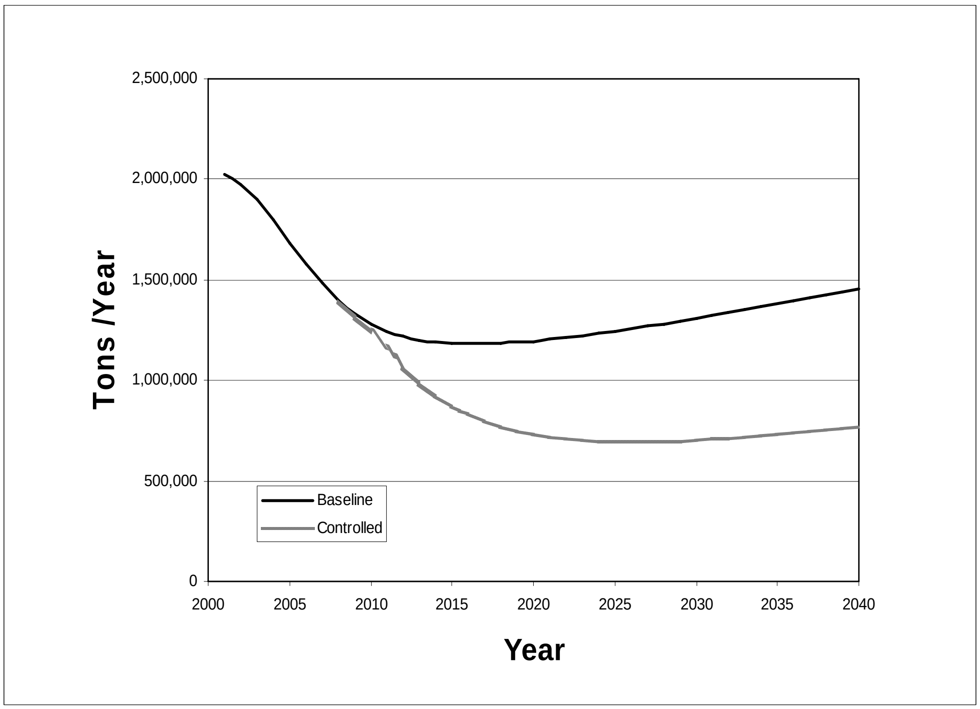
(1) VOC

Table IX-2 shows the VOC emissions and emission reductions we expect both with and without the new standards for engines, equipment, and vessels affected by the final rule. In 2002, Small SI and Marine SI emitted approximately 1,047,000 and 931,000 tons of VOC, respectively. Without the new standards, these emissions will decrease because of the effect of the existing emission control requirements to about 958,000 and 484,000 tons by 2040, respectively. With the new controls, this pollutant will be further reduced by 34 percent for Small SI engines and 73 percent for Marine SI engines by 2040. The VOC emission inventory trends over time for both categories of engines that are subject to the final rule are shown in Figure IX-1.

Table IX-2: National (50-State) VOC Emissions and Emission Reductions for Small SI and Marine SI Engines

Year	Category	Without Rule	With Rule	Reduction	% Reduction
2002	Small Engine	1,047,374	1,047,374	--	--
	Marine	931,132	931,132	--	--
	Both	1,978,506	1,978,506	--	--
2015	Small Engine	675,131	488,517	186,614	28
	Marine	505,981	384,108	121,873	24
	Both	1,181,112	872,624	308,487	26
2020	Small Engine	728,853	242,957	240,948	33
	Marine	460,481	242,957	217,524	47
	Both	1,189,334	730,862	458,472	39
2030	Small Engine	842,970	558,094	284,876	34
	Marine	458,656	139,083	319,573	70
	Both	1,301,626	697,177	604,449	46
2040	Small Engine	958,429	633,050	325,379	34
	Marine	483,949	128,906	355,043	73
	Both	1,442,377	761,956	680,422	47

Figure IX-1: Estimated VOC Emissions from Small SI and Marine SI Engines



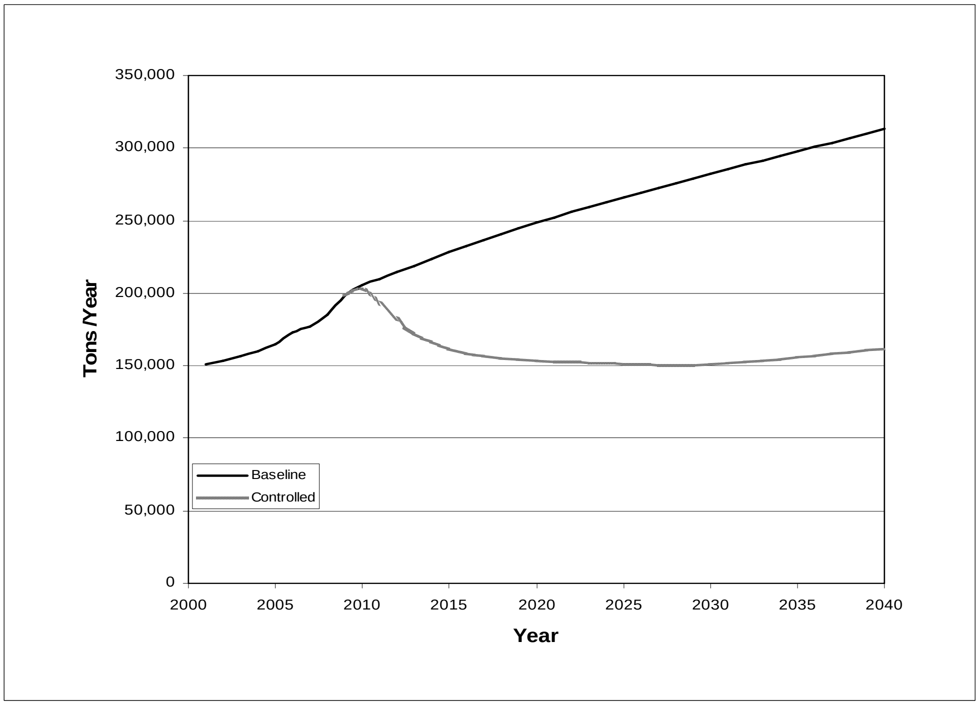
(2) NOx

Table IX-3 shows the NOx emissions and emission reductions we expect both with and without the new standards for engines affected by the final rule. In 2002, Small SI and Marine SI emitted approximately 107,000 and 46,300 tons of NOx, respectively. Without the new standards, these emissions will increase to about 181,000, and 132,000 tons by 2040, respectively. With the new controls, this pollutant will be reduced by 49 percent for Small SI engines and 48 percent for Marine SI engines by 2040. The NOx emission inventory trends over time for both categories of engines that are subject to the final rule are shown in Figure IX-2.

Table IX-3: National (50-State) NOx Emissions and Emission Reductions for Small SI and Marine SI Engines

Year	Category	Without Rule	With Rule	Reduction	% Reduction
2002	Small Engine	106,804	106,804	--	--
	Marine	46,311	46,311	--	--
	Both	153,115	153,115	--	--
2015	Small Engine	126,395	76,412	49,983	40
	Marine	101,703	85,334	16,369	16
	Both	228,098	161,746	66,353	29
2020	Small Engine	137,002	72,175	64,827	47
	Marine	111,525	81,398	30,128	27
	Both	248,527	153,572	94,954	38
2030	Small Engine	158,840	81,977	76,863	48
	Marine	123,335	68,639	54,696	44
	Both	282,175	150,616	131,559	47
2040	Small Engine	180,973	93,181	87,792	49
	Marine	131,907	68,461	63,445	48
	Both	312,880	161,643	151,237	48

Figure IX-2: Estimated NOx Emissions from Small SI and Marine SI Engines



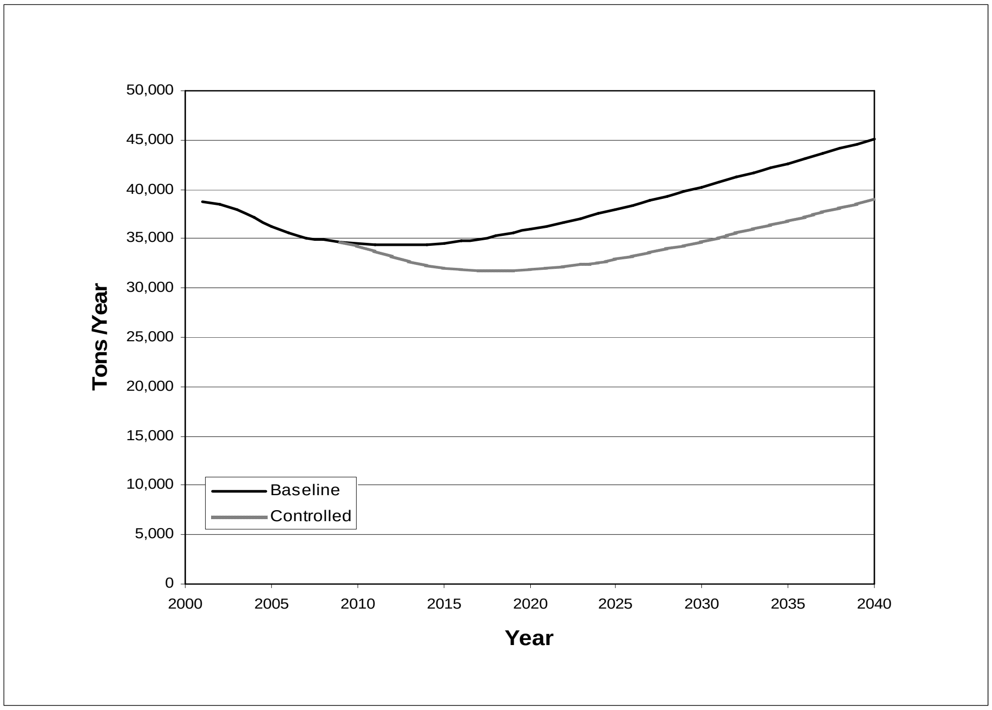
(3) PM2.5

Table IX-4 shows the PM2.5 emissions and emission reductions we expect both with and without the new standards for engines affected by the final rule. In 2002, Small SI and Marine SI emitted 23,000and 15,000 tons of PM2.5, respectively. Without the new standards, the PM2.5 emissions from Small SI engines will increase to 39,000 by 2040, while those from Marine SI will decrease to about 6,000 tons in that year due to the effects of the existing emission control requirements for certain types of Marine SI engines, such as outboards. With the new controls, this pollutant will be reduced by 3 percent for Small SI engines and an additional 84 percent for Marine SI engines by 2040. The PM2.5 emission inventory trends over time for both categories of engines that are subject to the final rule are shown in Figure IX-3.

Table IX-4: National (50-State) PM2.5 Emissions and Emission Reductions for Small SI and Marine SI Engines

Year	Category	Without Rule	With Rule	Reduction	% Reduction
2002	Small Engine	23,382	23,382		
	Marine	15,092	15,092		
	Both	38,474	38,474		
2015	Small Engine	27,747	27,115	632	2
	Marine	6,823	4,951	1,872	27
	Both	34,570	32,066	2,504	7
2020	Small Engine	30,009	29,189	820	3
	Marine	5,908	2,640	3,269	55
	Both	35,917	31,828	4,089	11
2030	Small Engine	34,535	33,572	963	3
	Marine	5,719	1,137	4,582	80
	Both	40,255	34,710	5,545	14
2040	Small Engine	39,079	37,979	1,100	3
	Marine	6,016	989	5,027	84
	Both	45,095	38,968	6,127	14

Figure IX-3: Estimated PM2.5 Emissions from Small SI and Marine SI Engines



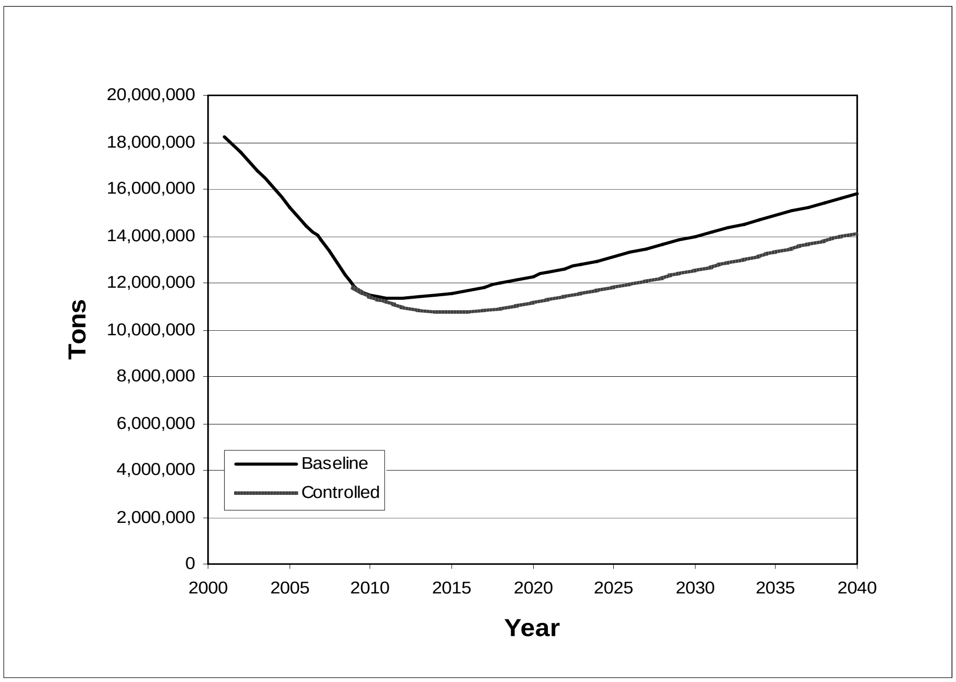
(4) CO

Table IX-5 shows the CO emissions and emission reductions we expect both with and without the new standards for engines affected by the final rule. In 2002, Small SI and Marine SI emitted 15,091,000 and 2,472,000 tons of CO, respectively. Without the new standards, these emissions will decrease because of the effect of the existing emission control requirements to about 14,007,000 and 1,766,000 tons by 2040, respectively. With the new controls, this pollutant will be reduced by an additional 9 percent for Small SI engines and an additional 21 percent for Marine SI engines by 2040. The CO emission inventory trends over time for both categories of engines that are subject to the final rule are shown in Figure IX-4.

Table IX-5: National (50-State) CO Emissions and Emission Reductions for Small SI and Marine SI Engines

Year	Category	Without Rule	With Rule	Reduction	% Reduction
2002	Small Engine	15,091,835	15,091,835		
	Marine	2,472,251	2,472,251		
	Both	17,564,086	17,564,086		
2015	Small Engine	9,879,027	9,135,515	743,512	8
	Marine	1,690,755	1,587,889	102,867	6
	Both	11,569,782	10,723,404	846,379	7
2020	Small Engine	10,645,870	9,679,462	966,407	9
	Marine	1,638,114	1,452,196	185,917	11
	Both	12,283,983	11,131,659	1,152,325	9
2030	Small Engine	12,310,505	11,166,921	1,143,584	9
	Marine	1,671,627	1,353,989	317,638	19
	Both	13,982,132	12,520,910	1,461,222	10
2040	Small Engine	14,007,335	12,701,792	1,305,543	9
	Marine	1,765,651	1,399,715	365,936	21
	Both	15,772,986	14,101,507	1,671,479	11

Figure IX-4: Estimated CO Emissions from Small SI and Marine SI Engines



B. Estimated Costs

In assessing the economic impact of setting emission standards, we have made a best estimate of the costs associated with the technologies we anticipate manufacturers will use in meeting the standards. In making our estimates for the final rule, we have relied on our own technology assessment, which includes information developed by EPA's National Vehicle and Fuel Emissions Laboratory (NVFEL). Estimated costs include variable costs (e.g. hardware and assembly time) and fixed costs (e.g. research and development, retooling, engine certification and test cell upgrades to 40 CFR 1065 requirements). We projected that manufacturers will redirect existing research and development funds to invest in the fixed costs associated with changes needed to meet the rulemaking requirements. The analysis also considers total operating costs, including maintenance and fuel consumption. Cost estimates based on the projected technologies represent an expected change in the cost of engines as they begin to comply with new emission standards. All costs are presented in 2005 dollars. Full details of our cost analysis can be found in Chapter 6 of the Final RIA. Estimated costs related to exhaust emissions were also subject to peer review, as described in a set of peer review reports that are available in the docket for this rulemaking.

Cost estimates based on the current projected costs for our estimated technology packages represent an expected incremental cost of equipment in the near term. For the longer term we have identified a factor that will cause cost impacts to decrease over time. We expect that manufacturers will undergo a learning process that will lead to lower variable costs. For instance, the analysis incorporates the expectation that Small SI engine manufacturers will optimize the catalyst muffler offerings available and thereby streamline their production and reduce costs. The cost analysis generally incorporates this learning effect by decreasing estimated variable costs by 20 percent starting in the sixth year of production. The learning curve has not been applied to Small SI EFI systems due to the fact that the technologies are currently well established on similar sized engines in other applications.

We project average costs to comply with the new exhaust emission standards for Small SI engines and equipment to range from $9-$11 per Class I equipment to meet the Phase 3 standards. We anticipate the manufacturers will meet the emission standard with several technologies including engine improvements and catalysts. For Class II equipment, we project average costs to range from $15-$26 per equipment to meet the new emission standards. We anticipate the manufacturers of Class II engines will meet the new exhaust emission standards by engine improvements and adding catalysts and/or electronic fuel injection to their engines. The use of electronic fuel injection is estimated to provide a fuel savings of 10% over the lifetime of a Class II engine. Using an average garden tractor estimated lifetime of 5.8 years, and the estimate that 6.6% of Class II engines will utilize electronic fuel injection, this calculates to be a lifetime savings of 273 gallons. This translates to a discounted lifetime savings of approximately $496 per engine, at an average fuel price of $1.81 per gallon.

For Small SI equipment, we have also estimated a per-unit cost for the new evaporative emission standards. The average short-term costs without fuel savings are projected to be $0.82 for handheld equipment, $3.05 for Class I equipment, and $6.73 for Class II equipment. These costs are based on fuel tank and fuel line permeation control, and for non-handheld equipment, running loss and diffusion control. Because evaporative emissions are composed of otherwise usable fuel that is lost to the atmosphere, measures that reduce evaporative emissions will result in fuel savings. We estimate that the average fuel savings, due to permeation control, be about 1.4 gallons over the 5 year average operating lifetime. This translates to a discounted lifetime savings of more than $2 at an average fuel price of $1.81 per gallon.

For marine engines, we estimated per-engine costs for OB, PWC, and SD/I engines for meeting the new exhaust emission standards. The short-term cost estimates without fuel savings are $290 for OB, $390 for PWC, and $360 for SD/I engines. For OB/PWC engines, we anticipate that manufacturers will meet the standards through the expanded production of existing low-emission technologies such as four-stroke and direct-injection two-stroke engines. For most SD/I engines, we anticipate that manufacturers will use catalytic control to meet the new standards.

For marine vessels, we have also estimated a per-unit cost for the new evaporative emission standards. The average short-term costs without fuel savings are projected to be $12 for boats with portable fuel tanks, $17 for PWC, and $74 for boats with installed fuel tanks. These costs are based on fuel tank and fuel line permeation control and diurnal emission control. For portable fuel tanks, diurnal emission control is based on an automatic sealing vent, for PWC we estimate that changes will not be necessary from current designs, and for other boats with installed fuel tanks, the estimated costs are based on the use of a passively-purged carbon canister. Because evaporative emissions are composed of otherwise usable fuel that is lost to the atmosphere, measures that reduce evaporative emissions will result in fuel savings. We estimate that the average fuel savings, due to permeation control, to be about 28 gallons over the 15 year average operating lifetime. This translates to a discounted lifetime savings of more than $30 at an average fuel price of $1.81 per gallon.

C. Cost per Ton

We have calculated the cost per ton of the Phase 3 standards contained in this final rule by estimating costs and emission benefits for these engines. We made our best estimates of the combination of technologies that engine manufacturers might use to meet the new standards, best estimates of resultant changes to equipment design, engine manufacturer compliance program costs, and fuel savings in order to assess the expected economic impact of the Phase 3 emission standards for Small SI engines and Marine SI engines. Emission reduction benefits are taken from the results of the Inventory chapter of the RIA (Chapter 3).

A summary of the annualized costs to Small SI and Marine SI engine manufacturers is presented in Table IX-6. These annualized costs are over a 30 year period and presented both with a 3 percent and a 7 percent discount rate. The annualized fuel savings for Small SI engines are due to reduced fuel costs from the use of electronic fuel injection on Class II engines as well as fuel savings from evaporative measures on all Small SI engines. The annualized fuel savings for Marine SI engines are due to reduced fuel costs from the expected elimination of two-stroke outboard motors from the new engine fleet as well as fuel savings from evaporative emission controls on all vessels.

Table IX-6: Estimated Annualized Cost to Manufacturers and Annualized Fuel Savings over 30 Years Due to the Phase 3 Small SI and Marine SI Engine Standards
(2005$, 3 and 7 percent discount rates)

Engine Category	Emissions Category	Annualized Cost to Manufacturers (millions/yr)		Annualized Fuel Savings (millions/yr)	
		3%	7%	3%	7%
Small SI Engines	Exhaust	$190	$182	$27	$24
	Evaporative	$68	$65	$59	$53
	Aggregate	$258	$247	$86	$77
Marine SI Engines	Exhaust	$123	$123	$67	$56
	Evaporative	$23	$22	$27	$22
	Aggregate	$146	$144	$94	$78

We have estimated the Small SI and Marine SI engine cost per ton of the Phase 3 HC+NOx standards over the typical lifetime of the equipment that are covered by this final rule. We have examined the cost per ton by performing a nationwide cost per ton analysis in which the net present value of the cost of compliance per year is divided by the net present value of the HC+NOx benefits over 30 years. The resultant discounted cost per ton is presented in Table IX-7. The total (exhaust and evaporative) cost per ton, using a 7 percent discount rate, with fuel savings is $856 for Small SI equipment and $360 for marine vessels. For the final rule as a whole, the cost per ton of HC+NOx reduction is $623. Reduced operating costs offset a portion of the increased cost of producing the cleaner Small SI and Marine SI engines. Reduced fuel consumption also offsets the costs of permeation control. Chapter 7 of the RIA contains a more detailed discussion of the cost per ton analysis.

Table IX-7: Estimated Cost Per Ton of the HC+NOx Emission Standards
(2005$, 3 and 7 percent discount rates)

Category	Implementation Dates	Discounted Cost per Ton	
		Without Fuel Savings (3% / 7%)	With Fuel Savings (3% / 7%)
Small SI Exhaust	2011-2012	$1,152 / $1,264	$986 / $1,097
Small SI Evaporative	2009-2013	$690 / $740	$90 / $140
Marine SI Exhaust	2010-2013	$700 / $830	$320 / $450
Marine SI Evaporative	2009-2012	$500 / $590	($100) / ($10)
Aggregate	2009-2013	$868/ $974	$519 / $623

As is discussed above, we are also expecting some reduction in direct PM emissions and carbon monoxide. These reductions will come primarily as a product of the technology being used to meet HC and NOx standards and not directly as a result of the implementation of specific technology to achieve these gains. Thus, we have elected to focus our cost per ton analysis on HC+NOx.

One useful purpose of cost per ton analysis is to compare this program to other programs designed to achieve similar air quality objectives. Toward that end, we made a comparison between the HC+NOx cost per ton values presented in Table C-2 and the HC+NOx cost per ton of other recent mobile source programs. Table IX-8 summarizes the HC+NOx cost per ton of several recent EPA actions for controlled emissions from mobile sources. While the analyses for each rule were not completely identical, it is clear that the Small SI and Marine SI values compare favorably with the other recent actions.

Table IX-8: Cost Per Ton of Previously Implemented HC+NOx Mobile Source Programs (2005$, 7 percent discount with fuel savings)

Program	Discounted Cost per Ton
2002 HH engines Phase 2	840
2001 NHH engines Phase 2	neg*
1998 Marine SI engines	1900
2004 Comm Marine CI	200
2007 Large SI exhaust	80
2006 ATV exhaust	300
2006 off-highway motorcycle	290
2006 recreational marine CI	700
2010 snowmobile	1430
2006 <50cc highway motorcycle	1860
2010 Class 3 highway motorcycle	1650

* fuel savings outweigh engineering/hardware costs

D. Air Quality Impact

Information on the air quality impacts of this action can be found in Section II, which includes health effect information on ozone, PM, CO and air toxics. It also includes modeled projections of future ozone concentrations with and without the controls detailed in this final rule. The emission reductions will lead to reductions in ambient concentrations of ozone, PM, CO and air toxics.

E. Benefits

This section presents our analysis of the health and environmental benefits that are estimated to occur as a result of the final Small SI and Marine SI engine standards throughout the period from initial implementation through 2030. Nationwide, the engines that are subject to the emission standards in this rule are a significant source of mobile source air pollution. The standards would reduce exposure to hydrocarbon, CO and NOx emissions and help avoid a range of adverse health effects associated with ambient ozone and $PM_{2.5}$ levels. In addition, the proposed standards would help reduce exposure to CO, air toxics, and $PM_{2.5}$ for persons who operate or who work with or are otherwise active in close proximity to these engines. As described below, the reductions in PM and ozone from the standards are expected to result in significant reductions in premature deaths and other serious human health effects, as well as other important public health and welfare effects.

EPA typically quantifies and monetizes PM- and ozone-related impacts in its regulatory impact analyses (RIAs) when possible. The RIA for the proposal for this rulemaking only quantified benefits from PM; in the current RIA we quantify and monetize the ozone-related health and environmental impacts associated with the final rule. The science underlying the analysis is based on the current ozone criteria document.[124] To estimate the incidence and monetary value of the health outcomes associated with this final rule, we used health impact functions based on published epidemiological studies, and valuation functions derived from the economics literature.[125] Key health endpoints analyzed include premature mortality, hospital and emergency room visits, school absences, and minor restricted activity days. The analytic approach to characterizing uncertainty is consistent with the analysis used in the RIA for the proposed O3 NAAQS.

The benefits modeling is based on peer-reviewed studies of air quality and health and welfare effects associated with improvements in air quality and peer-reviewed studies of the dollar values of those public health and welfare effects. These methods are consistent with benefits analyses performed for the recent analysis of the final Ozone NAAQS and the final PM NAAQS analysis.[126,127] They are described in detail in the regulatory impact analyses prepared for those rules.

The range of PM benefits associated with the final standards is estimated based on risk reductions estimated using several sources of PM-related mortality effect estimates. In order to provide an indication of the sensitivity of the benefits estimates to alternative assumptions about PM mortality risk reductions, in Chapter 8 of the RIA we present a variety of benefits estimates based on two epidemiological studies (including the ACS Study and the Six Cities Study) and the recent PM mortality expert elicitation.[128] EPA intends to ask the Science Advisory Board to provide additional advice as to which scientific studies should be used in future RIAs to estimate the benefits of reductions in PM-related premature mortality.

In a recent report on the estimation of ozone-related premature mortality published by the National Research Council (NRC),[129] a panel of experts and reviewers concluded that ozone-related mortality should be included in estimates of the health benefits of reducing ozone exposure. The report also recommended that the estimation of ozone-related premature mortality be accompanied by broad uncertainty analyses while giving little or no weight to the assumption that there is no causal association between ozone exposure and premature mortality. Because EPA has yet to develop a coordinated response to the NRC report's findings and recommendations, however, we have retained the approach to estimating ozone-related premature mortality used in RIA for the final Ozone NAAQS. EPA will specifically address the report's findings and recommendations in future rulemakings.

---

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

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

[126] U.S. Environmental Protection Agency. March 2008. Final Ozone NAAQS Regulatory Impact Analysis. Prepared by: Office of Air and Radiation, Office of Air Quality Planning and Standards.

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

[128] Industrial Economics, Incorporated (IEc). 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between PM2.5 Exposure and Mortality. Peer Review Draft. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August.

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

The range of ozone benefits associated with the final standards is based on risk reductions estimated using several sources of ozone-related mortality effect estimates. This analysis presents four alternative estimates for the association based upon different functions reported in the scientific literature. One estimate is derived from the National Morbidity, Mortality, and Air Pollution Study (NMMAPS),[130] which was used as the primary basis for the risk analysis in the ozone Staff Paper[131] and reviewed by the Clean Air Science Advisory Committee (CASAC).[132] We also use three studies that synthesize ozone mortality data across a large number of individual studies.[133,134,135] This approach is not inconsistent with recommendations provided by the NRC in their ozone mortality report (NRC, 2008), "The committee recommends that the greatest emphasis be placed on estimates from new systematic multicity analyses that use national databases of air pollution and mortality, such as in the NMMAPS, without excluding consideration of meta-analyses of previously published studies."

The range of total ozone- and PM-related benefits associated with the final standards is presented in Table IX.E-1. We present total benefits based on the PM- and ozone-related premature mortality function used. The benefits ranges therefore reflect the addition of each estimate of ozone-related premature mortality (each with its own row in Table IX.E-1) to estimates of PM-related premature mortality, derived from either the epidemiological literature or the expert elicitation. The estimates in Table IX.E-1, and all monetized benefits presented in this section, are in year 2005 dollars.

---

[130] Bell, M.L., et al. 2004. Ozone and short-term mortality in 95 US urban communities, 1987-2000. Jama, 2004. 292(19): p. 2372-8.

[131] U.S. EPA (2007) Review of the National Ambient Air Quality Standards for Ozone, Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper.EPA-452/R-07-003. This document is available in Docket EPA-HQ-OAR-2003-0190. This document is available electronically at: http:www.epa.gov/ttn/naaqs/standards/ozone/s_o3_cr_sp.html.

[132] CASAC (2007). Clean Air Scientific Advisory Committee's (CASAC) Review of the Agency's Final Ozone Staff Paper. EPA-CASAC-07-002. March 26.

[133] Bell, M.L., F. Dominici, and J.M. Samet. A meta-analysis of time-series studies of ozone and mortality with comparison to the national morbidity, mortality, and air pollution study. Epidemiology, 2005. 16(4): p. 436-45.

[134] Ito, K., S.F. De Leon, and M. Lippmann. Associations between ozone and daily mortality: analysis and meta-analysis. Epidemiology, 2005. 16(4): p. 446-57.

[135] Levy, J.I., S.M. Chemerynski, and J.A. Sarnat. 2005. Ozone exposure and mortality: an empiric bayes metaregression analysis. Epidemiology, 2005. 16(4): p. 458-68.

Table IX.E-1 Estimated 2030 Monetized PM-and Ozone-Related Health Benefits of the Final Small SI and Marine SI Engine Standards[a]

2030 Total Ozone and PM Benefits – PM Mortality Derived from American Cancer Society Analysis[a]			
Premature Ozone Mortality Function or Assumption	Reference	Mean Total Benefits (Billions, 2005$, 3% Discount Rate)[c,d]	Mean Total Benefits (Billions, 2005$, 7% Discount Rate)[c,d]
NMMAPS	Bell et al., 2004	$2.4	$2.2
Meta-analysis	Bell et al., 2005	$3.7	$3.5
	Ito et al., 2005	$4.4	$4.2
	Levy et al., 2005	$4.4	$4.3
Assumption that association is not causal[e]		$1.8	$1.6
2030 Total Ozone and PM Benefits – PM Mortality Derived from Expert Elicitation[b]			
Premature Ozone Mortality Function or Assumption	Reference	Mean Total Benefits (Billions, 2005$, 3% Discount Rate)[c,d]	Mean Total Benefits (Billions, 2005$, 7% Discount Rate)[c,d]
NMMAPS	Bell et al., 2004	$1.7 - $9.7	$1.6 - $8.8
Meta-analysis	Bell et al., 2005	$3.0 - $11	$2.9 - $10
	Ito et al., 2005	$3.7 - $12	$3.6 - $11
	Levy et al., 2005	$3.7 - $12	$3.7 - $11
Assumption that association is not causal[e]		$1.1 - $9.1	$1.0 - $8.2

[a] Total includes ozone and PM2.5 benefits. Range was developed by adding the estimate from the ozone premature mortality function to the estimate of PM2.5-related premature mortality derived from the ACS study (Pope et al., 2002).
[b] Total includes ozone and PM2.5 benefits. Range was developed by adding the estimate from the ozone premature mortality function to both the lower and upper ends of the range of the PM2.5 premature mortality functions characterized in the expert elicitation. The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.
[c] Note that total benefits presented here do not include a number of unquantified benefits categories. A detailed listing of unquantified health and welfare effects is provided in Table IX.E-6.
[d] Results reflect the use of both a 3 and 7 percent discount rate, as recommended by EPA's Guidelines for Preparing Economic Analyses and OMB Circular A-4. Results are rounded to two significant digits for ease of presentation and computation.
[e] A recent report published by the National Research Council (NRC, 2008) recommended that EPA "give little or no weight to the assumption that there is no causal association between estimated reductions in premature mortality and reduced ozone exposure."

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

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

Estimated Ozone and PM Impacts

To model the ozone and PM air quality benefits of this rule we used the Community Multiscale Air Quality (CMAQ) model. CMAQ simulates the numerous physical and chemical processes involved in the formation, transport, and deposition of particulate matter. This model is commonly used in regional applications to estimate the ozone and PM reductions expected to occur from a given set of emissions controls. The meteorological data input into CMAQ are developed by a separate model, the Penn State University / National Center for Atmospheric Research Mesoscale Model, known as MM5. The modeling domain covers the entire 48-State U.S., as modeled in final ozone NAAQS analysis.[136] The grid resolution for the modeling domain was 12 x 12 km.

The modeled ambient air quality data serves as an input to the Environmental Benefits Mapping and Analysis Program (BenMAP).[137] BenMAP is a computer program developed by EPA that integrates a number of the modeling elements used in previous Regulatory Impact Analyses (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) to translate modeled air concentration estimates into health effects incidence estimates and monetized benefits estimates.

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

The use of two sources of PM mortality reflects two different sources of information about the impact of reductions in PM on reduction in the risk of premature death, including both the published epidemiology literature and an expert elicitation study conducted by EPA in 2006. In 2030, based on the estimate provided by the ACS study, we estimate that PM-related emission reductions related to the final rule will result in 230 fewer premature fatalities annually. The number of premature mortalities avoided increases to 510 when based on the Six Cities study. When the range of expert opinion is used, we estimate between 120 and 1,300 fewer premature mortalities in 2030. We also estimate 220 fewer cases of chronic bronchitis, 530 fewer non-fatal heart attacks, 190 fewer hospitalizations (for respiratory and cardiovascular disease combined), 140,000 fewer days of restricted activity due to respiratory illness and approximately 23,000 fewer work-loss days. This analysis projects substantial health improvements for children from reduced upper and lower respiratory illness, acute bronchitis, and asthma attacks. These results are based on an assumed cutpoint in the long-term mortality concentration-response functions at 10 µg/m3, and an assumed cutpoint in the short-term morbidity concentration-response functions at 10 µg/m3. The impact using four alternative cutpoints (3 $\mu g/m^3$, 7.5 $\mu g/m^3$, 12 $\mu g/m^3$, and 14 $\mu g/m^3$) has on $PM_{2.5}$-related mortality incidence estimation is presented in Chapter 8 of the RIA.

For ozone, we estimate a range of between 77-350 fewer premature mortalities as a result of the final rule in 2030, assuming that there is a causal relationship between ozone exposure and mortality. We also estimate that by 2030, the final rule will result in over 1,300 avoided respiratory hospital admissions and emergency room visits, 450,000 fewer days of restricted activity due to respiratory illness, and 180,000 school loss days avoided.

[136] U.S. Environmental Protection Agency. March 2008. Final Ozone NAAQS Regulatory Impact Analysis. Prepared by: Office of Air and Radiation, Office of Air Quality Planning and Standards.
[137] Information on BenMAP, including downloads of the software, can be found at http://www.epa.gov/air/benmap.

Table IX.E-2 Estimated Reduction in Incidence of Adverse Health Effects Related to the Final Small SI and Marine SI Engine Standards[a]

		2020	2030
Health Effect		Mean Incidence Reduction (5^{th} – 95^{th} %ile)	
PM-Related Endpoints			
Premature Mortality – Derived from Epidemiology Literature	Adult, age 30+ - ACS cohort study (Pope et al., 2002)	150 (60 - 240)	230 (88 – 360)
	Adult, age 25+ - Six-Cities study (Laden et al., 2006)	340 (190 – 500)	510 (280 – 740)
	Infant, age <1 year – Woodruff et al. 1997	0 (0 – 1)	1 (0 – 1)
Premature Mortality – Derived from Expert Elicitation[b]	Adult, age 25+ - Lower Bound (Expert K)	81 (0 – 380)	120 (0 – 580)
	Adult, age 25+ - Upper Bound (Expert E)	840 (420 – 1,300)	1,300 (650 – 1,900)
Chronic bronchitis (adult, age 26 and over)		150 (28 – 270)	220 (40 – 400)
Acute myocardial infarction (adults, age 18 and older)		330 (180 – 480)	530 (280 – 770)
Hospital admissions—respiratory (all ages)[c]		40 (20 – 59)	61 (30 – 88)
Hospital admissions—cardiovascular (adults, age >18)[d]		81 (50 – 110)	130 (82 – 180)
Emergency room visits for asthma (age 18 years and younger)		150 (85 - 210)	210 (120 – 300)
Acute bronchitis (children, age 8–12)		400 (-14 – 810)	580 (-20 – 1,200)
Lower respiratory symptoms (children, age 7–14)		2,700 (1,300 – 4,000)	3,800 (1,800 – 5,800)
Upper respiratory symptoms (asthmatic children, age 9–18)		1,900 (610 – 3,300)	2,800 (880 – 4,700)
Asthma exacerbation (asthmatic children, age 6–18)		2,400 (270 – 7,000)	3,500 (380 – 10,000)
Work loss days (adults, age 18–65)		17,000 (15,000 – 19,000)	23,000 (20,000 – 26,000)
Minor restricted-activity days (adults, age 18–65)		100,000 (86,000 – 120,000)	140,000 (120,000 – 160,000)
Ozone-Related Endpoints			
Premature Mortality, All ages – Derived from NMMAPS	Bell et al., 2004	46 (20 – 72)	77 (34 – 120)
Premature Mortality, All ages – Derived from Meta-analyses	Bell et al., 2005	150 (84 – 210)	250 (140 – 360)
	Ito et al., 2005	200 (140 – 270)	340 (230 – 450)
	Levy et al., 2005	210 (160 – 260)	350 (260 - 440)
Premature Mortality – Assumption that association between ozone and mortality is not causal[e]		0	0
Hospital admissions- respiratory causes (children, under 2; adult, 65 and older)[f]		540 (170 – 900)	1,000 (290 – 1,700)
Emergency room visit for asthma (all ages)		200 (0 – 510)	320 (0 - 810)
Minor restricted activity days (adults, age 18-65)		310,000 (160,000 – 460,000)	450,000 (230,000 – 670,000)
School absence days		110,000 (40,000 – 200,000)	180,000 (62,000 – 320,000)

[a] Incidence is rounded to two significant digits. PM and ozone estimates represent impacts from the final standards nationwide.
[b] Based on effect estimates derived from the full-scale expert elicitation assessing the uncertainty in the concentration-response function for PM-related premature mortality (IEc, 2006).[138] The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.
[c] Respiratory hospital admissions for PM include admissions for chronic obstructive pulmonary disease (COPD), pneumonia, and asthma.
[d] Cardiovascular hospital admissions for PM include total cardiovascular and subcategories for ischemic heart disease, dysrhythmias, and heart failure.
[e] A recent report published by the National Research Council (NRC, 2008) recommended that EPA "give little or no weight to the assumption that there is no causal association between estimated reductions in premature mortality and reduced ozone exposure."
[f] Respiratory hospital admissions for ozone include admissions for all respiratory causes and subcategories for COPD and pneumonia.

(2) Monetized Benefits

Table IX.E-3 presents the estimated monetary value of reductions in the incidence of health and welfare effects. Tables IX.E-4 and IX.E-5 present the total annual PM- and ozone-related health benefits, which are estimated to be between $1.8 and $4.4 billion in 2030, assuming a 3 percent discount rate, or between $1.6 and $4.3 billion, assuming a 7 percent discount rate, using the ACS-derived estimate of PM-related premature mortality (Pope et al., 2002) and the range of ozone-related premature mortality studies derived from the epidemiological literature. The range of benefits expands to between $1.1 and $12 billion, assuming a 3 percent discount rate, when the estimate includes the opinions of outside experts on PM and the risk of premature death, or between $1.0 and $11 billion, assuming a 7 percent discount rate. All monetized estimates are stated in 2005$. These estimates account for growth in real gross domestic product (GDP) per capita between the present and the years 2020 and 2030. As the tables indicate, total benefits are driven primarily by the reduction in premature fatalities each year.

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

Tables IX.E-3, IX.E-4 and IX.E-5 do not include those additional health and environmental benefits of the rule that we were unable to quantify or monetize. These effects are additive to the estimate of total benefits, and are related to two primary sources. First, there are many human health and welfare effects associated with PM, ozone, and toxic air pollutant

[138] Industrial Economics, Incorporated (IEc). 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between PM2.5 Exposure and Mortality. Peer Review Draft. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August.

reductions that remain unquantified because of current limitations in the methods or available data. A full appreciation of the overall economic consequences of the final standards requires consideration of all benefits and costs projected to result from the new standards, not just those benefits and costs which could be expressed here in dollar terms. A list of the benefit categories that could not be quantified or monetized in our benefit estimates are provided in Table IX.E-6.

Table IX.E-3 Estimated Monetary Value in Reductions in Incidence of Health and Welfare Effects (in millions of 2005$) [a,b]

		2020	2030
$PM_{2.5}$-Related Health Effect		Estimated Mean Value of Reductions (5th and 95th %ile)	
Premature Mortality – Derived from Epidemiology Studies[c,d,]	Adult, age 30+ - ACS study (Pope et al., 2002) 3% discount rate 7% discount rate	 $1,000 ($240 - $2,100) $910 ($220 - $1,900)	 $1,600 ($370 - $3,200) $1,400 ($330 - $2,800)
	Adult, age 25+ - Six-cities study (Laden et al., 2006) 3% discount rate 7% discount rate	 $2,300 ($630 - $4,400) $2,100 ($570 - $3,900)	 $3,500 ($970 - $6,700) $3,200 ($870 - $6,000)
	Infant Mortality, <1 year – (Woodruff et al. 1997) 3% discount rate 7% discount rate	 $3.2 ($0.8 - $6.2) $2.9 ($0.8 - $5.6)	 $3.9 ($1.0 - $7.7) $3.5 ($0.9 - $6.9)
Premature mortality – Derived from Expert Elicitation[c,d,e]	Adult, age 25+ - Lower bound (Expert K) 3% discount rate 7% discount rate	 $540 ($0 - $2,600) $490 ($0 - $2,400)	 $850 ($0 - $4,100) $760 ($0 - $3,700)
	Adult, age 25+ - Upper bound (Expert E) 3% discount rate 7% discount rate	 $5,600 ($1,500 - $11,000) $5,100 ($1,4000 - $10,000)	 $8,800 ($2,400 - $17,000) $8,000 ($2,100 - $16,000)
Chronic bronchitis (adults, 26 and over)		$70 ($5.7 - $230)	$110 ($8.6 - $350)
Non-fatal acute myocardial infarctions 3% discount rate 7% discount rate		 $34 ($10 - $72) $33 ($10 - $70)	 $52 ($15 - $110) $51 ($14 - $110)
Hospital admissions for respiratory causes		$0.8 ($0.4 - $1.2)	$1.3 ($0.6 - $1.8)
Hospital admissions for cardiovascular causes		$2.2	$3.5

		($1.3 - $2.9)	($2.2 - $4.7)
Emergency room visits for asthma		$0.05 ($0.03 - $0.08)	$0.07 ($0.04 - $0.1)
Acute bronchitis (children, age 8–12)		$0.2 ($0 - $0.4)	$0.2 ($0 - $0.6)
Lower respiratory symptoms (children, 7–14)		$0.05 ($0.02 - $0.09)	$0.07 ($0.03 - $0.1)
Upper respiratory symptoms (asthma, 9–11)		$0.06 ($0.02 - $0.1)	$0.08 ($0.02 - $0.2)
Asthma exacerbations		$0.1 ($0.01-$0.4)	$0.2 ($0.02 - $0.5)
Work loss days		$2.5 ($2.2 - $2.8)	$3.4 ($3.0 - $3.8)
Minor restricted-activity days (MRADs)		$2.9 ($0.3 – $5.7)	$4.0 ($0.4 - $7.7)
Recreational Visibility, 86 Class I areas		$17 (na)[f]	$7 (na)
Ozone-related Health Effect			
Premature Mortality, All ages – Derived from NMMAPS	Bell et al., 2004	$340 ($86 - $680)	$590 ($150 - $1,200)
Premature Mortality, All ages – Derived from Meta-analyses	Bell et al., 2005	$1,100 ($310 - $2,100)	$1,900 ($530 - $3,600)
	Ito et al., 2005	$1,500 ($450 - $2,800)	$2,600 ($760 - $4,700)
	Levy et al., 2005	$1,600 ($470 - $2,700)	$2,600 ($800 - $4,700)
Premature Mortality – Assumption that association between ozone and mortality is not causal[f]		$0	$0
Hospital admissions- respiratory causes (children, under 2; adult, 65 and older)		$8.7 ($2.1 - $15)	$17 ($3.8 - $31)
Emergency room visit for asthma (all ages)		$0.07 ($0 - $0.2)	$0.1 ($0 - $0.3)
Minor restricted activity days (adults, age 18-65)		$19 ($8.5 - $31)	$27 ($13 - $46)
School absence days		$9.7 ($3.4 - $17)	$15 ($5.4 - $27)
Worker Productivity		$3.1 (na)[g]	$5.1 (na)[g]

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

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

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

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

[e] Based on effect estimates derived from the full-scale expert elicitation assessing the uncertainty in the concentration-response function for PM-related premature mortality (IEc, 2006).[139] The effect estimates of five of the twelve experts included in the elicitation panel fall within the empirically-derived range provided by the ACS and Six-Cities studies. One of the experts fall below this range and six of the experts are above this range. Although the overall range across experts is summarized in this table, the full uncertainty in the estimates is reflected by the results for the full set of 12 experts. The twelve experts' judgments as to the likely mean effect estimate are not evenly distributed across the range illustrated by arraying the highest and lowest expert means.

[f] A recent report published by the National Research Council (NRC, 2008) recommended that EPA "give little or no weight to the assumption that there is no causal association between estimated reductions in premature mortality and reduced ozone exposure."

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

[139] Industrial Economics, Incorporated (IEc). 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between PM2.5 Exposure and Mortality. Peer Review Draft. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August.

Table IX.E-4 Total Monetized Benefits of the Final Small SI and Marine SI Engine Rule – 3% Discount Rate

Total Ozone and PM Benefits (billions, 2005$) – PM Mortality Derived from the ACS Study					
2020			**2030**		
Ozone Mortality Function	Reference	Mean Total Benefits	Ozone Mortality Function	Reference	Mean Total Benefits
NMMAPS	Bell et al., 2004	$1.5	NMMAPS	Bell et al., 2004	$2.4
Meta-analysis	Bell et al., 2005	$2.3	Meta-analysis	Bell et al., 2005	$3.7
	Ito et al., 2005	$2.7		Ito et al., 2005	$4.4
	Levy et al., 2005	$2.7		Levy et al., 2005	$4.4
Assumption that association is not causal[a]		$1.2	Assumption that association is not causal[a]		$1.8
Total Ozone and PM Benefits (billions, 2005$) – PM Mortality Derived from Expert Elicitation (Lowest and Highest Estimate)					
2020			**2030**		
Ozone Mortality Function	Reference	Mean Total Benefits	Ozone Mortality Function	Reference	Mean Total Benefits
NMMAPS	Bell et al., 2004	$1.1 - $6.1	NMMAPS	Bell et al., 2004	$1.7 - $9.7
Meta-analysis	Bell et al., 2005	$1.8 - $6.9	Meta-analysis	Bell et al., 2005	$3.0 - $11
	Ito et al., 2005	$2.2 - $7.3		Ito et al., 2005	$3.7 - $12
	Levy et al., 2005	$2.3 - $7.4		Levy et al., 2005	$3.7 - $12
Assumption that association is not causal[a]		$0.7 - $5.8	Assumption that association is not causal[a]		$1.1 - $9.1

[a] A recent report published by the National Research Council (NRC, 2008) recommended that EPA “give little or no weight to the assumption that there is no causal association between estimated reductions in premature mortality and reduced ozone exposure.”

Table IX.E-5 Total Monetized Benefits of the Final Small SI and Marine SI Engine Rule – 7% Discount Rate

Total Ozone and PM Benefits (billions, 2005$) – PM Mortality Derived from the ACS Study					
2020			**2030**		
Ozone Mortality Function	Reference	Mean Total Benefits	Ozone Mortality Function	Reference	Mean Total Benefits
NMMAPS	Bell et al., 2004	$1.4	NMMAPS	Bell et al., 2004	$2.2
Meta-analysis	Bell et al., 2005	$2.2	Meta-analysis	Bell et al., 2005	$3.5
	Ito et al., 2005	$2.6		Ito et al., 2005	$4.2
	Levy et al., 2005	$2.6		Levy et al., 2005	$4.3
Assumption that association is not causal[a]		$1.1	Assumption that association is not causal[a]		$1.6
Total Ozone and PM Benefits (billions, 2005$) – PM Mortality Derived from Expert Elicitation (Lowest and Highest Estimate)					
2020			**2030**		
Ozone Mortality Function	Reference	Mean Total Benefits	Ozone Mortality Function	Reference	Mean Total Benefits
NMMAPS	Bell et al., 2004	$1.0 - $5.6	NMMAPS	Bell et al., 2004	$1.6 - $8.8
Meta-analysis	Bell et al., 2005	$1.8 - $6.4	Meta-analysis	Bell et al., 2005	$2.9 - $10
	Ito et al., 2005	$2.2 - $6.8		Ito et al., 2005	$3.6 - $11
	Levy et al., 2005	$2.2 - $6.8		Levy et al., 2005	$3.7 - $11
Assumption that association is not causal[a]		$0.7 - $5.2	Assumption that association is not causal[a]		$1.0 - $8.2

[a] A recent report published by the National Research Council (NRC, 2008) recommended that EPA "give little or no weight to the assumption that there is no causal association between estimated reductions in premature mortality and reduced ozone exposure."

Table IX.E-6 Unquantified and Non-Monetized Potential Effects of the Final Small SI and Marine SI Engine Standards

POLLUTANT/EFFECTS	EFFECTS NOT INCLUDED IN ANALYSIS - CHANGES IN:
Ozone Health[a]	Chronic respiratory damage[b] Premature aging of the lungs[b] Non-asthma respiratory emergency room visits Exposure to UVb (+/-)[e]
Ozone Welfare	Yields for -commercial forests -some fruits and vegetables -non-commercial crops Damage to urban ornamental plants Impacts on recreational demand from damaged forest aesthetics Ecosystem functions Exposure to UVb (+/-)[e]
PM Health[c]	Premature mortality - short term exposures[d] Low birth weight Pulmonary function Chronic respiratory diseases other than chronic bronchitis Non-asthma respiratory emergency room visits Exposure to UVb (+/-)[e]
PM Welfare	Residential and recreational visibility in non-Class I areas Soiling and materials damage Damage to ecosystem functions Exposure to UVb (+/-)[e]
Nitrogen and Sulfate Deposition Welfare	Commercial forests due to acidic sulfate and nitrate deposition Commercial freshwater fishing due to acidic deposition Recreation in terrestrial ecosystems due to acidic deposition Existence values for currently healthy ecosystems Commercial fishing, agriculture, and forests due to nitrogen deposition Recreation in estuarine ecosystems due to nitrogen deposition Ecosystem functions Passive fertilization
CO Health	Behavioral effects
HC/Toxics Health[f]	Cancer (benzene, 1,3-butadiene, formaldehyde, acetaldehyde) Anemia (benzene) Disruption of production of blood components (benzene) Reduction in the number of blood platelets (benzene) Excessive bone marrow formation (benzene) Depression of lymphocyte counts (benzene) Reproductive and developmental effects (1,3-butadiene) Irritation of eyes and mucus membranes (formaldehyde) Respiratory irritation (formaldehyde) Asthma attacks in asthmatics (formaldehyde) Asthma-like symptoms in non-asthmatics (formaldehyde) Irritation of the eyes, skin, and respiratory tract (acetaldehyde) Upper respiratory tract irritation and congestion (acrolein)
HC/Toxics Welfare	Direct toxic effects to animals Bioaccumulation in the food chain Damage to ecosystem function Odor

[a] The public health impact of biological responses such as increased airway responsiveness to stimuli, inflammation in the lung, acute inflammation and respiratory cell damage, and increased susceptibility to respiratory infection are likely partially represented by our quantified endpoints.
[b] The public health impact of effects such as chronic respiratory damage and premature aging of the lungs may be partially represented by quantified endpoints such as hospital admissions or premature mortality, but a number of other related health impacts, such as doctor visits and decreased athletic performance, remain unquantified.
[c] In addition to primary economic endpoints, there are a number of biological responses that have been associated with PM health effects including morphological changes and altered host defense mechanisms. The public health impact of these biological responses may be partly represented by our quantified endpoints.
[d] While some of the effects of short-term exposures are likely to be captured in the estimates, there may be premature mortality due to short-term exposure to PM not captured in the cohort studies used in this analysis. However, the PM mortality results derived from the expert elicitation do take into account premature mortality effects of short term exposures.
[e] May result in benefits or disbenefits.
[f] Many of the key hydrocarbons related to this rule are also hazardous air pollutants listed in the Clean Air Act.

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

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

- The exclusion of potentially significant and unquantified benefit categories (such as health, odor, and ecological benefits of reduction in air toxics, ozone, and PM);
- Errors in measurement and projection for variables such as population growth;
- Uncertainties in the estimation of future year emissions inventories and air quality;
- Uncertainty in the estimated relationships of health and welfare effects to changes in pollutant concentrations including the shape of the C-R function, the size of the effect estimates, and the relative toxicity of the many components of the PM mixture;
- Uncertainties in exposure estimation; and
- Uncertainties associated with the effect of potential future actions to limit emissions.

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

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

- All fine particles, regardless of their chemical composition, are equally potent in causing premature mortality. This is an important assumption, because PM produced via transported precursors emitted from Small SI and Marine SI engines may differ significantly from PM precursors released from electric generating units and other industrial sources. However, no clear scientific grounds exist for supporting differential effects estimates by particle type.
- The C-R function for fine particles is approximately linear within the range of ambient concentrations under consideration (above the assumed threshold of 10 µg/m3). Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM, including both regions that may be in attainment with $PM_{2.5}$ standards and those that are at risk of not meeting the standards.
- In a recent report on the estimation of ozone-related premature mortality published by the National Research Council (NRC), a panel of experts and reviewers concluded that ozone-related mortality should be included in estimates of the health benefits of reducing ozone exposure. The report also recommended that the estimation of ozone-related premature mortality be accompanied by broad uncertainty analyses while giving little or no weight to the assumption that there is no causal association between ozone exposure and premature mortality. Because EPA has yet to develop a coordinated response to the NRC report's findings and recommendations, however, we have retained the approach to estimating ozone-related premature mortality used in RIA for the final Ozone NAAQS. EPA will specifically address the report's findings and recommendations in future rulemakings.

Despite these uncertainties, we believe this benefit-cost analysis provides a conservative estimate of the estimated economic benefits of the final standards in future years because of the exclusion of potentially significant benefit categories. Acknowledging benefits omissions and uncertainties, we present a best estimate of the total benefits based on our interpretation of the best available scientific literature and methods supported by EPA's technical peer review panel, the Science Advisory Board's Health Effects Subcommittee (SAB-HES). The National Academies of Science (NRC, 2002) also reviewed EPA's methodology for analyzing the health benefits of measures taken to reduce air pollution. EPA addressed many of these comments in the analysis of the final PM NAAQS.[140,141] The analysis of the final standards incorporates this most recent work to the extent possible.

(4) Benefit-Cost Analysis

In estimating the net benefits of the final standards, the appropriate cost measure is 'social costs.' Social costs represent the welfare costs of a rule to society. These costs do not consider transfer payments (such as taxes) that are simply redistributions of wealth. Table XII.E-7 contains the estimates of monetized benefits and estimated social welfare costs for the final

[140] National Research Council (NRC). 2002. Estimating the Public Health Benefits of Proposed Air Pollution Regulations. The National Academies Press: Washington, D.C.
[141] U.S. Environmental Protection Agency. October 2006. *Final Regulatory Impact Analysis (RIA) for the Proposed National Ambient Air Quality Standards for Particulate Matter*. Prepared by: Office of Air and Radiation. Available at HTTP://www.epa.gov/ttn/ecas/ria.html.

rule and each of the final control programs. The annual social welfare costs of all provisions of this final rule are described more fully in Section IX.F.

The results in Table IX.E-7 suggest that the 2020 monetized benefits of the final standards are greater than the expected social welfare costs. Specifically, the annual benefits of the total program will range between $1.2 to $4.0 billion annually in 2020 using a three percent discount rate, or between $1.1 to $3.8 billion assuming a 7 percent discount rate, compared to estimated social costs of approximately $210 million in that same year. These benefits are expected to increase to between $1.8 and $6.4 billion annually in 2030 using a three percent discount rate, or between $1.6 and $6.1 billion assuming a 7 percent discount rate, while the social costs are estimated to be approximately $190 million. Though there are a number of health and environmental effects associated with the final standards that we are unable to quantify or monetize (see Table IX.E-6), the benefits of the final standards outweigh the projected costs. When we examine the benefit-to-cost comparison for the rule standards separately, we also find that the benefits of the specific engine standards outweigh their projected costs.

Table IX.E-7 Summary of Annual Benefits, Costs, and Net Benefits of the Final Small SI and Marine SI Engine Standards (Millions, 2005$)[a]

Description	2020	2030
Estimated Social Costs[b]		
Small SI	$163	$185
Marine SI	$44	$0.8
Total Social Costs	$210	$190
Estimated Health Benefits of the Final Standards[c,d,e,f]		
Small SI		
3 percent discount rate	$860 to $2,600	$820 to $2,900
7 percent discount rate	$790 to $2,500	$710 to $2,800
Marine SI		
3 percent discount rate	$340 to $1,400	$980 to $3,500
7 percent discount rate	$310 to $1,300	$890 to $3,300
Total Benefits		
3 percent discount rate	$1,200 to $4,000	$1,800 to $6,400
7 percent discount rate	$1,100 to $3,800	$1,600 to $6,100
Annual Net Benefits (Total Benefits – Total Costs)		
3 percent discount rate	$990 to $3,800	$1,600 to $6,200
7 percent discount rate	$890 to $3,600	$1,400 to $5,900

[a] All estimates represent annualized benefits and costs anticipated for the years 2020 and 2030. Totals may not sum due to rounding.
[b] The calculation of annual costs does not require amortization of costs over time. Therefore, the estimates of annual cost do not include a discount rate or rate of return assumption (see Chapter 9 of the RIA). In Chapter 9, however, we use both a 3 percent and 7 percent social discount rate to calculate the net present value of total social costs consistent with EPA and OMB guidelines for preparing economic analyses (US EPA, 2000 and OMB, 2003).
[c] Total includes ozone and PM2.5 benefits. Range was developed by adding the estimate from the ozone premature mortality function, including an assumption that the association is not causal, to PM2.5-related premature mortality derived from the ACS (Pope et al., 2002) and Six Cities (Laden et al., 2006) studies.
[d] Annual benefits analysis results reflect the use of a 3 percent and 7 percent discount rate in the valuation of premature mortality and nonfatal myocardial infarctions, consistent with EPA and OMB guidelines for preparing economic analyses (US EPA, 2000 and OMB, 2003).[142,143]
[e] Valuation of premature mortality based on long-term PM exposure assumes discounting over the SAB recommended 20-year segmented lag structure described in the Regulatory Impact Analysis for the Final Clean Air Interstate Rule (March, 2005).
[f] Not all possible benefits or disbenefits are quantified and monetized in this analysis. Potential benefit categories that have not been quantified and monetized are listed in Table IX.E-6.

F. Economic Impact Analysis

We prepared an Economic Impact Analysis (EIA) to estimate the economic impacts of the final emission control program on the Small SI and Marine SI engine and equipment markets. In this section we briefly describe the Economic Impact Model (EIM) we developed to estimate the market-level changes in price and outputs for affected markets, the social costs of the

[142] U.S. Environmental Protection Agency, 2000. Guidelines for Preparing Economic Analyses. www.yosemite1.epa.gov/ee/epa/eed/hsf/pages/Guideline.html.
[143] Office of Management and Budget, The Executive Office of the President, 2003. Circular A-4. http://www.whitehouse.gov/omb/circulars.

program, and the expected distribution of those costs across affected stakeholders. As defined in EPA's *Guidelines for Preparing Economic Analyses*, social costs are the value of the goods and services lost by society resulting from a) the use of resources to comply with and implement a regulation and b) reductions in output.[144]

A quantitative Economic Impact Model (EIM) was developed to estimate price and quantity changes and total social costs associated with the emission control program. The EIM is a computer model comprised of a series of spreadsheet modules that simulate the supply and demand characteristics of each of the markets under consideration. The model methodology is firmly rooted in applied microeconomic theory and was developed following the methodology set out in OAQPS's *Economic Analysis Resource Document*.[145] Chapter 9 of the RIA contains a detailed description of the EIM, including the economic theory behind the model and the data used to construct it, the baseline equilibrium market conditions, and the model's behavior parameters. The EIM and the estimated compliance costs presented above are used to estimate the economic impacts of the program. The results of this analysis are summarized below.

(1) Market Analysis Results

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

The compliance costs associated with the new Small SI and Marine SI engine and equipment standards are expected to lead to price and quantity changes in these markets. A summary of the market analysis results is presented in Table XII.F-1 for 2014, 2018, and 2030. These years were chosen because 2014 is the year with the highest compliance cost; 2018, the year in which the compliance costs are reduced due to the learning curve, and the market impacts reflect variable costs as well as growth in equipment population; and 2030 illustrates the long-term impacts of the program. Results for all years can be found in Chapter 9 of the RIA.

For all markets, the market impacts for the early years are driven by either the fixed cost or the combination of the fixed and variable costs associated with different standards. This leads to a small increase in estimated price impacts for the years 2008 through 2014, the period during which the costs change over time reflecting the phase-in of different costs (variable and fixed costs) for each standard or the phase-in of different standards. The increase is small because the annual per unit compliance costs from these new standards are relatively smaller than the engine or equipment per unit price.

The Small SI exhaust standards begin in 2011 for Class II and 2012 for Class I. The marine exhaust standards generally begin in 2010. The Small SI evaporative emission standards are staggered beginning in 2008, with regulatory flexibility providing some small delays until 2013. The marine evaporative emission standards are staggered beginning in 2009, with regulatory flexibility providing some small delays until 2015.

---

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

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

In the Marine SI market, the average price increase for Marine SI engines in 2014, the high cost year, is estimated to be about 2.4 percent, or $266. In the long term (by 2030), the average price increase is expected to decline to about 1.9 percent, or $213. On the vessel side, the average price change reflects the direct equipment compliance costs plus the portion of the engine costs that are passed on to the equipment purchaser (via higher engine prices). The average price increase in 2014 is expected to be about 1.6 percent, or $285. By 2030, this average price increase is expected to decline to about 1.3 percent, or $231. These price increases are expected to vary across vessel categories. The category with the largest price increase is expected to be personal watercraft engines, with an estimated price increase of about 3.0 percent in 2014; this is expected to decrease to 2.4 percent in 2030. The smallest expected change in 2014 is expected to be for sterndrive/inboards vessels, which are expected to see price increases of about 0.9 percent.

In the Small SI market, the average price increase for Small SI engines in 2014, the high cost year, is estimated to be about 8.3 percent, or $14. By 2030, this average price increase is expected to decline to about 7.4 percent, or $12. On the equipment side, the average price change reflects the direct equipment compliance costs plus the portion of the engine costs that are passed on to the equipment purchaser (via higher engine prices). The average price increase for all Small SI equipment in 2014 is expected to be about 2.6 percent, or $10. By 2030, this average price increase is expected to decline to about 2.3 percent, or $8. The average price increase and quantity decrease differs by category of equipment. For Class I equipment, the price increase is estimated to be about 6.2 percent ($17) in 2014, decreasing to 5.6 percent ($15) in 2030. For Class II equipment, a higher price increase is expected, about 2.6 percent ($24) in 2014, decreasing to 2.2 percent ($20) in 2030.

For the handheld equipment market, prices are expected to increase about 0.2 percent or $0.3 for all years, and quantities are expected to decrease about 0.3 percent.

Table XII.F-2: Estimated Market Impacts for 2014, 2018, 2030 (2005$)

Market	Change in Price		Change in Quantity	
	Absolute	Percent	Absolute	Percent
2014				
Marine				
Engines	$266	2.4%	-10,883	-2.7%
Equipment	$285	1.6%	-12,229	-3.2%
SD/I	$299	0.9%	-1,578	-1.7%
OB Recreational	$870	1.0%	-144	-2.0%
OB Luxury	$271	1.4%	-5,666	-2.8%
PWC	$253	3.0%	-4,841	-6.0%
Small SI				
Engines	$14	8.3%	-303,992	-1.9%
Equipment	$10	2.6%	-360,310	-1.4%
Class I	$17	6.2%	-209,284	-2.1%
Class II	$24	2.6%	-101,104	-2.8%
HH	$0.3	0.2%	-49,922	-0.3%
2018				
Marine				
Engines	$213	1.9%	-9,055	-2.2%
Equipment	$231	1.3%	-10,145	-2.6%
SD/I	$244	0.7%	-1,318	-1.4%
OB Recreational	$702	0.8%	-119	-1.6%
OB Luxury	$218	1.1%	-4,697	-2.3%
PWC	$204	2.4%	-4,010	-4.8%
Small SI				
Engines	$12	7.4%	-284,995	-1.7%
Equipment	$8	2.3%	-347,189	-1.2%
Class I	$15	5.6%	-200,155	-1.9%
Class II	$20	2.2%	-91,871	-2.4%
HH	$0.3	0.2%	-55,164	-0.3%
2030				
Marine				
Engines	$213	1.9%	-9,802	-2.2%
Equipment	$231	1.3%	-10,981	-2.6%
SD/I	$244	0.7%	-1,426	-1.4%
OB Recreational	$702	0.8%	-129	-1.6%
OB Luxury	$218	1.1%	-5,085	-2.3%
PWC	$204	2.4%	-4,341	-4.8%
Small SI				
Engines	$12	7.4%	-338,346	-1.7%
Equipment	$8	2.3%	-412,103	-1.2%
Class I	$15	5.6%	-237,485	-1.9%
Class II	$20	2.2%	-109,120	-2.4%
HH	$0.3	0.2%	-65,498	-0.3%

(2) Economic Welfare Analysis

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

The total estimated social costs of the program are about $444 million, $399 million, and 459 million for 2014, 2018 and 2030. These estimated social costs are a slight less than the total compliance costs for those years. The slight reduction in social costs when compared to compliance costs occurs because the total engineering costs do not reflect the decreased sales of the Small SI and Marine SI engines and equipment that are incorporated in the total social costs. Results for all years are presented in Chapter 9 of the RIA.

Table XII.F-2 shows how total social costs are expected to be shared across stakeholders, for selected years.

We estimate the total social costs of the program to be approximately $459 million in 2030. The Marine SI sector is expected to bear about 33.5 percent of the social costs of the programs in 2030, and the Small SI sector is expected to bear 66.5 percent. In each of these two sectors, these social costs are expected to be born primarily by end-users of Marine SI and Small SI equipment (about 86 percent). This will also be offset by the fuel savings. The remaining 14 percent is expected to be borne by Small SI or Marine SI engine and equipment manufacturers.

Table XII.F-2: Summary of Estimated Social Costs for 2014, 2018, 2030 (2005$, $million)

Stakeholder Group	2014		2018		2030	
	Surplus Change	Percent	Surplus Change	Percent	Surplus Change	Percent
Marine SI						
Engine Manufacturers	-$10.5	2.4%	-$8.7	2.2%	-$9.4	2.1%
Equipment Manufacturers	-$29.7	6.7%	-$25.0	6.3%	-$27.1	5.9%
End User (Households)	-$130.0	29.3%	-$108.2	27.1%	-$117.2	25.6%
Subtotal	-$170.2	38.4%	-$142.0	35.6%	-$153.7	33.5%
Small SI						
Engine Manufacturers	-$5.4	1.2%	-$5.0	1.2%	-$5.9	1.3%
Equipment Manufacturers	-$18.1	4.1%	-$16.9	4.2%	-$20.0	4.4%
End User (Households)	-$250.2	56.4%	-$235.0	58.9%	-$278.9	60.8%
Subtotal	-$273.6	61.6%	-$256.8	64.4%	-$304.9	66.5%
TOTAL	-$443.8		-$398.8		-$458.6	

Table XII.F-3 contains the distribution of the total surplus losses for the program from 2008 through 2037. This table shows that Small SI and Marine SI equipment manufacturers are expected to bear more of the burden of the program than engine manufacturers. The present value of net social costs of the final standards through 2037 at a 3 percent discount rate, shown in Table XII.F-3, is estimated to be $4.2 billion, taking the fuel savings into account. We also performed an analysis using a 7 percent social discount rate.[146] Using that discount rate, the present value of the net social costs through 2037 is estimated to be $2.7 billion, including the fuel savings.

Table XII.F-3: Estimated Net Social Costs Through 2037 by Stakeholder (2005$, $million)

Stakeholder Group	Surplus Change	Percent of total Surplus	Surplus Change	Percent of total Surplus
	NPV 3%		NPV 7%	
Marine SI				
Engine Manufacturers	-$167.0	2.2%	-$100.8	2.2%
Equipment Manufacturers	-$474.5	6.2%	-$285.2	6.3%
End User (Households)	-$2,079.0	27.3%	-$1,257.1	27.9%
Subtotal	-$2,720.5	35.7%	-$1,643.2	36.5%
Small SI				
Engine Manufacturers	-$94.1	1.2%	-$54.8	1.2%
Equipment Manufacturers	-$329.9	7.4%	-$195.4	7.5%
End User (Households)	-$4,472.1	58.7%	-$2,612.8	58.0%
Subtotal	-$4,896.1	64.3%	-$2,863.0	63.5%
Total Social Costs	-$7,616.6		-$4,506.2	
Fuel Savings	$3,374.6		$1,774.7	
Net Social Costs	-$4,242.0		-$2,731.5	

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

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

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

[146] EPA has historically presented the present value of cost and benefits estimates using both a 3 percent and a 7 percent social discount. The 3 percent rate represents a demand-side approach and reflects the time preference of consumption (the rate at which society is willing to trade current consumption for future consumption). The 7 percent rate is a cost-side approach and reflects the shadow price of capital.

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

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

While variations in the above model parameters may affect the distribution of social costs among stakeholders and the estimated market impacts, they will not affect the total social costs of the program. This is because the total social costs are directly related to the total compliance costs. To explore the effects of key sources of uncertainty, we performed a sensitivity analysis in which we examine the results of using alternative values for the price elasticity of supply and demand, and alternative baseline prices for certain equipment markets. The results of these analyses are contained in Appendix 9H of the RIA prepared for this rule.

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

X. Public Participation

We published the proposed rule on May 18, 2007 (72 FR 28098) and held a public hearing on June 5, 2007 in Reston, Virginia. The public comment period continued until August 3, 2007. We received written comments from over 100 entities, including manufacturers, state and environmental groups, and individual citizens. The comments covered a wide range of issues, many of which were very specific recommendations related to test procedures and certification and compliance provisions. The comments and our responses are described in the Summary and Analysis of Comments document which has been placed in the docket for this rulemaking. Commenters also raised a variety of broader issues that we highlight in this section.

Diffusion and running loss control for nonhandheld Small SI engines and equipment. We proposed diffusion and running loss standards for nonhandheld Small SI engines and equipment. The diffusion standard included a simple measurement procedure and a corresponding standard that could be met with basic technology to limit venting from fuel tanks. We proposed a variety of methods for controlling running losses. The most common approach expected is for equipment manufacturers to install a vent line to route running loss vapors to the engine’s intake. We proposed an alternative approach that would allow equipment manufacturers to demonstrate that fuel temperatures would increase only a small amount during operation, which would minimize the source of running loss vapors. Manufacturers objected to the proposed measurement procedure and standard for diffusion emissions. They also commented that they thought the temperature-based option for controlling running losses was impractical based on the measurement procedures and other implementation provisions. We are therefore removing the temperature-based option for running loss control. Manufacturers must generally either run a vapor line from the fuel tank to the engine's intake or find a way to use a sealed fuel tank. Under any remaining technology scenario for controlling running loss emissions, manufacturers would be designing and producing their fuel tanks with inherently low diffusion emissions. We therefore anticipate that diffusion emissions will be controlled even though we are not adopting standards or measurement requirements for diffusion.

SHED testing for nonhandheld engines and equipment. We proposed to allow certification based on California ARB's SHED testing on an interim basis to ease the transition to EPA's Phase 3 standards. The SHED procedure is intended to measure all evaporative emissions from a piece of equipment rather than separately measuring emissions from fuel lines and fuel tanks. It is also intended to capture diurnal emissions. As described in the proposal, we chose not to apply diurnal emission standards. Manufacturers requested that we include a long-term allowance for SHED testing so they could choose to sell California-certified products nationwide without repeating their certification efforts to comply with EPA's different standards and testing protocol. While there is some chance that manufacturers could concentrate their emission controls, for example, on diurnal and fuel tank permeation such that they would not need low-permeation fuel lines, we believe that on balance a SHED-certified product will invariably be at least as low-emitting as equipment that uses only certified low-permeation fuel lines and fuel tanks. As a result, we are including in the regulations a long-term allowance for manufacturers to meet EPA requirements based on an overall measurement of evaporative emissions from equipment with complete fuel systems.

Bonding requirements for Small SI engines. We described in the proposal that we were considering bonding requirements for Small SI engines. We described our concerns that low-cost products were being sold without the necessary commitment to following through on any obligations that may arise over an engine's operating life, such as warranty, recall, or some other finding of noncompliance with the regulations. Several commenters strongly supported the bonding requirements. No commenters objected to the bonding requirements. We requested comment on defining a threshold for determining which companies had a sufficient presence in the United States and a good compliance history that would allow us to conclude that bonding requirements were not needed. Subsequent discussions with manufacturers led us to narrow our approach to focus on multiple thresholds tailored to specific types of companies. A baseline threshold of $10 million in long-term assets applies for engine manufacturers. A mid-level threshold of $6 million applies to secondary engine manufacturers. These are generally smaller companies with smaller sales volumes. We are also including a reduced threshold of $3 million for companies that have had U.S.-certified engines for at least ten years without any violations. We believe bonding requirements should still apply for companies with a long-term market presence, but a lower asset threshold for these companies is appropriate.

A noteworthy change from the proposal is the inclusion of domestically produced engines. While the proposal focused on imported engines, we concluded that trade rules and good practice dictate that the bonding requirements should apply equally to companies producing product in the United States. Manufacturers of any substantial size would easily meet the asset threshold, so the only additional companies likely to be affected by this change would be very small domestic manufacturers. We may conclude that these companies too should meet bonding requirements if we have reason to believe that they will be unable to meet their obligations related to in-use engines. On the other hand, we believe there will be cases where manufacturers can use something other than a posted bond to demonstrate that they will meet these obligations. We are therefore including provisions for a process by which small manufacturers would be able to request that a different asset threshold (or a different bond value) would apply. We would evaluate these requests on a case-by-case basis and approve changes to the specified approach only if it was clear that manufacturers would meet their in-use obligations.

Transition to exhaust emission standards for sterndrive/inboard engines. Manufacturers expressed concerns before the proposed rule that they were anticipating a change in engine models from General Motors, which supplies most companies with partially complete engines for making sterndrive/inboard engines. With the approaching obsolescence of two of these engine models, engine manufacturers did not want to put in the effort to redesign those engines for one or two years of production before they made the transition to the replacement engine models. We described several possible approaches for addressing this in the proposal. We are adopting a provision to specify directly in the regulation that we are approving a one-year hardship for the affected engine models, which allows the engine manufacturers to produce these engines in the 2010 model year without meeting emission standards. Starting in the 2011 model year, manufacturers would need to meet the new emission standards for their full product line.

Phase-in for marine diurnal requirements. We proposed to apply the diurnal emission standards for marine vessels starting in 2010. Manufacturers recommended delaying this standard until 2011 to allow time for the industry to establish consensus standards related to installation parameters for carbon canisters and other elements of diurnal emission control systems. Manufacturers also pointed out that a one-year delay would be preferable to a phase-in, which would be problematic for boat builders. The U.S. Coast Guard agreed that an extra year would be helpful to ensure that manufacturers had enough time to design and build systems that would not have safety problems. We agreed that starting the diurnal emission standards in 2011 would be appropriate. Late in the rulemaking process, the marine manufacturers raised a concern that small boat builders might need additional time to learn about the regulatory requirements and make the necessary design changes for complying with standards. We agreed to consider a staged approach, similar to what we are adopting for Small SI equipment manufacturers under the Phase 3 standards, in which boat builders would be able to make a certain number of noncompliant boats over the first year or two. Manufacturers emphasized that the best approach was to phase in the diurnal standard (30 percent of boats the first year, 60 percent the second year, 100 percent the third year), including large businesses. We believe a more limited transition will be sufficient to meet the need to modify vessels to comply with the new standards. We are adopting approach that would allow companies to make up to 50 percent of their products between July 2011 and July 2012 that do not yet comply with diurnal emission standards. All boats would need to comply after July 2012. A separate provision for small-volume boat builders would allow for up to 1200 noncompliant boats over the first two years that the standards apply (July 2011 to July 2013).

Definition of "engine" We proposed to define the point at which engines became subject to emission standards as the point at which any component was attached to an engine block. This was intended to clarify the relationship between primary and secondary engine manufacturers and to prevent circumvention of the regulations by allowing the importation or other sale of partially complete engines that needed neither certification nor an exemption. Manufacturers pointed out that there were several incidental components added to engines early in the process, many times by the company that cast and/or machined the engine block for shipment to the engine manufacturer. We objected to the idea that an engine should not be subject to emission standards until it reached a running configuration because this would make it difficult or impossible to enforce our requirements. We chose to identify the best point early in the assembly process for making engines subject to standards to be the point of crankshaft installation. This is generally the first major assembly procedure and it involves most of the engine's moving parts.

Setting up the regulations to clearly prohibit the sale of partially complete engines without a certificate or an exemption led us to adopt provisions to accommodate the several legitimate business practices in which manufacturers ship engines before they have reached a certified configuration. First, we proposed a process by which original engine manufacturers could ship partially complete engines to secondary engine manufacturers, including requirements for labeling engines and for secondary engine manufacturers to first obtain a certificate for the engine in question. Commenters objected to the labeling requirements and pointed out that there would sometimes be a need for shipping engines before the secondary engine manufacturer had an approved certificate. We agreed to simplify the labeling requirement such that the primary engine manufacturer would be able to use a single label for all its engines, identifying only its company name and the basis for the exemption, and referring to the bill of lading, which would identify the secondary engine manufacturer. We are also adopting regulatory provisions to clarify that these shipments may occur during the time that we are reviewing an application for certification from the secondary engine manufacturer, subject to certain requirements that are similar to those that apply for traditional engine manufacturers in building up inventory before their certification is approved. We also allow shipment of these engines when the secondary engine manufacturer has a valid exemption; this may occur for example, if the secondary engine manufacturer is developing a new model or is assembling engines only for export.

Second, we proposed and are finalizing a provision to allow manufacturers broad discretion to ship partially complete engines between two of their own facilities. Manufacturers would only need to get our approval by describing their plans for this type of shipment in their application for certification. We may set certain reasonable conditions to ensure that manufacturers do not use these provisions to circumvent the regulations, but we would generally not require any specific labeling or recordkeeping steps for this practice.

Third, we proposed to include partially complete engines sold as replacement components under the replacement-engine exemption in §1068.240. Manufacturers expressed a concern that these engines were needed as replacement components and should therefore not be subject to standards. We noted that the existing replacement-engine exemption does not fit well with partially complete engines that are identical to engines currently being produced under a valid certificate of conformity (up to that stage of completion). As a result, we have included language in §1068.240 describing a streamlined path for these engines. The more difficult question relates to partially complete engines specially produced for replacement or repower where the old engine is subject to a previous tier of emission standards. We are concerned, as described above, that manufacturers could exploit this as a loophole if we did not specify that these engines are subject to emission standards. We are modifying the replacement-engine exemption to allow for very limited use of replacement engines without the administrative requirements and oversight provisions that currently apply under §1068.240. Under this approach we specify that manufacturers may produce and sell a certain number of replacement engines, including partially complete engines, based on production volumes from preceding years without making a determination that a new engine meeting current standards is unavailable to repower the equipment. Manufacturers would also not need to take possession of the old engine block (or confirm that it has been destroyed). For any number of noncompliant replacement engines exceeding the specified threshold, manufacturers would need to meet all the requirements that currently apply under §1068.240. See Section VIII above and Chapter 1 of the Summary and Analysis of Comments for further information and discussion related to replacement engines.

XI. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

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

In addition, EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis is contained in the Final Regulatory Impact Analysis, which is available in the docket and is summarized in Section IX.

B. Paperwork Reduction Act

The information collection requirements in this final rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. The Information Collection Request (ICR) documents prepared by EPA has been assigned EPA ICR number 2251.02 and 1722.06.

The Agency will collect information to ensure compliance with the provisions in this rule. This includes a variety of requirements, both for engine manufacturers, equipment manufacturers and manufacturers of fuel system components. Section 208(a) of the Clean Air Act requires that manufacturers provide information the Administrator may reasonably require to determine compliance with the regulations; submission of the information is therefore mandatory.

As shown in Table XIV-1, the total annual burden associated with this final rule is about 131,000 hours and $17 million based on a projection of 1,031 respondents. The estimated burden for engine manufacturers is a total estimate for both new and existing reporting requirements. Most information collection is based on annual reporting. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

Table XIV-1: Estimated Burden for Reporting and Recordkeeping Requirements

Industry Sector	Number of Respondents	Average Burden per Respondent	Annual Burden Hours	Annualized Capital Costs	Annual Labor Costs	Annual Operation and Maintenance Costs
Small SI engine manufacturers	58	885	51,301	$4,829,036	$2,065,643	$3,268,306
Small SI equipment (evaporative)	500	19	9,500	$0	$412,500	$120,500
Tank and hose component mfr's. (evaporative)	53	68	3,615	$0	$97,670	$12,773
Marine SI engine manufacturers	38	1,596	60,640	$0	$3,110,584	$6,462,307
Marine SI equipment & fuel system component mfr. (evaporative)	343	29	10,020	$0	$730,450	$120,232
TOTAL	992	2,597	135,076	$5,829,036	$6,416,847	$9,984,118
					Total Annual Cost = $16,400,965	

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

C. Regulatory Flexibility Act

(1) Overview

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

For purposes of assessing the impacts of this action on small entities, small entity is defined as: (1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201 (see Table XIV-2, below); (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of smaller than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. The following table provides an overview of the primary SBA small business categories potentially affected by this regulation.

Table XIV-2: Small Business Definitions for Entities Affected by this Rule

Industry	NAICS[a] Codes	Threshold Definitions for Small Business[b]
Small SI and Marine SI Engine Manufacturers	333618	1,000 employees
Equipment Manufacturers:		
Farm Machinery	333111	500 employees
Lawn and Garden	333112	500 employees
Construction	333120	750 employees
Sawmill and Woodworking	333210	500 employees
Pumps	333911	500 employees
Air and Gas Compressors	333912	500 employees
Generators	335312	1,000 employees
Boat Builders	336612	500 employees
Fuel Tank Manufacturers:		
Other Plastic Products	326199	500 employees
Metal Stamping	332116	500 employees
Metal Tank (Heavy Gauge)	332420	500 employees
Fuel Line Manufacturers:		
Rubber and Plastic Fuel Lines	326220	500 employees

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

After considering the economic impacts of this final rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. The small entities directly regulated by this final rule cover a wide range of small businesses including engine manufacturers, equipment manufacturers, boat manufacturers, fuel tank manufacturers, and fuel hose manufacturers. Small governmental jurisdictions and small organizations as described above will not be impacted. We have determined that the estimated effect of the rule is to impact 43 companies with costs between one and three percent of revenues, and 18 additional companies with costs over three percent of revenues. These 61 companies represent less than 5 percent of the total number of small businesses impacted by the new regulations. All remaining companies (over 1,000 of them) would be impacted with costs by less than one percent of revenues. It should be noted that this estimate is based on the highest level of estimated cost in the first years of the program. We estimate substantially lower long-term costs as manufacturers learn to produce compliant products at a lower cost over time.

Pursuant to section 603 of the RFA, EPA prepared an initial regulatory flexibility analysis (IRFA) for the May 18, 2007 proposed rule (72 FR 28098). Pursuant to section 609(b) of the RFA, EPA convened a Small Business Advocacy Review Panel to obtain advice and recommendations from representatives of small entities that would potentially be regulated by the rule. A detailed discussion of the Panel's advice and recommendations is found in the Panel Reports, which have been placed in the docket for this rule.[147] A summary of the Panel's recommendations is presented in the May 2007 proposal (72 FR 28245).

In the final rule, EPA has made some changes to the proposal that reduced the level of impact to small entities directly regulated by the rule. As described in Section III.C.1, EPA is adopting less stringent standards for SD/I high-performanceengines than originally proposed, based in part on the comments from SD/I engine manufacturers, most of which are small businesses. This change has resulted in a reduction in the number of entities projected to be impacted by more than 1 percent.

Despite the determination that this rule will not have a significant economic impact on a substantial number of small entities, EPA prepared a Small Business Flexibility Analysis that has all the components of a final regulatory flexibility analysis (FRFA). A FRFA examines the impact of the rule on small businesses along with regulatory alternatives that could reduce that impact. The Small Business Flexibility Analysis (which is presented in Chapter 10 of the Final RIA) is available for review in the docket, and is summarized below.

(2) Need for and Objective of the Rulemaking

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 and carbon monoxide are linked to potentially serious respiratory health problems, especially respiratory effects and environmental degradation, including visibility impairment in and around our national parks. (Section II and Chapter 2 of the Final RIA for this rule describe these pollutants and their health effects.) Over the past quarter century, state and federal representatives have established emission control programs that significantly reduce emissions from individual sources. Many of these sources now pollute at only a small fraction of their pre-control rates.

This final rule includes standards that will require manufacturers to substantially reduce exhaust emissions and evaporative emissions from Marine SI engines and vessels and from Small SI engines and equipment. We are promulgating the standards under section 213(a)(3) of the Clean Air Act, which directs EPA to set emission standards that "achieve the greatest degree of emission reduction achievable through the application of technology" giving appropriate consideration to cost, noise, energy, safety, and lead time. In addition to the general authority to regulate nonroad engines under the Clean Air Act, section 428 of the 2004 Consolidated Appropriations Act requires EPA to propose and finalize regulations for new nonroad spark-ignition engines below 50 horsepower.

(3) Summary of Significant Public Comments

In the proposal, EPA proposed provisions consistent with each of the Panel's recommendations and sought comments on all the small business provisions (see 72 FR 28245, May 18, 2007). We received a number of comments during the comment period after we issued

[147] "Panel Report of the Small Business Advocacy Review Panel on EPA's Planned Proposed Rule, Control of Emissions from Nonroad Spark-Ignition Engines and Equipment," October 10, 2006, Docket EPA-HQ-OAR-2004-0008-0562.

the proposal. The following section summarizes the most significant comments received. A summary of all comments pertaining to the small business provisions can be found in our Summary and Analysis of Comments document contained in the public docket for this rulemaking.

With regard to marine exhaust emission standards, NMMA and several SD/I engine manufacturers commented on EPA's proposed criteria for which SD/I engine manufacturers would be eligible for the small business flexibilities. They recommended that EPA should base the criteria on number of employees rather than engine production level. They recommended a 500 employee threshold for small-businesses with the option to qualify as a small-volume manufacturer if the 5,000 unit level is not exceeded.

With regard to marine evaporative emission standards, NMMA, which represents many vessel manufacturers, noted that EPA acknowledged the challenges faced by the small boat builders and even requested comment on a three-year phase-in (33-66-100 percent) for the diurnal emission standards over model years 2010-2012. Rather than a phase-in, NMMA supported an additional two years of lead time for compliance (i.e., until model year 2013) for small businesses to allow for sufficient time for these business to gain experience with carbon canisters.

(4) Type and Numbers of Small Entities Affected

The standards being promulgated for Small SI engines and equipment will affect manufacturers of both handheld equipment and nonhandheld equipment. Based on EPA certification records, the Small SI nonhandheld engine industry is made up primarily of large manufacturers including Briggs and Stratton, Tecumseh, Honda, Kohler and Kawasaki. The Small SI handheld engine industry is also made up primarily of large manufacturers including Electrolux Home Products, MTD, Homelite, Stihl and Husqvarna. EPA has identified 10 Small SI engine manufacturers that qualify as a small business under SBA definitions. Half of these small manufacturers certify gasoline engines and the other half certify liquefied petroleum gas (LPG) engines.

The Small SI equipment market is dominated by a few large businesses including Toro, John Deere, MTD, Briggs and Stratton, and Electrolux Home Products. While the Small SI equipment market may be dominated by just a handful of companies, there are many small businesses in the market; however these small businesses account for less than 10 percent of equipment sales. We have identified over three hundred equipment manufacturers that qualify as a small business under the SBA definitions. More than 90 percent of these small companies manufacture fewer than 5,000 pieces of equipment per year. The median employment level is 65 employees for nonhandheld equipment manufacturers and 200 employees for handheld equipment manufacturers. The median sales revenue is approximately $9 million for nonhandheld equipment manufacturers and $20 million for handheld equipment manufacturers.

EPA has identified 25 manufacturers that produce fuel tanks for the Small SI equipment market that meet the SBA definition of a small business. Fuel tank manufacturers rely on three different processes for manufacturing plastic tanks – rotational molding, blow molding and injection molding. EPA has identified small business fuel tank manufacturers using the rotational molding and blow molding processes but has not identified any small business manufacturers using injection molding. In addition, EPA has identified two manufacturers that produce fuel lines for the Small SI equipment market that meet the SBA definition of a small business. The majority of fuel line in the Small SI market is made by large manufacturers including Avon Automotive and Dana Corporation.

The standards being promulgated for Marine SI engines and vessels will affect manufacturers in the OB/PWC market and the SD/I market. Based on EPA certification records, the OB/PWC market is made up primarily of large manufacturers including, Brunswick (Mercury), Bombardier Recreational Products, Yamaha, Honda, Kawasaki, Polaris, Briggs & Stratton, and Nissan. Two companies qualify as a small business under the SBA definition. Tohatsu makes outboard engines. The other small business is Surfango which makes a small number of motorized surfboards and has certified their product as a PWC.

The SD/I market is made up mostly of small businesses; however, these businesses account for less than 20 percent of engine sales. Two large manufacturers, Brunswick (Mercruiser) and Volvo Penta, dominate the market. We have identified 28 small entities manufacturing SD/I marine engines. The third largest company is Indmar, which has much fewer than the SBA threshold of 1,000 employees. Based on sales estimates, number of employees reported by Thomas Register, and typical engine prices, we estimate that the average revenue for the larger small SD/I manufacturers is about $50-60 million per year. However, the vast majority of the SD/I engine manufacturers produce low production volumes of engines and typically have fewer than 50 employees.

The two largest boat building companies are Brunswick and Genmar. Brunswick owns approximately 25 boat companies and Genmar owns approximately 12 boat companies. Based on a manufacturer list maintained by the U.S. Coast Guard, there are over 1,600 boat builders in the United States. We estimate that, based on manufacturer identification codes, more than 1,000 of these companies produce boats using gasoline marine engines. According to the National Marine Manufacturers Association (NMMA), most of these boat builders are small businesses. These small businesses range from individuals building one boat per year to businesses near the SBA small business threshold of 500 employees.

We have identified 14 marine fuel tank manufacturers in the United States that qualify as small businesses under the SBA definition. These manufacturers include five rotational molders, two blow molders, six aluminum fuel tank manufacturers, and one specialty fuel tank manufacturer. The small rotational molders average fewer than 50 employees while the small blow-molders average over 100 employees.

We have only identified one small fuel line manufacturer that produces for the Marine SI market. Novaflex primarily distributes fuel lines made by other manufacturers but does produce its own filler necks. Because we expect vessel manufacturers will design their fuel systems such that there will not be standing liquid fuel in the fill neck (and therefore the new low-permeation fuel line requirements will not apply to the fill neck), we have not included this manufacturer in our analysis. The majority of fuel line in the Marine SI market is made by large manufacturers including Goodyear and Parker-Hannifin.

To gauge the impact of the new standards on small businesses, EPA employed a cost-to-sales ratio test to estimate the number of small businesses that will be impacted by less than one percent, between one and three percent, and above three percent. For this analysis, EPA assumed that the costs of complying with the final standards are completely absorbed by the regulated entity. Overall, EPA projects that 43 small businesses will be impacted by one to three percent, 18 small businesses will be impacted by over three percent, and the remaining companies (over 1,000 small businesses) will be impacted by less than one percent. Table XIV-3 summarizes the impacts on small businesses from the new exhaust and evaporative emission standards for Small SI engines and equipment and Marine SI engines and vessels. A more detailed description of the inputs used for each affected industry sector and the methodology used to develop the estimated impact on small businesses in each industry sector is included in the Small Business Flexibility Analysis as presented in Chapter 10 of the Final RIA for this rulemaking.

Table XIV-3: Summary of Impacts on Small Businesses

Industry Sector	0-1 percent	1 - 3 percent	> 3 percent
Manufacturers of Marine OB/PWC engines	2	0	0
Manufacturers of Marine SD/I engines < 373 kW	4	5	0
Manufacturers of Marine SD/I engines ≥ 373 kW (high-performance)	19	0	0
Boat Builders	>1,000	0	0
Manufacturers of Fuel Lines and Fuel Tanks for Marine SI Vessels	14	0	0
Small SI engines and equipment	314	38	18
Manufacturers of Fuel Lines and Fuel Tanks for Small SI Applications	27	0	0
Total	380 plus >1,000 boat builders	43	18

(5) Reporting, Recordkeeping, and Compliance Requirements

For any emission control program, EPA must have assurances that the regulated products will meet the standards. Historically, EPA's programs for Small SI engines and Marine SI engines have included provisions requiring that engine manufacturers be responsible for providing these assurances. The program that EPA is adopting for manufacturers subject to this final rule include testing, reporting, and recordkeeping requirements for manufacturers of engines, equipment, vessels, and fuel system components including fuel tanks, fuel lines, and fuel caps.

For Small SI engine manufacturers and OB/PWC engine manufacturers, EPA is continuing the same reporting, recordkeeping, and compliance requirements prescribed in the current regulations. For SD/I engine manufacturers, which are not currently subject to EPA regulation, EPA is applying similar reporting, recordkeeping, and compliance requirements to those for OB/PWC engine manufacturers. Testing requirements for engine manufacturers will include certification emission (including deterioration factor) testing and production-line testing.

Reporting requirements will include emission test data and technical data on the engines. Manufacturers will also need to keep records of this information.

Because of the new evaporative emission requirements, there will be new reporting, recordkeeping and compliance requirements for Small SI equipment manufacturers. Small SI equipment manufacturers participating in the transition program will also be subject to reporting, recordkeeping and compliance requirements. There will also be new reporting, recordkeeping and compliance requirements for fuel tank manufacturers, fuel line manufacturers, fuel cap manufacturers and marine vessel manufacturers choosing to certify their products with EPA. Testing requirements for these manufacturers would include certification emission testing. Reporting requirements would include emission test data and technical data on the designs. Manufacturers will also need to keep records of this information.

(6) Steps Taken to Minimize the Impact on Small Entities

The Panel recommended that EPA consider and seek comment on a wide range of regulatory alternatives to mitigate the impacts of the rulemaking on small businesses, including those flexibility options described below. A copy of the Final Panel Report is included in the docket for this final rule. A summary of the Panel's recommendations for the various groups of small businesses affected by the rule is presented in the May 2007 proposal (72 FR 28245).

In response to the Panel's recommendations, we proposed a range of small business flexibilities for the various groups of small businesses affected by the proposed standards. As noted earlier, we received a number of comments during the comment period after we issued the proposal. A complete summary of the comments pertaining to the small business provisions can be found in our Summary and Analysis of Comments document contained in the public docket for this rulemaking.

EPA is adopting several small business flexibilities as part of this rule. A few changes have been made to some of the proposed flexibilities in response to the comments received on the proposal as well as other changes made in the rulemaking. The flexibilities available to small businesses affected by the new exhaust emission standards for SD/I engines are summarized in Section III.F. The flexibilities available to small businesses affected by the new exhaust emission standards for OB/PWC engines are summarized in Section IV.G. The flexibilities available to small businesses affected by the new exhaust emission standards for Small SI engines are summarized in Section V.F. Finally, the flexibilities available to small businesses affected by the new evaporative emission standards for both Marine SI engines and vessels and Small SI engines and equipment are summarized in Section VI.G.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104-4, establishes requirements for federal agencies to assess the effects of their regulatory actions on state, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "federal mandates" that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires that EPA identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation of why that alternative was not adopted.

Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

This rule contains no federal mandates for state, local, or tribal governments as defined by the provisions of Title II of the UMRA. The rule imposes no enforceable duties on any of these governmental entities. Nothing in the rule will significantly or uniquely affect small governments.

EPA has determined that this rule contains federal mandates that may result in expenditures of more than $100 million to the private sector in a single year. EPA believes that the final rule represents the least costly, most cost-effective approach to achieve the air quality goals of the rule. The costs and benefits associated with the final rule are discussed in Section IX and in the Final Regulatory Impact Analysis as required by the UMRA.

E. Executive Order 13132: Federalism

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

Under section 6 of Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or EPA consults with State and local officials early in the process of developing the proposed regulation. EPA also may not issue a regulation that has federalism implications and that preempts State law, unless the Agency consults with State and local officials early in the process of developing the regulation.

Section 4 of the Executive Order contains additional requirements for rules that preempt State or local law, even if those rules do not have federalism implications (i.e., the rules will not have substantial direct effects on the States, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government). Those requirements include providing all affected State and local officials notice and an opportunity for appropriate participation in the development of the regulation. If the preemption is not based on express or implied statutory authority, EPA also must consult, to the extent practicable, with appropriate State and local officials regarding the conflict between State law and Federally protected interests within the agency's area of regulatory responsibility.

This final rule has federalism implications because it preempts State law. It does not include any significant revisions from current statutory and regulatory requirements, but it codifies existing statutory requirements. Prior to the passage of Public Law 108-199, the various states could adopt and enforce nonroad emission control standards previously adopted by the state of California under section 209(e) of the Clean Air Act, once California had received authorization from EPA to enforce such standards. As part of directing EPA to undertake this rulemaking, section 428 of PL 108-199 has taken away the authority of states to adopt California standards for any nonroad spark-ignition engine under 50 horsepower that they had not already adopted by September 1, 2003. No state had done so by that date. No current state law is affected by the provisions of PL 108-199 mentioned above. This rule codifies the statutory provision prohibiting other states from adopting California standards for nonroad spark-ignition engines under 50 horsepower. It does not affect the independent authority of California.

EPA did consult with representatives of various State and local governments in developing this rule. EPA has also consulted representatives from the National Association of Clean Air Agencies (NACAA), which represents state and local air pollution officials. These officials participated in two EPA workshops regarding the Small SI safety study in which they expressed concern about the language of section 428 of Public Law 108-199 limiting the states ability to adopt the California standards for nonroad spark-ignition engines under 50 horsepower and urged EPA to move expeditiously in adopting new Federal emission standards for this category.

As required by section 8(a) of Executive Order 13132, EPA included a certification from its Federalism Official stating that EPA had met the Executive Order's requirements in a meaningful and timely manner, when it sent the draft of this final rule to OMB for review pursuant to Executive Order 12866. A copy of this certification has been included in the public version of the official record for this final rule.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications."

This final rule does not have tribal implications as specified in Executive Order 13175. This rule will be implemented at the Federal level and impose compliance costs only on engine and equipment manufacturers. Tribal governments will be affected only to the extent they purchase and use equipment with regulated engines. Thus, Executive Order 13175 does not apply to this rule.

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

Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, section 5-501 of the Order directs the Agency to evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This final rule is not subject to the Executive Order because it does not involve decisions on environmental health or safety risks that may disproportionately affect children.

The effects of ozone on children's health were addressed in detail in EPA's rulemaking to establish the NAAQS for these pollutants, and EPA is not revisiting those issues here. EPA believes, however, that the emission reductions from the strategies in this rulemaking will further reduce air toxic emissions and the related adverse impacts on children's health.

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

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

EPA has determined that this final rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This final rule will reduce air pollution from mobile sources in general and thus decrease the amount of such emissions to which all affected populations are exposed.

I. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

This rule is not a "significant energy action" as defined in Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001), because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. If promulgated, this final rule is expected to result in the use of emission control technologies that are estimated to reduce nationwide fuel consumption by around 100 million gallons per year by 2020.

J. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Public Law 104-113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless doing so will be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This final rulemaking involves technical standards. EPA will use the test procedures specified in 40 CFR part 1065. While the Agency identified the test procedures specified by the International Organization for Standardization (ISO 8178) as being potentially applicable, we are not adopting them in this final rulemaking. The use of this voluntary consensus standard will be impractical because we have been working with engine manufacturers and other interested parties in comprehensive improvements to test procedures for measuring engine emissions, as reflected by the provisions in part 1065. We expect these procedures to form the basis for internationally harmonized test procedures that will be adopted by ISO, other testing organizations, and other national governments.

K. Congressional Review Act

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

List of Subjects

40 CFR Part 9

Reporting and recordkeeping requirements.

40 CFR Part 60

Administrative practice and procedure, Air pollution control, Incorporation by reference, Intergovernmental relations, Reporting and recordkeeping requirements.

40 CFR Part 80

Environmental protection, Air pollution control, Fuel additives, Gasoline, Imports, Incorporation by reference, Labeling, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements.

40 CFR Part 85

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

40 CFR Part 86

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

40 CFR Part 89

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

40 CFR Part 90

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Reporting and recordkeeping requirements, Research, Warranty.

40 CFR Part 91

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

40 CFR Part 92

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

40 CFR Part 94

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

40 CFR Part 1027

Environmental protection, Administrative practice and procedure, Air pollution control, Imports, Reporting and recordkeeping requirements.

40 CFR Part 1039

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

40 CFR Part 1042

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

40 CFR Parts 1045, 1048, 1051, 1054, and 1060

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

40 CFR Part 1065

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

40 CFR Part 1068

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

40 CFR Part 1074

Environmental protection, Administrative practice and procedure, Motor vehicle pollution.

Dated______________

____

Stephen L. Johnson,

Administrator.