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Phase 2 Emission Standards for New Nonroad Spark-Ignition Handheld Engines At or Below 19 Kilowatts

Summary and Analysis of Comments

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Summary of Analysis and Comments

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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INTRODUCTION

On January 27, 1998, the US Environmental Protection Agency (EPA) published in the Federal Register a Notice of Proposed Rulemaking (NPRM) for emission standards for new nonroad spark ignition (SI) engines at or below 19 kilowatts (kW). The purpose of the small SI engines NPRM, as required by section 213(a)(3) of the amended Clean Air Act, is to regulate emissions from a category of new nonroad engines and vehicles that, in EPA's judgment, cause or contribute to air pollution in areas that failed to attain the National Ambient Air Quality Standards (NAAQS) for ozone or carbon monoxide.

After the close of the comment period for the January 1998 NPRM, EPA determined it was desirable to get further details regarding the technological feasibility, cost and lead time implications of meeting standards more stringent than those contained in the base proposal in the NPRM. For the purpose of gaining additional information on feasibility, cost and lead time implications, and potential impact on equipment manufacturers of more stringent standards, EPA had several meetings, phone conversations, and written correspondence with specific engine and equipment manufacturers, with industry associations representing those manufacturers, and with representatives of state regulatory associations. Additionally, EPA received numerous comments on the NPRM requesting closer harmonization with the compliance program provisions adopted by the State of California. In some cases, EPA also discussed these harmonization issues with manufacturers to improve the Agency's understanding of the needs and benefits to the industry of such harmonization; when applicable, these conversations are also noted in the meeting documentation provided to the docket. EPA published a Notice of Availability on December 1, 1998 (63 FR 66081) which highlighted these additional meetings held and items received by the Agency between February and October of 1998. In response to all of the comments and new information, EPA decided to separate the adoption of Phase 2 standards for nonroad SI engines into two separate rulemakings, the first rule dealing with nonhandheld engines, the second rule dealing with handheld engines. EPA issued a final rule containing the Phase 2 standards for nonhandheld engines in March 1999. In July 1999, EPA issued a Supplemental Notice of Proposed Rulemaking (SNPRM) containing the reproposed Phase 2 standards for handheld engines.

The Agency held a public hearing on this reproposal in August 1999 in Ypsilanti, Michigan. A number of individuals representing engine, equipment and emission controls manufacturers and associations presented prepared statements and answered questions. A transcript of the public hearing is available in the docket for this rulemaking (EPA Air Docket A-96-55, Item IV-F-04).[1] The public comment period during which the Agency accepted written comments on the proposal was closed on March 13, 1998. The Agency received submissions regarding the NPRM from approximately 30 commenters including engine or equipment manufacturers or manufacturer associations, emission controls manufacturer associations, state organization, environmental groups and others. All relevant information received, regardless of

[1]The docket items referenced in this document are contained in EPA Air Docket A-96-55, unless otherwise noted in the text.

the date of receipt, was, to the maximum extent possible, considered in the development of this final rule for the Phase 2 handheld engines.

How to use this document

The purpose of this document is to summarize and respond to comments submitted by the public on issues that affect handheld engines. Included in the document are responses to the issues raised at the public hearing and in the written and oral comments received by EPA during the development of the rule. Each of the remaining sections of this document is structured by topic rather than by individual commenter. Sections begin with a brief description of the approach taken in the July 1999 SNPRM, followed by a summary of the relevant comments and finally by EPA's response to those comments. All of the written comments submitted to EPA, as well as records of all oral comments received during and after the comment period are contained in the docket for EPA's Statements of Principles for Nonroad Phase 2 Small Spark-Ignited Engines (EPA Air Docket A-96-55). The appendix lists those who have participated in the rulemaking, either with written comments or in phone conversations.

SECTION 1: EMISSION STANDARDS AND RELATED PROVISIONS

1.1 Handheld Standards

1.1.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed HC+NOx standards are 50 g/kW-hr HC+NOx for Classes III-IV, 72 g/kW-hr HC+NOx for Class V, 50 g/kW-hr for Class I-A and 40 g/kW-hr for Class I-B. The proposed CO standards are the same as those in the Phase I rulemaking, for Classes III-V, with the exception that they would have to be met at the end of the certification useful life period. The CO standard for Classes I-A and I-B is 610 g/kW-hr. The proposed rule did request comment on the ability of 4-stroke engines, redesigned 2-stroke engines, or other technologies, such as electronic fuel injection or the application of catalysts, to achieve a 50 g/kW-hr HC+NOx standard for Class V engines (see 64 FR at 40947). The proposed rule also requested comments on a number of assumptions and issues (see 64 FR at 40947), including the potential for addressing the concerns and any resulting impact on manufacturers' ability to meet the standards contained in this SNPRM which allow for the use of the ABT program.

1.1.2 Summary of the Comments

Ryobi commented that it supports a 50 g/kW-hr standard for all three handheld engine classes (Item IV-D-47, pages 3, 5). Based on the direction clean technologies are headed today, Class V should be held to the same standard as Classes III and IV, Ryobi asserted.

The California ARB commented that the 50 g/kW-hr standard is appropriate for Class III and IV. The California ARB also supports a 50 g/kW-hr standard for Class V, arguing that it is easier to control emissions from larger engines (Item VI-G-21, page 2).

John Deere supports the 50 g/kW-hr standard for Classes III and IV. John Deere also supports a 50 g/kW-hr standard for Class V and cites various technical reasons for their position (Item IV-D-48, pages 1, 16-18).

Echo commented that given the leadtime, the proposed standards should be feasible for compression wave, stratified charge, and 4-stroke technologies, although a catalyst will have to be used in some cases (Item IV-D-37, pages 3, 5). It also suggests fuel injection with a catalyst may be a possibility for meeting the 50 g/kW-hr standards (although cost is a principle concern). Echo also supports a "unified nationwide standard."

Several months after the close of the formal comment period for the July 1999 SNPRM, the Sierra Club (Item VI-G-36, page 1) and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) (Item VI-G-38, page 2) submitted comments recommending more stringent standards for Class V (and

to expedite the effective dates for all of the handheld standards) based on their belief that manufacturers could meet such standards. The Manufacturers of Emission Controls Association (MECA) (Item VI-G-37, page 2) also submitted additional comments several months after the close of the formal comment period for the July 1999 SNPRM recommending a more stringent standard for Class V engines.

Stihl commented that it does not believe the 50 g/kW-hr standard for Classes III and IV and the 72 g/kW-hr standard for Class V are technically nor economically feasible (Item IV-D-45, pages 2-3). Stihl supports 72 g/kW-hr and 87 g/kW-hr, respectively. Its technical concerns are ergonomic (higher weight/worse handling), safety (due to hot catalysts with high conversion rates that could increase risk of fire and burn injuries for the operator), and operation related (power loss, running problems, and durability). The economic comments are included in discussion of a later topic.

Bee Tee Equipment commented that EPA should adopt a standard in line with the California ARB Tier 2 standards and one that clearly identifies commercial products for separate consideration (Item IV-D-36, page 1).

Tecumseh claimed that the proposed standards are excessively low (Item VI-G-05, pages 1-2). The identified technologies are not production viable at this time, in Tecumseh's view. The standards are lower than California's and will lead to a new round of emission standard development. Companies have had little ability to recover Phase 1 development costs due to extremely low profit margins on these engines, Tecumseh claims. ABT will not be very useful with such low standards, Tecumseh argues, because it won't be able to certify at levels much below the standards.

OPEI commented that EPA's standards should be technology neutral (Item VI-D-05, page 2).

Husqvarna/FHP claimed that publicly available data on the compression wave technology do not support a finding that the proposed limits are feasible for any engine class (Item VI-D-08, pages 35-39). Using the emission levels noted in the record, and including a compliance margin of 1.25, a 20 g/kW-hr catalyst, and a 1.3 DF for the engine/catalyst, yields emissions above 50 g/kW-hr, according to Husqvarna/FHP.

Husqvarna/FHP argued that the proposed Class V limit of 72 g/kW-hr is not feasible (Item VI-D-08, pages 67-74). Even John Deere's testing of the Stihl engine (at 50 g/kW-hr) adjusted for compliance margin shows that due to deterioration, it wouldn't be capable of meeting the standard, Husqvarna/FHP claims. They point to Stihl's analysis that says a compression wave technology-equipped chainsaw would have less power, more weight, and inadequate multi-position operation for professional applications. There is no information to support the conclusion that stratified charge designs can work for Class V, Husqvarna/FHP claims. EPA's data on the Komatsu Air Head engine (and adding compliance margin and deterioration effects) show that it couldn't meet 72 g/kW-hr, and four-strokes won't work for Class V due to decreased power, increased weight, performance problems, lubrication problems

at very low temperatures, and problems operating multi-positionally for extended periods, according to Husqvarna/FHP. (Further comments on these technologies are included in sections 1.4-1.7 of this document.)

Husqvarna/FHP commented that the reasons cited by EPA for adoption of the Class I-A and I-B standards support the alternative standards the company favors (i.e., 72/72/87 g/kW-hr): Emission reduction is more difficult for smaller displacement engines typical of handheld engines; there are significant practicality and cost issues involved in requiring manufacturers to maximize emission reductions at the expense of other functional requirements; multi-positional four-stroke engines do not yet meet the feasibility requirements. Plus, the alternative standards the company supports are based on manufacturer-suggested levels for currently available commercialized engines. The result of adopting the alternative standards would be to harmonize the requirements with those of California. (Item VI-D-08, pages 120-121).

1.1.3 EPA Response to the Comments

Based on consideration of the comments above, we are adopting a slightly different schedule of Phase 2 HC+NOx standards compared to those proposed in the SNPRM. (The final phase-in standards are changing from the proposal because we are adopting a four year phase-in schedule with today's action instead of the proposed five year phase-in schedule. However, the long-term standards of the final rule are the same as those proposed.) The CO standards being adopted with today's action are the same as proposed in the July 1999 SNPRM. The new Phase 2 standards will begin to take effect with the 2002 model year for Classes III and IV and the 2004 model year for Class V. For HC+NOx, engine manufacturers will be required to meet a declining standard that varies by engine class. As proposed in the July 1999 SNPRM, engine manufacturers will be required to meet a HC+NOx standard of 50 g/kW-hr for Classes III and IV and 72 g/kW-hr for Class V SNPRM at the end of the phase in. However, the fleet average standards that a manufacturer is required to meet during the phase-in period differ from those proposed in response to comments that have persuaded EPA that a faster phase-in is more appropriate in order to meet the requirements of the Act. Table 1 and Table 2, below, contain the full schedule of Phase 2 HC+NOx standards and CO standards, respectively, being adopted today for handheld engines by model year. Engine manufacturers will be able to use the averaging, banking and trading program to demonstrate compliance with the Phase 2 HC+NOx standards on average. Engine manufacturers will be required to meet the Class III and Class IV CO standard beginning with the 2002 model year and the Class V CO standard beginning with the 2004 model year. Unlike the HC+NOx standards, the CO standards do not decrease over time and the averaging, banking and trading program does not apply to them.

Table 1
Phase 2 HC+NOx Emission Standards for Handheld Engines

Engine Class	HC+NOx Standards (g/kW-hr) by Model Year					
	2002	2003	2004	2005	2006	2007 and later
Class III	238	175	113	50	50	50
Class IV	196	148	99	50	50	50
Class V	—	—	143	119	96	72

Table 2
Phase 2 CO Emission Standards for Handheld Engines

Engine Class	CO Standard (g/kW-hr)	Effective Model Year
Class III	805	2002
Class IV	805	2002
Class V	603	2004

The Clean Air Act at section 213(a)(3) requires us to adopt standards that result in the greatest emission reductions achievable through the application of technology which the Administrator determines will be available, giving appropriate consideration to cost, lead time, noise, energy and safety factors. As a result of information now available, and due to the rapid technological advances the handheld engine industry is making in an effort to design engines which are more environmentally friendly, we have determined that the standards being adopted today are achievable during the timeframe being adopted today. Table 3 summarizes the handheld technologies we conclude are capable of meeting the newly adopted standards by engine class.

Table 3
Potential Technologies for Meeting the Phase 2 Standards for Handheld Engines

Engine Class	Technologies
III	- Compression Wave Technology + low-medium efficiency Catalyst - Stratified Scavenging with Lean Combustion + medium-high efficiency Catalyst - 4-Stroke
IV	-Compression Wave Technology - Compression Wave Technology + low efficiency Catalyst - Stratified Scavenging with Lean Combustion + medium efficiency Catalyst - 4-Stroke
V	- Compression Wave Technology - 4-Stroke (on certain applications) - Stratified Scavenging with Lean Combustion

While not all of the technologies discussed above have yet been demonstrated in mass-produced production engines operated under typical in-use conditions, we are confident that these technologies will provide industry with several emission control alternatives for meeting the new Phase 2 standards under the leadtime provided by the final rule. Manufacturer prototype testing, California ARB certification information, and testing that we have performed as listed in Chapter 3 of the Final Regulatory Impact Analysis (RIA) demonstrate that currently available 2-stroke and 4-stroke technologies can achieve the newly adopted emission standards, especially if one considers catalysts are available to use along with the 2-stroke engine technologies. In addition to the technologies highlighted in Table 3, we have examined two other promising technologies that may be available to help manufacturers meet the standards being adopted today. One of these technologies, a new engine design, referred to as DIPS, utilizes direct fuel injection and has shown promise in achieving HC emissions levels below the standards being adopted today possibly without the use of a catalyst. The second technology is a redesigned spark plug developed by Pyrotek that has been shown to achieve incremental emission HC reductions (at low cost) that could be beneficial for engines which may need slightly more reductions to meet the emission standards being adopted today. Both of these technologies are described in further detail in Chapter 3 of the Final RIA. Finally, we understand that manufacturers are developing electronic fuel injection systems which if successful, should also allow low emissions. However, we have insufficient information at this time to consider this technology in this rulemaking although it may well be available during the 2002-2007 time period during which these standards will take effect.

For 2-stroke engines, John Deere has certified a 25cc trimmer engine outfitted with the compression wave technology (also referred to as the John Deere LE engine) under the California ARB's Tier 2 program for small SI engines. The engine, which would be a Class IV engine under our classifications, was certified to a HC+NOx emissions level of 61 g/kW-hr at a useful life of 125 hours. In addition, John Deere adapted two Class V chainsaw engines and achieved

HC+NOx emissions below the Class V standard of 72 g/kW-hr. Both of the chainsaw prototype applications did have significantly lower power with the compression wave technology retrofitted to the engine. However, the revised engine designs had been developed in a very short period of time and the fuel metering system had not been optimized for either of the engines. We believe John Deere's efforts to retrofit the compression wave technology on these two Class V engines demonstrates the potential to apply the technology to Class V applications. Other manufacturers have also certified a number of advanced 2-stroke engine designs in California to meet the California ARB's Tier 2 HC+NOx standard for model year 2000. Among these engines, Komatsu Zenoah has certified two stratified scavenging with lean combustion engine designs at 66 g/kW-hr HC+NOx at a useful life of 300 hours with a 25.4cc engine and 53 g/kW-hr HC+NOx at a useful life of 300 hours with a 33.6cc engine. Stihl has certified an engine at 66 g/kW-hr HC+NOx at a useful life of 300 hours for a 56.5cc engine (i.e., Class V under our classifications).

While neither John Deere's compression wave technology engine nor the Komatsu Zenoah stratified scavenging with lean combustion engines noted above currently meets the newly adopted final phase in emission standards alone, at least John Deere has informed us that perhaps 50% of its Class IV applications are expected to comply with the standards while relying on the compression wave technology only. This may be due to John Deere's expectations for further improvement to that technology and to the company's ability to take advantage of averaging to reduce costs. Thus, the addition of a catalyst on at least some applications, along with further engine improvements should allow John Deere to demonstrate compliance with the Phase 2 standards. Allowing for a 20% compliance margin to account for variation within production runs and less precise manufacturing from prototype models to production runs, the target certification level in Classes III and IV is estimated to be around 40 g/kW-hr HC+NOx for the technology prototypes (i.e., certification engines) at the end of their regulatory useful lives. The required catalyst conversion efficiencies for these engines to meet the target level noted above have been estimated using information from a number of sources. Engine out emissions (without catalyst) at the end of the useful life are taken from the California ARB's Tier 2 certification data. HC+NOx emission deterioration information for the compression wave technology is also obtained from the California ARB certification data, which states the deterioration for the compression wave technology is 1.1. HC+NOx emission deterioration information for the stratified scavenging with lean combustion is estimated from EPA test data (Docket A-96-55 Item VI-A-01) and is assumed to be 1.0. Finally, a 30% deterioration in catalyst efficiency is assumed as the catalyst goes from new to the end of the certification useful life. Using this information, it is estimated that, without improvements in engine emission performance, the new engine catalyst conversion efficiency for the 25cc compression wave technology engine would need to be approximately 50% (30 g/kW-hr HC+NOx). For the 25.4cc stratified scavenged with lean combustion engine a 57% (38 g/kW-hr HC+NOx) efficiency catalyst would be needed and for the 33.6cc stratified scavenged with lean combustion engine a 36% (19 g/kW-hr HC+NOx) efficiency catalyst would be needed, given the current level of engine-out emissions. Concerns regarding catalyst heat management need to be addressed, especially in cases where high levels of HC+NOx need to be converted in a catalyst. However, given the fact that catalysts used on currently certified handheld engines have been shown to have conversion efficiencies in the range cited above, the amount of lead time available to

manufacturers prior to the implementation of the Phase 2 standards will be sufficient for manufacturers to implement additional engine and equipment improvements such that catalysts may be utilized on handheld engines without catalyst heat management concerns. Further, we believe that John Deere's, Ryobi's, and Echo's support of the 50 g/kW-hr standard supports the conclusion that if catalysts are used then catalyst heat issues can adequately be addressed. Although the current California standards are somewhat less stringent than the federal standards being adopted today, the fact that catalysts are being used in some of these California certified applications demonstrates that manufacturers have the ability to design equipment adequately addressing catalyst temperature issues. We believe that the leadtime available before implementation of this rule and the period during phase-in to the final standards will allow additional improvements in engine-out emission performance. These improvements will include refinements of the fuel metering technology, improvements in combustion chamber and piston head design, and improvements in spark ignition possibly via such devices as the Pyrotek spark plug mentioned earlier. Lastly, as the test data from the California ARB certification list shows, emissions of larger engines (as illustrated in comparison of the 25.4cc and 34cc stratified scavenged with lean combustion engines) decreases with increased engine size and therefore catalyst conversion requirements (and catalyst temperatures) will not be as high with larger Class IV engine displacements. It should be noted that for Class V (engines with displacement above 50cc), we do not believe that manufacturers will need to employ catalysts to meet the standards being adopted today, and therefore catalyst heat management concerns should not be a concern.

Although 2-stroke engines currently dominate the handheld engine market, we have determined that 4-stroke engines have the potential to achieve a significant share of the handheld market in the future. Ryobi, one of the biggest manufacturers of handheld equipment, has commented that it intends to expand the number of 4-stroke models available under the Phase 2 program. Three manufacturers have recently certified 4-stroke engines with the California ARB for the 2000 model year Tier 2 program that are used in handheld applications. Fuji Heavy Industries has certified a 4-stroke engine at 17 g/kW-hr HC+NOx for a useful life of 125 hours with a 24.5cc engine. Komatsu Zenoah has certified a 4-stroke engine at 31 g/kW-hr HC+NOx for a useful life of 300 hours with a 26.4cc engine. Ryobi has also certified two different 4-stroke engine families at 15 g/kW-hr HC+NOx for a useful life of 50 hours and at 21 g/kW-hr HC+NOx for a useful life of 300 hours. Both of these designs are on a 26.2cc engine. All of the 4-stroke engines noted above would be expected to meet the standards adopted today without use of a catalyst.

As shown in Tables 1 and 2, Class V engines have until 2004 to start certifying, and this is sufficient time for engine manufacturers to develop the compression wave technology, or stratified scavenging with lean combustion, or develop their own technology, for Class V engines. In fact, John Deere has already made preliminary application of the compression wave technology to two Class V chainsaw engines to demonstrate the applicability of the technology to Class V engines and has demonstrated low emission levels with those initial applications. Therefore, we conclude that the issues raised by Stihl and Husqvarna regarding technological feasibility do not undermine the achievability of the Class V standards, since adequate technology will be available. We discuss our analysis of the technologies supporting the final standards in detail in Chapter 3 of the Final RIA for the rule, and incorporate that discussion by

reference in response to the comments raising concerns regarding technological feasibility, safety, and operation.

With regard to the more stringent Class V standard supported by John Deere, Ryobi, the California ARB, the Sierra Club, STAPPA/ALAPCO, and MECA, we do not believe the existing information provides us with a high enough degree of certainty to determine that a tighter standard is feasible for all applications within the leadtime provided by the rule. As noted earlier, John Deere has submitted information on two Class V engines equipped with the compression wave technology. The test results show that low emission levels are achievable on the larger engines as well. However, as noted earlier, the redesigned engines were not fully developed to address all issues, including emissions deterioration over the longest useful life category to which Class V engines are expected to certify. Based on John Deere's experience with applying the compression wave technology to its 25cc engine, at least in the near term, emissions will likely increase as the system is redesigned to address issues needed to make the engine production ready and deliver maximum performance. In addition, while we are optimistic that low deterioration can be demonstrated, the deterioration characteristics of the compression wave technology out to 300 hours remain unknown at this time. Due to these concerns, we cannot be as certain that Class V engines can achieve a standard of 50 g/kW-hr as is being adopted for Class III and IV engines and applications within the timeframe of implementation of the Class V standards. Therefore, for Class V we are adopting the 72 g/kW-hr HC+NOx standard as proposed. It should be noted that the Class V standards during the phase in period differ from those proposed because of the revised four year implementation schedule.

1.2 Handheld Phase-in

1.2.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained a phase-in schedule for five engine classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed the standards and phase-in schedules at 64 FR at 40968-40969. EPA requested comment on the appropriateness of the proposed two year delay for Class V engines (64 FR 40949).

1.2.2 Summary of the Comments

John Deere commented that based on its previous development leadtime estimates, John Deere supports a phase-in of 2002-4 for all three handheld engine classes (Item IV-D-48, pages 14-16).

Ryobi argued that the phase-in schedule is unnecessary and unfairly penalizes manufacturers who have invested in clean technologies (Item IV-D-47, pages 4-5). Ryobi supports a standard that takes effect in 2002 for all classes. If EPA believes a phase-in is necessary, it should be based on an increasing percent of compliant engines rather than a decreasing levels of emissions, Ryobi claimed.

California ARB commented that the phase in period should be shortened since

manufacturers will already be producing the technologies EPA has identified for sale in California. The California ARB recommends that five years for national compliance (after California's 2000 date for Tier 2) should be sufficient time for a complete phase-in (Item VI-G-21, page 2).

Several months after the close of the formal comment period for the July 1999 SNPRM, the Sierra Club (Item VI-G-36, page 1) and STAPPA/ALAPCO (Item VI-G-38, page 2) submitted comments recommending an expedited phase in schedule for all of the handheld standards (and a more stringent standard for Class V, as noted earlier) based on their belief that manufacturers could meet such standards on a more accelerated schedule. MECA (Item VI-G-37, page 2) also submitted additional comments several months after the close of the formal comment period for the July 1999 SNPRM recommending an expedited phase in schedule for all of the handheld standards.

Husqvarna/FHP commented that in the nonhandheld rule, where the technology needed to meet the final standard is known, manufacturers generally need four years to redesign the multiple engine families and four years to commercialize the new designs. Husqvarna/FHP assert that the ICF report notes these assumptions apply to both nonhandheld and handheld engines. The compression wave technology has not been applied across all engine classes and significant pre-production research and development remains to be done (Item VI-D-08, page 33).

1.2.3 EPA Response to the Comments

We are adopting a shorter phase in schedule than we proposed in the SNPRM. We are finalizing a four year implementation schedule instead the five year schedule proposed in the July 1999 SNPRM. Each manufacturer's position with regard to implementing new technologies is unique. While some manufacturers have a small number of families, or have sales heavily dominated by one or two large engine families, other manufacturers have many families and do not have sales dominated by any specific engine family. Therefore, in determining the appropriate implementation schedule, we must balance the need for those manufacturers which have large numbers of families to have adequate time to address all of their families against the environmental benefit of achieving emission reductions as soon as possible. Based on the number of families currently certified by small SI engine manufacturers, we have determined that a four year implementation schedule of the Phase 2 standards is feasible, especially when taking into consideration the benefits of the averaging, banking, and trading program as well as the flexibilities provided for small volume engine manufacturers and small volume engine families. Moreover, as discussed below in section 2, commenters have persuaded us that some acceleration of the phase in period is necessary and appropriate to avoid an undesirable delay in transition to cleaner technology that could have resulted from the phase in schedule and ABT program as proposed. Some commenters requested us to adopt an even more aggressive schedule than a four year phase-in. However, we believe the leadtime before the standards are scheduled to take effect is appropriate based on the fact that the HC+NOx standards being adopted today for Class III and Class IV are, in the long term, more stringent than the California ARB's HC+NOx standards for these engines (i.e., 72 g/kW-hr effective model year 2000 for engines 0-65cc with

the exception of exempted applications), on which industry had been focusing and developing technologies over the past few years, and because many of the Class V engine families are used in certain farm and construction equipment applications which are exempted from meeting the California ARB standards. In addition, we believe that industry needs sufficient time in the near term to finish developing products for the California market that meet the California ARB Tier 2 emission standards for small SI engines. However, not all engines will necessarily be redesigned to meet the California ARB Tier 2 standards due to the farm and construction equipment exemption noted above, and because some manufacturers have told us that they expect to provide a limited lineup of engines for the California market. Furthermore, we believe the schedule of standards being adopted today will allow manufacturers to sell their engines designed to meet the California ARB Tier 2 standards nationwide for a number of years, recouping the investments made for such designs, while redesigning their product offerings to meet the proposed HC+NOx standards on average. Because most of the Class V engines are exempt from the California ARB Tier 2 requirements, and because the manufacturers of most Class V engines also have significant numbers of Class IV engines to redesign, we are retaining the delayed implementation schedule for Class V engines as proposed, as modified to accommodate a four year phase-in period. Finally, the selection of the 4-year phase in over the proposed 5-year phase in helps to alleviate concerns, discussed below in section 2, regarding the risk that in early years of the program manufacturers might generate so many credits in the ABT program that there is a delay in transition to the cleaner technology upon which our final standards are based. This is because under the final rule, all manufacturer production will have to meet the final phase in standards, on average, one model year earlier than under the proposal, requiring a faster retirement of credits generated during the phase in period than would otherwise have been the case.

1.3 Alternative Standards

1.3.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule requested comment on the costs, feasibility and other effects of complying nationwide with a 72 g/kW-hr HC+NOx standard for all three classes of handheld engines versus the standards being reproposed today. Specific areas include the engine designs and technologies that would be used to comply with a 72 g/kW-hr HC+NOx standard, the cost of adopting such technologies, and the potential for such Class III and Class IV engines to be modified to meet a 50 g/kW-hr HC+NOx standard. Lastly, the proposed rule also requested comment on the alternative standard set nominated by some members of the handheld industry (72/72/87 for classes III, IV and V respectively). In addition, the proposal requested to receive information about the costs associated with this alternative set of standards.

1.3.2 Summary of the Comments

Husqvarna/FHP asserted that what it called the "Consensus Alternative" standards (i.e., 72/72/87) continue to be the only emission limits which satisfy the CAA Section 213 test (Item

VI-D-08, pages 4-6, 30-31). They are technology forcing, but allow a wide variety of options, according to Husqvarna/FHP, and they are feasible based on cost given the ABT and small volume flexibilities. They allow equipment to meet the safety requirements, and they achieve 90% of the reductions, compared to the SNPRM standards, and are in the range of cost-effectiveness consistent with other categories, Husqvarna/FHP claims. The HC+NOx standards for Classes III, IV and V of 50/50/72 g/kW-hr, respectively, are not feasible for the wide range of engines based on a small number of prototype engines which are not evidence of feasibility to commercialize all applications, plus they are not feasible across the entire range of operating conditions for which the products are designed, Husqvarna/FHP argued. Plus, catalyst development presents enormous technical challenges in Husqvarna/FHP's view. The standard of 72 g/kW-hr for HC+NOx is not feasible for Class V because they require greater power, reliability, and durability, and are designed to operate across a wider range of temperatures, according to Husqvarna/FHP. The significantly greater power restricts use of emission control options that would work for smaller engines.

Husqvarna/FHP commented that the Unfunded Mandates Reform Act of 1995 requires EPA to "identify and consider a reasonable number of regulatory alternatives" and to select the "least costly, most cost-effective, or least burdensome alternative" that achieves the objectives of the rule (Item VI-D-08, pages 7-11). Husqvarna/FHP asserted that EPA performed such an analysis in the Recreational Marine rule and picked standards taking into consideration the high incremental cost-effectiveness associated with more stringent standards. In addition, for nonhandheld engines, EPA adopted Phase 2 standards that are the same as California, and they are based on the conversion to a currently known technology.

Husqvarna/FHP and Stihl submitted comments supporting standards of 72 g/kW-hr for Classes III and IV and 87 g/kW-hr for Class V, claiming that the specific technologies they were selecting to meet those levels for purposes of meeting the California ARB standards, which are not the technologies upon which EPA based its reproposed standards, would not be able to be modified to meet the reproposed standards of 50 g/kW-hr for Classes III and IV and 72 g/kW-hr for Class V. Husqvarna/FHP also submitted a study performed by National Economic Research Associates (NERA) purporting to examine the cost effectiveness of the standards supported by Husqvarna/FHP (relative to the Phase 1 standards) and the cost effectiveness of the standards contained in the July 1999 SNPRM (relative to the standards supported by Husqvarna/FHP). NERA's study claims that the cost effectiveness of the standards supported by Husqvarna/FHP relative to Phase 1 were significantly more favorable, at least to Husqvarna/FHP, than the cost effectiveness of the reproposed standards relative to the standards supported by Husqvarna/FHP.

Stihl requested that EPA reconsider the limits in 2006 for Class IV and 2008 for Class V. They propose to use 72 g/kW-hr for Class IV in 2006 and 87 g/kW-hr for Class V in 2008. This is based on their arguments that the standards proposed by EPA in the SNPRM are neither technologically nor economically feasible (as described in other sections of this document).

1.3.3 EPA Response to the Comments

While it may be true that the technologies certain manufacturers have been developing to

meet the California ARB's Tier 2 standards will not be capable of meeting the tighter federal standards being adopted today, we have concluded that the standards being adopted today are the most appropriate standards given the requirements of section 213(a)(3) of the Clean Air Act, which requires our standards for nonroad engines and vehicles to achieve the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available, giving appropriate consideration to cost, lead time, noise, energy and safety factors. This statutory requirement is a technology-forcing provision that reflects Congress' intent that our standards encourage manufacturers to shift their production to more innovative, environmentally friendly technologies. It does not mean that our standards should be able to be met by all currently used technologies, nor does it preclude our standards from rendering less innovative and environmentally beneficial technologies obsolete. In addition, as described later, the cost effectiveness of the adopted standards (relative to the currently applicable Phase 1 standards) is in the range of other nonroad programs we have adopted in recent years. It can also be noted that manufacturers which have invested in technologies not capable of meeting the Phase 2 standards being adopted today, but capable of meeting the slightly less stringent California ARB HC+NOx standard of 72 g/kW-hr, will still be able to certify such technologies under the Phase 2 program and earn credits in the ABT program during the transition years. Such credits will help them as they transition their entire selection of engines to meet the Phase 2 standards being adopted today. Manufacturers who have not yet developed compliant technologies can learn from the technologies already developed and/or expand the application of these technologies to their own production lines.

The Unfunded Mandates Reform Act (UMRA) does not specify the type of analysis that must be used to consider regulatory alternatives, and EPA need only consider alternatives that are consistent with the objectives of the regulation. Under CAA section 213, the objectives of this rule are to protect air quality by achieving the greatest emissions reduction achievable through technology that will be available. UMRA does not change this statutory structure, and therefore does not require EPA to adopt less costly alternatives based on a less advanced technology that does not meet the objectives of the CAA. We have selected the least costly, most cost effective approach that achieves the goals of the rule, as embodied in CAA Section 213.

1.4 Compression Wave Technology

1.4.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule did request comment on the likelihood that cost-effective solutions (specifically the John Deere LE technology) can be made available over the next two to three years across the full range of handheld engines and applications (see 64 FR at 40948).

1.4.2 Summary of the Comments

John Deere's comments addressed and refuted a variety of "concerns" raised by other

manufacturers about their compression wave technology (Item IV-D-48, pages 3-11)

Stihl submitted a University of Stuttgart study on a compression wave technology - equipped Stihl 70.7 cc chainsaw engine that shows power loss, higher emissions, etc. with the LE-equipped engine (Item IV-D-45, all pages).

Echo commented that the compression wave technology has not demonstrated a history of reliable service. Startability, stability, and acceleration must be proven, Echo stated (Item IV-D-37, page 3).

Husqvarna/FHP argued that the compression wave technology is incapable of meeting the SNPRM limits in commercially viable engines (Item VI-D-08, pages 32-34). This agrees with EPA's assessment that a catalyst would be necessary to achieve the SNPRM standards, they claimed. At best, the evidence shows that compression wave technology can meet a 72 g/kW-hr level in a Class IV prototype engine, according to the commenter. Compression wave technology does not appear suited in any way to Class V engines, the company claimed. The feasibility of adding a catalyst to a compression wave technology engine to meet a 50 g/kW-hr standard has not been demonstrated, they argued. Even John Deere's testing of the Stihl engine (at 50 g/kW-hr) adjusted for a compliance margin and deterioration wouldn't be capable of meeting the standard, they claimed. The Stihl Class V chainsaw equipped with compression wave technology saw power decrease from 3.8 kW to 3.09 kW. The video of the chainsaw shows it has unsafe, erratic idle characteristics and difficulties in achieving a stable fuel supply outside the narrow range of optimal operating conditions, in the commenter's view. Husqvarna's testing of a 45 cc chainsaw with compression wave technology confirmed these same problems, they claimed. Appendix A contains Husqvarna's critique of the compression wave technology and cites numerous problems. Stihl's analysis of the compression wave technology also includes problems associated with the technology. Stihl's analysis claims a compression wave technology equipped chainsaw would have less power, more weight, and inadequate multi-position operation for professional applications. Further comments on this topic are listed in item 1.4. The engine would require an expensive pump system to control fuel pressure, and there are lubrication problems, according to Husqvarna/FHP. Heat problems at the injection port and at the outlet side of the cylinder were likely, and the air/fuel mixture did not fulfill the requested ratio over a wide speed range, argued Husqvarna/FHP. Plus, the HC+NOx emissions, which were good at optimal operating conditions, increase two to threefold when used at the power required in professional applications. The compression wave technology tuning effect appears to restrict the engine's useful speed range far below what is acceptable, according to Husqvarna/FHP.

Husqvarna/FHP also submitted a study performed by National Economic Research Associates (NERA) purporting to examine the cost effectiveness of the standards supported by Husqvarna/FHP (relative to the Phase 1 standards) and the cost effectiveness of the standards contained in the July 1999 SNPRM (relative to the standards supported by Husqvarna/FHP). NERA's study claims that the cost effectiveness of the standards supported by Husqvarna/FHP relative to Phase 1 were significantly more favorable, at least to Husqvarna/FHP, than the cost effectiveness of the reproposed standards relative to the standards supported by Husqvarna/FHP.

1.4.3 EPA Response to the Comments

While John Deere had nearly completed a successful prototype on a Class IV trimmer engine prior to the July 1999 SNPRM, it was constructing a preliminary prototype for a 70cc Class V chainsaw engine during the comment period and was able to submit a video and emission test results showing successful preliminary application of the technology to a Class V chainsaw in their comments on the July 1999 SNPRM. After the close of the comment period, John Deere submitted additional feedback on the analysis performed by Stihl and Husqvarna on their respective prototypes. John Deere addressed the majority of each company's concerns listed in their reports. John Deere also acknowledged that more development time is needed in order to optimize the system for Class V applications and to determine if an additional lubrication system will be necessary on chainsaw and similar application engines. Nevertheless, based on the fact that John Deere has been successfully developing the technology for approximately one year, and has shown us that it can in this relatively short period of time address the majority of issues that have been raised by Stihl and Husqvarna, we have concluded that the compression wave technology holds a great deal of promise and that industry will be able to address all issues raised in the lead time provided under today's rule. Therefore, we conclude that this technology will be available to meet the standards adopted in the final rule.

1.5 John Deere Patent/Licensing Fee

1.5.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule did request comment on the licensing fees suggested by John Deere (see 64 FR at 40948), the impact such fees would have on competition given the cost for other technology options, and the level of licensing fee necessary to allow this licensed technology to be a cost effective option for other manufacturers.

1.5.2 Summary of the Comments

Echo argued that the provisions of John Deere's proposed licensing agreement (e.g. development work is the responsibility of the licensee, any patentable ideas a manufacturer develops become the property of John Deere) are completely unworkable. The licensing fee is excessive compared to the value of the product, according to Echo (Item IV-D-37, page 3).

The California ARB commented that the proposal does not limit manufacturers' technology options, and that the specifics of one company's policies cannot reasonably be used as an argument against the standards (Item VI-G-21, page 2).

Husqvarna/FHP argued that the licensing fees proposed by John Deere are not affordable (Item VI-D-08, pages 76-83). The proposed licensing arrangement included a number of elements such as royalty payments based on the cost of the equipment. A provision that grants John Deere rights in any technological improvement in the design, and a provision that allows

John Deere to cancel the license in the event of any challenge to the patent are also objectionable to Husqvarna/FHP. Typical profits in the consumer market are well below the minimum fee of $7.50 proposed by John Deere and would drive out competitors from that market, according to Husqvarna/FHP. The licensing proposal is premature, Husqvarna/FHP claimed, since the license relates to a patent application which has not yet been allowed by the U.S. Patent Office. (The typical patent review process is about 2 years.) There is no level of licensing fee that makes the compression wave technology a cost-effective option, because of the fundamental defects in the compression wave technology design (power, weight, speed/acceleration, temperature, operating mode, reliability, and cost according to Husqvarna/FHP. Given that the technology cannot meet the proposed standards, in Husqvarna/FHP's view, the issue of cost-effective licensing fees for the compression wave technology becomes irrelevant.

1.5.3 EPA Response to the Comments

While the provisions of the licensing agreement currently published by John Deere may not be acceptable to other manufacturers, especially those that compete directly against John Deere in the consumer market, we are confident that the availability of future competing technologies, such as the stratified scavenging with lean combustion engine and the 4-stroke engine, will lead to lower licensing fees and perhaps licensing agreement provisions for all technologies which licensees will find more favorable. Moreover, even assuming hypothetically that John Deere's technology becomes the only reasonable alternative to comply with the standards, EPA would have the authority under section 308 of the CAA to seek court action to direct John Deere to license it on reasonable terms. Therefore, we do not view the initial licensing fee proposal offered by John Deere to be an impediment to the availability of LE technology for purposes of achieving the standards adopted today. The fact that no manufacturer has agreed to pay the license fee as proposed by John Deere suggests that it may be too high and may need to be lowered. However, we do not know what the ultimate level of the licensing fee will be and therefore, for cost purposes, we have assumed the levels proposed by John Deere. This tends to result in higher costs than anticipated, overestimating the potential impact on consumer prices. It also tends to result in a rule that is less cost-effective than actually anticipated.

1.6 Stratified Scavenged Technology

1.6.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule did request comment on the ability of redesigned 2-stroke engines to achieve a 50 g/kW-hr HC+NOx standard (see 64 FR at 40947).

1.6.2 Summary of the Comments

Echo commented that they question the feasibility of the 50 g/kW-hr standards for stratified charge engines (Item IV-D-37, page 2). Kawasaki recently introduced a stratified

charge 2-stroke engine with a catalyst that obtains 46 g/hp-hr (61.3 g/kW-hr) THC+NOx

Stihl identified, at the public hearing, a number of asserted problems with the stratified charge design.

Husqvarna/FHP asserted that based on the emission data in the record, the suggestion that stratified scavenging technology is a feasible way to achieve the 50 g/kW-hr limit for Classes III and IV is unfounded (Item VI-D-08, pages 54-55). The Komatsu engine exceeded the USFS requirements without a catalyst, Husqvarna/FHP claimed. Husqvarna/FHP also argued that there is no emission data or other supporting information specific to Class V. EPA's data on the Komatsu Zenoah Class IV "Air Head" engine reflects HC+NOx emissions between 63.5 and 74.3 g/kW-hr. Although it is difficult to predict precisely the emissions from a similarly equipped Class V engine, higher displacement engines have higher total volume through the engine and thus produce more hydrocarbons. Accordingly, a Class V engine equipped with stratified scavenging technology would be unable to comply with the proposed limit of 72 g/kW-hr, Husqvarna/FHP claimed, especially once adequate margins were built in to account for manufacturing variability and deterioration factors.

1.6.3 EPA Response to the Comments

Komatsu Zenoah did not submit any comments on the July 1999 SNPRM. However, Komatsu Zenoah has developed 25.4cc and 33.6cc versions of this technology and certified them with the California ARB under the Tier 2 program at HC+NOx levels of 66 g/kW-hr for a useful life of 300 hours and 53 g/kW-hr for a useful life of 300 hours, respectively. (They are also certified to meet the U.S. Forest Service temperature requirements.) Neither of these engines is equipped with a catalyst. While our recent testing of their prototype trimmer did reveal concerns of high surface temperature of the exhaust housing, observation of the current muffler/housing arrangement revealed that the design was not optimized and that there was room for improvement in its design. While the California ARB certification emissions data shows that current engines equipped with stratified scavenging with lean combustion are emitting at levels above the 50 g/kW-hr HC+NOx standard adopted today for Class III and IV, our emission test data on Komatsu Zenoah's 25cc stratified scavenging with lean combustion engine with one medium/high and one medium efficiency catalyst ranged from 28 to 39 g/kW-hr HC+NOx, respectively. Using the data associated with the catalyst that yielded 28 g/kW-hr, and assuming a 30% deterioration of the catalyst and 10% deterioration of the engine, the resultant emission level in-use is estimated to be 48 g/kW-hr. While this result shows compliance with the standards adopted in this rulemaking can already be achieved with this technology, it is likely that emissions will need to be lowered even more either through engine improvements or better catalyst designs to allow for a compliance margin with production engines. Compliance with the USFS temperature requirements may also need to be further addressed. However, several years still remain before full compliance with these standards is required and we are confident that further development will bring this technology within reasonable emissions for use in meeting these standards. In addition, our testing was conducted on the 25.4cc engine, and application of this technology to larger displacement engines will result in lower emissions. This is seen in the California ARB certification results where emissions on the 33.6cc engine are lower than the

emission on the 25.4cc engine. Therefore, we conclude that stratified scavenging with lean combustion will be an available technology for meeting the Class IV standards.

In regard to application of the stratified scavenging with lean combustion technology to Class V engines, we expect the decrease in emissions with this technology in larger engines, as was shown in the comparison of the 25.4cc to the 33.6cc engines, to continue due to the favorable surface to volume ratios in larger displacement engines. This will be beneficial because catalysts should not need to be utilized on Class V engines and the degree of enleanment can be decreased and therefore provide the amount of lubrication needed in high speed applications, such as chainsaws. Therefore, the technology will also be available for Class V engines under the standards adopted today. We conclude that the stratified scavenging with lean combustion technology should be available for Class III engines as well, but manufacturers will need to address the unfavorable surface to volume ratios in the smallest engines which tend to result in higher g/kW-hr emission levels, which suggest the need for higher efficiency catalysts.

1.7 4-Stroke Technology

1.7.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule did request comment on the ability of 4-stroke engines to achieve a 50 g/kW-hr HC+NOx standard (see 64 FR at 40947).

1.7.2 Summary of the Comments

Echo argued that the 4-stroke technology has not proven itself to the commercial user (Item IV-D-37, pages 3-4). The 4-stroke is too heavy, accelerates too slowly, has too many parts to be sufficiently durable, and maintenance would be more difficult and costly, according to Echo. Switching over to 4-stroke would require a completely new manufacturing facility. Ryobi's original design was not for commercial applications, Echo claimed, and their second design has not been certified to the California ARB's Tier 2 standard. Honda had to recall many of their 4-stroke engines, Echo stated.

Ryobi commented that they introduced the first 4-stroke handheld engine in 1994. It has proven to be a powerful and reliable power source and can meet EPA's Class IV standard of 50 g/kW-hr. They just introduced two new 4-stroke handheld engines for commercial applications. 4-strokes offer several advantages over 2-strokes, such as no oil/fuel mixing is required and there is more power in low RPM range, Ryobi stated. Consumer satisfaction is high and the engines are very durable, according to Ryobi. Ryobi plans to expand its family of 4-strokes to larger models in the coming years, including Class V applications (e.g., trimmers, blower, chainsaw, utility engines). Ryobi is willing to license their 4-stroke design to other manufacturers (Item IV-D-47).

Stihl identified, at the public hearing, a number of asserted problems with 4-stroke

designs.

Husqvarna/FHP commented that in its view none of the record material supports lowering the standards to 50 g/kW-hr for Classes III or IV (Item VI-D-08, pages 56-59). They cite Stihl's analysis of 4-stroke technologies and their alleged concerns (i.e., increased weight, increased complexity, ergonomic problems, poor handling, lower power, slower acceleration, insufficient lubrication at temperature extremes, ability to operate multi-positionally is limited, etc.). They argue that EPA's proposed decision to eliminate the 14 kg weight specification for handheld engines using 4-stroke engines appears to be consistent with the lack of evidence supporting the feasibility of weight reduction.

1.7.3 EPA Response to the Comments

Considering all of these comments and the fact that manufacturers are already certifying low-emitting 4-stroke engines for use in handheld applications under the California ARB's Tier 2 program, we have concluded that the 4-stroke engine has a significant place among the technologies capable of meeting the finalized standards. We discuss our analysis of the 4-stroke technology in detail in Chapter 3 of the Final RIA for the rule, and incorporate that discussion by reference in response to the comments raising concerns with this technology. We note that 4-stroke engines may not be the manufacturer's preferred choice for all engine displacements or equipment applications. While the 4-stroke is currently being applied in Class IV applications, such as trimmers, it may be less likely of a desired solution for Class III due to the cost of developing whole new 4-stroke engines for the few engine families in this class. (Class III applications tend to be the lowest priced consumer products.) The low volumes of the majority of Class III engine family sales may make the 4-stroke engine a less cost effective solution than other technologies unless the engine block and components can be adapted from a larger Class IV engine production line. Some manufacturers may find the cost of the 4-stroke technology on Class III equipment to be too large compared to the retail price, especially given the consumer market focus for these engines. For Class V engines we are confident that the 4-stroke engine design can be adapted to equipment in the lower displacement Class V engines. However, 4-stroke engines have not been demonstrated in the larger Class V applications for which manufacturers have expressed concerns over potential increased weight, ergonomic problems, and the need to assure sufficient lubrication. To our knowledge, the manufacturers who currently market large displacement Class V equipment in the United States have no experience in designing and producing 4-stroke engines for handheld equipment, adding to their difficulty in applying this technology. Therefore, we conclude that 4-stroke technology will be cost-effective and widely available for Class IV engines, will be available but possibly less cost-effective for Class III engines, and will be available for at least the lower displacement Class V engines under the standards adopted today. However, we cannot similarly predict the applicability of 4-stroke technology for the largest displacement Class V engines within the time constraints for implementation of Class V standards.

1.8 Handheld DF's

1.8.1 Summary of the Proposal

Section 90.104 lists the proposed assigned deterioration factors (DFs) for small volume manufacturers and small volume engine families.

1.8.2 Summary of the Comments

Tecumseh argued that DFs for lower emitting engines will be higher than the 1.1 level assumed by EPA (Item VI-G-05, pages 2-3). They expect the absolute g/kW-hr increase in emissions for new designs will stay about the same as current designs, resulting in a DF of about 1.5 for the cleaner engines. In addition, EPA has failed to account for the deterioration effects of catalysts, Tecumseh claimed.

1.8.3 EPA Response to the Comments

Based on other available deterioration data, specifically from California ARB certification data which is contained in the RIA, EPA believes that the 1.5 deterioration factor as mentioned by Tecumseh is inaccurately high for the large majority of 2-stroke engines covered by this rulemaking. Regarding inclusion of catalyst deterioration, we have accounted for catalyst deterioration by assuming that the catalyst efficiency will decrease 30% over the useful life of the engine. Information on deterioration factors from engines with catalysts can also be found in the California ARB certification data.

1.9 Catalysts for Handheld Engines

1.9.1 Summary of the Proposal

Section 90.103 of the supplementary proposed rule contained emission standards for five engine Classes (Classes III-V, Class I-A and Class I-B). EPA's SNPRM discussed these standards at 64 FR at 40968-40969. The proposed rule did request comment on the ability of the John Deere LE technology, the Komatsu Zenoah stratified scavenging design, or mini 4-stroke technologies to accommodate a catalyst. Specific areas on which EPA requested comment include the ability to provide sufficient engine and muffler cooling with each of the technologies, catalyst conversion efficiencies, and engine or equipment design changes needed to accommodate a catalyst specifically in response to the U.S. Department of Agriculture (USDA) Forest Service requirements for equipment used on Federal land (see 64 FR at 40947).

1.9.2 Summary of the Comments

Tecumseh asserted that catalysts have not been shown to be compatible with handheld engines (Item VI-G-05, pages 2-3). To achieve the efficiencies needed to meet the standards, the catalysts would need to be too large, according to Tecumseh, resulting in products not meeting consumer expectations. After factoring in deterioration over the useful life, the upper end of

levels associated with the LE technology would not be able to meet the proposed standards, Tecumseh argued.

Echo commented that because of the high temperatures of catalysts, they are working to find ways to eliminate burn injuries and minimize the potential for starting fires (Item IV-D-37, page 3). USFS temperature requirements will be difficult to meet. They are also trying to meet the UL-82 temperature requirements for contact surfaces. Regardless, they are hopeful that with the amount of leadtime they will be able to comply with the proposed standards.

MECA commented that the issue of exhaust temperature management can be successfully addressed through the proper design of the engine/fuel delivery/catalyst/exhaust system, and argued that equipment can be designed to meet the USFS temperature requirements (Item VI-G-3). Catalysts can be applied to larger, 2-stroke engines used in commercial applications. While these engines generate more power, and have the potential to generate more heat over the catalyst, they also provide additional opportunities for reducing or dissipating temperatures, MECA argued.

Husqvarna/FHP claimed that the addition of a catalyst to the compression wave technology and stratified charge engines exceeded USFS standards by up to 100°C (Item VI-D-8, pages 37, 60-67). Catalysts will have to be individually designed for each engine, Husqvarna/FHP stated. Husqvarna's experience shows this takes about 1 year of additional development. The technologies envisioned under the SNPRM will require significant redesign in order to safely accommodate a catalyst, Husqvarna/FHP claimed. EPA's assumption that a low-efficiency catalyst will be sufficient for the compression wave technology or stratified charge to meet 50 g/kW-hr based on prototype engine levels is not supportable, Husqvarna/FHP argued. Due to variation in engine emissions, manufacturers cannot know with certainty what efficiency catalyst is needed until engines are in production. The oxygen-rich exhaust of the compression wave technology and stratified charge can cause low-efficiency catalysts to act like high-efficiency catalysts. If one of these engines is exposed to excess fuel in the presence of excess oxygen, as during a hot restart, the engine can generate a tremendous amount of heat in a very short time, endangering the operator and creating the risk of lash fire Husqvarna/FHP claimed. Design changes are key to managing heat produced by the compression wave technology and stratified charge technologies equipped with catalysts, and EPA has underestimated the difficulty of managing the heat, according to Husqvarna/FHP. Chainsaws pose a particular problem because the manufacturer's ability to redesign the engine housing is limited due to weight and power issues. (None of Husqvarna's current catalyst equipped models are chainsaws.)

A number of parties related to the timber industry have also submitted comments regarding their concern over potential forest fires with the use of catalysts on Class V commercial equipment.

1.9.3 EPA Response to the Comments

In regard to the application of catalysts in Classes III and IV, a variety of catalyst substrates exist in the marketplace today, including the traditional honeycomb substrate, a plate

substrate (as currently used in several trimmer applications), and a circular wire mesh substrate. Some catalyst designs are able to achieve higher conversion percentage than others based on the available surface area of the catalyst. Data from our testing of several low engine out emission engines retrofitted with catalysts (a Komatsu Zenoah stratified scavenging with lean combustion engine, retrofitted with flat plate and honeycomb catalyst, and a John Deere compression wave technology engine, retrofitted with a prototype metallic sponge catalyst) have shown catalyst conversion efficiencies of 45% or higher.

The main concern raised by manufacturers with the use of catalysts is safety and compliance with the USFS temperature requirements. Higher conversion efficiencies of the catalyst and higher exhaust flow rate (which tends to increase with engine size) both can result in higher catalyst and exhaust gas temperatures. The needed conversion efficiency of the catalyst and available cooling are factors that need to be addressed in order to successfully apply catalysts to small engines. While catalyst and muffler designs can influence the conversion efficiency, the ability to cool the muffler is largely dependent on the application. Leaf blowers can blow air past the muffler thereby being able to achieve a high degree of cooling. Trimmers typically have ample available space around the muffler and therefore can be designed to handle a certain amount of additional cooling by extending the muffler housing out beyond current equipment designs. (It should be noted that there are a number of such handheld applications currently certified, both federally and with the California ARB, that employ catalysts and also comply with the U.S. Forest Service temperature requirements.) Chainsaws on the other hand have compact packaging requirements and therefore have less flexibility in being able to handle increased amounts of cooling.

The power of an engine will influence the amount of heat that is generated in a catalyst. The general trend is that while larger engines produce more power, they also have larger surface to volume ratios which typically means lower engine out emissions (on a g/kW-hr basis), therefore decreasing the needed efficiency of a catalyst to obtain a given emission standard in g/kW-hr. Therefore, in regards to various engine classes and applications, the large majority of Class III engines are trimmers, and have the capability to easily incorporate a low- to medium-efficiency catalyst. For these engines, any additional heat can be managed by muffler and muffler housing redesign. Class IV incorporates a large range of engine sizes and applications from trimmers to chainsaws. The low emitting 2-stroke engine technologies that will be available for these engines reveal that, except in the case of 4-stroke engines, a catalyst may be needed to certify to the emission standards being adopted today. The major sales application in Class IV is trimmers and, as with Class III, this application will be able to incorporate a fair degree of cooling with muffler and muffler housing redesign. Blowers will also be able to incorporate a catalyst with sufficient ability to achieve a high degree of cooling. Chainsaws using Class IV engines will be limited in the degree of catalyst conversion based on the tight packaging.

However, such applications should still be able to meet the standards through controlling engine out emissions and the use of a catalyst. Additionally, averaging, banking and trading gives the manufacturer additional flexibility. Averaging, banking and trading can assist a manufacturer who may have Class IV chainsaws, or other more difficult cooling applications, in

need of emission reduction by allowing the manufacturer to, for example, produce a chainsaw without a catalyst (thereby forgoing the cost and lead time associated with catalyst and cooling redesign) and, if emitting above the standard, offset these excess emissions with credits from lower emitting trimmers and blowers equipped with catalysts. With regard to Class IV 4-stroke engines, based on the certification data submitted by manufacturers to the California ARB, we believe that such engines will not require the use of a catalyst to meet the standards being adopted today and therefore will not have any heat issues that need to be addressed. Finally, with regard to Class V engines, the standards being adopted today have been set at levels that are not expected to require the use of catalysts. Therefore, Class V applications should not have any catalyst heat issues that need to be addressed.

1.10 Class I-A and Class I-B

1.10.1 Summary of the Proposal

Section 90.103 of the proposal contains standards and effective dates for the proposed Class I-A and Class I-B. EPA requested comment on the assumptions for which I-B was established and on ways to prevent proliferation of two strokes into the Class I-B nonhandheld applications from occurring. EPA also requested comment on the level of the proposed Class I-B standards and the feasibility of achieving lower emission standards with OHV, SV and 2-stroke engines. EPA also requested information on the need to establish standards for Class I-A engines operated on natural gas.

In the July 1999 SNPRM, we requested comment regarding the possibility that if the proposed Class I-A and I-B standards were adopted, manufacturers might shift significant production from Class I to the smaller displacement engines. We also requested comment on the potential for 2-stroke engines to meet the proposed Class I-A and I-B standards and the potential for such engines to be used in existing nonhandheld applications such as mowers. We noted that if such a change in the market were to occur, the benefits of the recently finalized Phase 2 program for Class I engines which anticipates a turnover to clean 4-stroke OHV technology would be seriously compromised.

1.10.2 Summary of the Comments

PPEMA commented that they do not oppose the creation of the new classes or the standards proposed. EPA should retain performance based standards only and allow any engine that meets the standards to certify (2-stroke or 4-stroke), PPEMA argued (Item VI-D-07, page 4).

Tecumseh commented that the proposed emission standards are appropriate (Item VI-G-05, page 1). EPA doesn't need to be concerned about the possibility of small 2-strokes being used in lawnmowers, since it's not practical to use such small engines in these applications, Tecumseh stated.

OPEI commented that EPA's standards should be technology neutral. They strongly support EPA's proposal for Class I-A and I-B engines (Item VI-D-05, page 2). EPA doesn't need

to be concerned about the possibility of 2-strokes being used in lawnmowers since FEL caps will prevent this from happening, according to OPEI; small two-strokes don't have enough power; consumers are demanding more power; and only niche products would benefit and they currently use 4-strokes and would not change to 2-stroke because of the high cost of switching.

Echo commented that the Class I-A and I-B requirements create an unfair advantage for 4-stroke engines (Item IV-D-37, page 2). Applying to Class I-A the same standards, useful life, and test procedures as for 2-strokes, is in effect banning 2-strokes from applications for which they are well-suited, Echo argued. EPA should consider lowering the standards for Class I-A and I-B since catalysts are more practical on nonhandheld applications, according to Echo. EPA doesn't need to be concerned about 2-stroke lawnmowers in Class I-A or I-B, since in Echo's view the power requirements of lawnmowers won't allow it.

Suzuki Motor Corporation commented that they fully support the proposed Class I-A and I-B provisions (Item VI-D-06, page 1). The provisions will allow for the introduction of small 4-stroke engines for use in lightweight implements that require hand portability, but are not classified as handheld and are thus subject to the more stringent nonhandheld engine standards which Suzuki claims are unattainable for these smaller 4-strokes.

California ARB commented that Class I-A is acceptable since engines below 66 cc are used overwhelmingly in handheld applications. They would not expect Class I-B engines to displace Class I engines in lawnmowers, but they recommend that EPA adopt specific provisions to prevent such an occurrence (either prohibit 2-stroke engines from Class I-B entirely, prohibit the use of Class I-B engines in walk-behind lawnmowers, or redefine Class I to include all walk-behind lawnmowers, regardless of displacement) (Item VI-G-21, page 3).

Husqvarna/FHP commented that any new engine classes should be technology neutral (i.e., there shouldn't be any limitation on the technologies which can be used to meet standards) (Item VI-D-08, pages 118-120). They believe the proposed standards are so low as to preclude any realistic possibility at this time of the use of 2-stroke engines in Class I-A or I-B applications such as walk behind lawnmowers. The only engine likely to be able to meet such standards in nonhandheld applications is a two-stroke with fuel injection, according to Husqvarna/FHP, but they would be prohibitively expensive and therefore commercially unrealistic.

Honda commented that they support the inclusion of Class I-A and I-B in the Phase 2 regulations and believe EPA should adopt the standards as proposed (Item VI-D-01, pages 1-3). The Class I limit is based on a typical 190 cc lawnmower engine. Engines below 100 cc cannot reasonably or cost effectively meet the same standard, Honda claimed. Many small manufacturers have been adversely affected by a shortage of Phase 1 engines of the Class I-A size, according to Honda. In response to whether Class I-B engines could be used to power lawnmowers, Honda doesn't have any information on 2-strokes but they believe that mowers could use engines of this size. They would likely be 17-inch cutting width, but they have never been big volume sellers.

1.10.3 EPA Response to the Comments

We are adopting provisions for two new classes of nonhandheld engines. Based on the fact that it is generally more difficult for smaller displacement engines to meet the same emission standards as larger displacement engines, we continue to believe that the recently adopted Phase 2 Class I standard which is technically feasible and economically viable for the existing larger displacement 4-stroke engines in Class I (which have displacements typically above 125cc and are used primarily in lawnmowers), could be too costly for manufacturers to be achievable for not currently marketed smaller displacement engines that equipment manufacturers assert they need to use in applications requiring the use of much smaller displacement nonhandheld engines. Therefore, we are adopting the proposed provisions to subdivide the Class I engine category by adding two new nonhandheld engine classes and redesignating the span of displacements covered by Class I. Under today's action, Class I-A will include nonhandheld engines below 66cc, Class I-B will include nonhandheld engines equal to or greater than 66cc but less than 100cc, and Class I will cover engines equal to or greater than 100cc but less than 225cc.

Based on the comments submitted on the proposed Class I-A and Class I-B provisions, we do not believe that it is likely manufacturers would shift significant production from Class I to the smaller displacement engines. Neither do we believe that manufacturers could design and market to any appreciable extent significant numbers of 2-stroke engines in nonhandheld applications.

With today's action, we are adopting the Class I-A and Class I-B standards as proposed. Table 4, below, contains the Phase 2 standards being adopted for Class I-A and Class I-B engines. Based on the comments submitted by manufacturers, we do not believe there is any need to be concerned at this time over the possibility of 2-stroke engines proliferating in these nonhandheld engine classes. With regard to the issue of tighter standards for nonhandheld engines through the application of catalysts raised by one manufacturer, we believe that issue should be addressed in future rulemakings that affect all nonhandheld engines, since the current standards for Phase 2 nonhandheld engines were set at levels that did not rely upon the use of catalysts. With regard to the implementation date of the new standards, we are adopting a slight delay for implementation of the Class I-A and Class I-B standards to the 2001 model year. Under the provisions of the July 1999 SNPRM, implementation of the Class I-A and Class I-B standards would have begun upon the effective date of the final rule, which is 60 days after publication in the Federal Register. This would have meant a manufacturer would have to immediately recertify current Phase 1 designs that fall under the 100cc displacement cutoff for Class I-A and Class I-B. We do not believe this is necessary given the limited number of engines expected to covered by these provisions. Therefore, under today's action, manufacturers may wait until the 2001 model year to certify engines below 100cc to the Class I-A and Class I-B provisions.

Table 4
Phase 2 Emission Standards for Class I-A and Class I-B Engines

Engine Class	HC+NOx Standard (g/kW-hr)	CO Standard (g/kW-hr)	Effective Model Year
Class I-A	50	610	2001
Class I-B	40	610	2001

1.11 CO and PM Emission Standards

1.11.1 Summary of the Proposal

Section 90.103 of the proposal contains CO emission standards for Classes I-A and I-B and for Classes III-V. EPA requested information on PM emissions from handheld engines and the need for PM standards for small SI nonroad engines in general.

1.11.2 Summary of the Comments

PPEMA commented that they support the proposed CO standards and asserted that there is no need to establish PM limits (Item VI-D-07, page 3).

OPEI commented that they support the proposed CO standards and asserted that there is no need to establish PM limits (Item VI-D-05, page 5).

The California ARB commented that they believe an investigation of PM and toxics from handheld engines, as EPA previously proposed, is still a good idea (Item VI-G-21 , page 4). They recommend the study include the classification and ranking of the toxicity of various 2-stroke designs compared to diesel PM.

Husqvarna/FHP commented that they support the proposed CO standards (Item VI-D-08, page 114).

1.11.3 EPA Response to the Comments

We are finalizing the CO limits as proposed in the July SNPRM and listed in Table 2. With regard to emissions of particulate matter (PM), the July 1999 SNPRM did not propose any standards. Nor did the SNPRM take any position regarding whether such standards would be appropriate. However, we requested information on PM emissions from handheld engines and the need for PM standards for small SI nonroad engines under section 213(a)(4) of the Clean Air Act. We are not prepared to establish PM standards under section 213(a)(4) of the Clean Air Act at this time. However, we have agreed with other parties that a PM and hazardous air pollutant (HAP) test program will be conducted (see 62 FR 14746). The Portable Power Equipment Manufacturers Association (PPEMA), in cooperation with us, has agreed to conduct a test

program to evaluate and quantify emissions of PM and HAP including, but not limited to, formaldehyde, acetaldehyde, benzene, toluene, and 1,3 butadiene. We anticipate that testing will be conducted on Phase 2 technology handheld engines, with a sufficient magnitude of engines tested to represent the range of new basic technologies used to comply with the Phase 2 engine standards being adopted today. We expect that the information generated by this program will be useful in informing any future consideration of PM or HAP standards for small SI engines.

1.12 Useful Life

1.12.1 Summary of the Proposal

Section 90.105 of the proposal contains the useful life options for Classes III-V, I-A and I-B.

1.12.2 Summary of the Comments

OPEI commented that they support EPA's proposal to allow manufacturers to select the appropriate useful life based on design features and performance characteristics (Item VI-D-05, page 8).

California ARB commented that they support EPA's proposed useful life designations which are consistent with California's. They also support allowing manufacturers to select the appropriate durability period (Item VI-G-21, page 3).

Husqvarna/FHP commented that they agree with the SNPRM that selection of the useful life category should be left to the manufacturer (Item VI-D-08, page 115-116).

1.12.3 EPA Response to the Commenters

EPA is finalizing that the selection of the appropriate useful life category will be the responsibility of the manufacturer, as discussed in the proposal.

1.13 Engines over 25 hp and less than 1.0 liter

1.13.1 Summary of the Proposal

Section 90.1 of the proposal states that "To the extent permitted by other parts of this chapter, this Part may, at the engine manufacturer's option, apply to engines with gross power output greater than 19kW that have an engine displacement of less than or equal to one liter."

1.13.2 Summary of the Comments

Tecumseh (Item VI-G-05, page 1) and OPEI (Item VI-D-05, page 4) support EPA's proposed provisions.

1.13.3 EPA Response to the Comments

We are adopting the provisions as proposed that allow manufacturers the option of certifying engines above 19 kW and less than or equal to one liter in displacement to the small SI engine program beginning with the 2001 model year. It should be noted that if a manufacturer chooses to certify such engines under the small engine program, the engines will need to be certified to the Phase 2 requirements for the appropriate class of nonhandheld engines, which is expected to be the Class II requirements (i.e., engines above 225cc in displacement), for a useful life period of 1,000 hours. We recently issued a Notice of Proposed Finding (see 64 FR 6008) which announced our intent to propose regulations for "large nonroad SI engines" (which include these greater than 19 kW but less than one liter engines). We expect to issue a NPRM for large nonroad SI engines in 2000, and to propose that engines greater than 19 kW and less than one liter in displacement meet small SI nonroad engine requirements. If, however, we do not propose and/or adopt such a requirement for these engines as part of the large SI nonroad program, we would expect to consider reasonable approaches to minimizing disruption, as appropriate, to the affected industry. Such approaches would be addressed in the rulemaking process for large nonroad SI engines.

1.14 Professional Chainsaw Exemption

1.14.1 Summary of the Proposal

Section 90.103 of the proposal contains emission standards for Class V engines which is defined as engines from 50cc and larger. The emission standards are 72 g/kW-hr for HC+NOx and 603 g/kW-hr for CO.

1.14.2 Summary of the Comments

Robbo Holleran (forester) commented that professional chainsaws should be exempted from Phase 2, or if that is not possible, professional saws of 50 cc or larger should be, due to increased weight/safety concerns (Item IV-D-38, page 1).

Walter Malmquist (saw mill owner) commented that professional and commercial chainsaws should be exempted from Phase 2 due to potential bans on operation of saws with catalytic converters during high fire danger time, loss in power/weight ratio, and increased costs (Item IV-D-40, page 1).

Bill Gross commented that professional chainsaws should be exempted from Phase 2 due to increased weight and slight decrease in emissions (Item IV-D-42, page 1).

Plumb Lumber Company commented that professional chainsaws should be exempted from Phase 2 due to increased weight/safety, cost, and efficiency concerns (Item IV-D-46, page 1).

Vermont Forest Products Association commented that professional and commercial

chainsaws of 50 cc and higher should be exempted from Phase 2 due to increased weight/safety concerns, cost, and the potential for bans on use in some high fire danger areas (Item IV-D-39, page 1).

South Carolina Timber Producers Association commented that professional and commercial chainsaws above 50 cc should be exempted from Phase 2 due to increased weight, power loss, cost, limited impact of such equipment on the environment, and forest fire/safety concerns from catalysts. EPA should conduct further study and allow further comment from professional loggers on the impact of Phase 2 to their profession, the commenter argued (Item IV-D-41, pages 1-2).

Virginia Forestry Association commented that the new regulations would add unacceptable weight and cost to chainsaws, while reducing power and durability. We need to consider the livelihood and health of loggers, the commenter stated (Item VI-G-02, page 1).

Ethan Allen, a furniture manufacturer, commented (Item V-G-91, page 1) that they would like EPA to allow an exemption from EPA Phase 2 Emission Regulations for professional or commercial chainsaws 50cc displacement or larger. Their concern is that the regulations will add weight to the saws. The resulting heavier saws from the Phase 2 Regulation will increase fatigue and back muscle problems creating unsafe conditions for the commercial user, Ethan Allen claims. The loss of power that will also result from Phase 2 implementation will result in the operator having to work harder, longer, and creating additional unsafe conditions according to Ethan Allen.

1.14.3 EPA Response to the Commenters

Under today's action, handheld engines used in professional and commercial chainsaws above 50cc (i.e., Class V engines) will be required to meet the Phase 2 standards. We are aware of the impact that increased weight can have on a logger that utilizes the equipment on a regular basis, as well as the concern over the increased risk of potential forest fires with the use of catalysts. However, we conclude that manufacturers of engines used in professional chainsaws will be able to meet the standards being adopted today for Class V through the use of technologies such as the stratified scavenging with lean combustion technology or compression wave technology which do not have significant impacts on equipment weight or power. In addition, the estimated increase in equipment cost due to the Phase 2 standards compared to the current cost of such equipment is estimated to be at or below 10 percent. With regards to the use of catalysts on these applications, we believe the standard for Class V engines being adopted today and the technologies expected to be available for meeting the standards will not require the use of catalysts on these engines. Therefore the increased exhaust temperature concerns noted by commenters are not expected to be an issue for these engines.

SECTION 2: AVERAGING, BANKING, AND TRADING

2.1 General Program

2.1.1 Summary of the Proposal

The July 1999 SNPRM contained provisions to include all Phase 2 handheld engines and the newly designated nonhandheld engine classes (Class I-A and Class I-B) in the certification averaging, banking, and trading (ABT) program adopted in the March 1999 final rule for Phase 2 nonhandheld engines. The proposed ABT program was described at 64 FR 40951-40953 of the SNPRM. Averaging means the exchange of emission credits among engine families within a given engine manufacturer's product line. Averaging allows a manufacturer to certify one or more engine families to Family Emissions Limits (FELs) above the applicable emission standard. However, the increased emissions have to be offset by one or more engine families certified to FELs below the same emission standard, such that the average emissions in a given model year from all of the manufacturer's families (weighted by various parameters including engine power, useful life, and number of engines produced) are at or below the level of the emission standard. Banking means the retention of emission credits by the engine manufacturer generating the credits for use in future model year averaging or trading. Trading means the exchange of emission credits between engine manufacturers which then can be used for averaging purposes, banked for future use, or traded to another engine manufacturer.

2.1.2 Summary of the Comments

PPEMA (Item VI-D-07, page 10) commented that it supports the proposed ABT program. OPEI (Item VI-D-05, page 9) commented that it supports the proposal's provisions for unlimited life and no discounting of credits. Suzuki Motor Corporation (Item VI-D-06, page 2) commented that it supports the proposed ABT program for handheld engines and the newly defined Classes I-A and I-B. California ARB (Item VI-G-21, page 4) commented that it supports the ABT program in general. However, if EPA adopts the initial standards in the proposed phase-in schedule, the California ARB commented that credit generation should not be allowed in the initial period. California ARB noted concerns regarding excessive credits being generated.

2.1.3 EPA Response to the Comments

We are finalizing provisions to include handheld engines and Classes I-A and I-B in the ABT program for small SI engines with a number of revisions as described throughout this section. In response to the concerns cited by the California ARB as well as more recent discussions with John Deere, we are adopting revised provisions of the ABT program that will affect the generation of early credits, and the life of credits generated during the phase in of the standards.

Under the ABT provisions being adopted for handheld engines, only those credits generated by engines certified with FELs at or below 72 g/kW-hr will have an unlimited credit life. Such credits will be available to the manufacturer for the duration of the Phase 2 program

and will not be discounted in any manner. Credits generated by engines certified with FELs above 72 g/kW-hr can be used by a manufacturer in the model year in which they are generated for its own averaging purposes, or traded to another manufacturer to be used for averaging purposes in that model year. However, such credits generated by engines may not be carried over to the next model year, including when traded to another manufacturer. We believe this approach is necessary to ensure that the ABT program does not contribute to a significant delay in implementation of the low-emitting technologies envisioned under the Phase 2 program, a risk under the proposed program which commenters alerted us to in comments on the SNPRM. Without the limitation, we are concerned that manufacturers could certify marginally cleaner engines, especially during the first years of the phase in period when the fleet average standards are the highest, and generate enough credits to significantly delay implementation of technologies meeting the long term standards (i.e., 50 g/kW-hr for Classes III and IV and 72 g/kW-hr for Class V) for a significant portion of the fleet. We have selected the 72 g/kW-hr level as the cutoff for generating such credits based on the fact that the California ARB has adopted this level for its Tier 2 program for engines covered by our handheld engine regulations. Many manufacturers have targeted their near-term production to meet this, rather than a more stringent, emission level. We believe it would be less fair to select a cut off level that penalized manufacturers who have already devoted substantial resources to reducing their engines' emissions for purposes of meeting the California standards. At the same time, we agree that generation of a significant amount of credits through short-term engine improvements that would not result in compliance with either California's standards or the final Phase 2 standards is an unacceptable outcome if it causes delay of the ultimate transition to cleaner technology. Therefore, we have decided that the best way to resolve this issue is to provide that manufacturers that have certified engines to meet a 72 g/kW-hr HC+NOx standard for the California market will be able to certify and sell such engines nationwide and realize the full emission benefit of those engines under the ABT program.

2.2 Early Banking

2.2.1 Summary of the Proposal

The ABT program proposed in the July 1999 SNPRM contained provisions to allow manufacturers to generate early credits from engines before the Phase 2 standards were implemented. The credits could be banked until the Phase 2 standards took effect and then used for averaging, banking or trading purposes. In order to be eligible for early credits, we proposed that an engine would have to comply with all of the Phase 2 requirements (e.g., full useful life certification, PLT testing, etc.) and be certified with an FEL below the applicable first year phase in HC+NOx standard for its engine class.

2.2.2 Summary of the Comments

PPEMA (Item VI-D-07, page 11) commented that it supports the proposed early credit program. OPEI (Item VI-D-05, page 9) also commented that it supports the proposed early credit program. Stihl (Item IV-D-45) commented that the proposed regulations dealing with early credits for Class V should refer to the credits being generated against a level of 138 g/kW-hr, not

131 g/kW-hr. Stihl (Item VI-G-41), in a subsequent submittal to EPA, requested clarification if credits could generated during the 2000 model year, prior to the promulgation and effective date of the final regulations for Phase 2 handheld engines. John Deere (Item VI-E-09) noted concerns that manufacturers could certify marginally cleaner engines against the relatively high first year phase in standards and generate enough credits to significantly delay implementation of technologies meeting the long term standards. CARB (Item VI-G-21, page 4) noted that if we retained the initial lenient standards, then credit generation should not be allowed in the initial period due to concerns over excessive amounts of credits being generated.

2.2.3 EPA Response to the Comments

We are adopting early banking provisions for handheld engines with the final Phase 2 program for handheld engines, with certain differences from the proposal. Manufacturers will be allowed to begin using the averaging and banking portions of the ABT program beginning with the 2000 model year for those engines certified to the Phase 2 requirements and produced after the effective date of this action. Consistent with the approach discussed above for credit generation and in response to the concerns raised by the California ARB and John Deere discussed above, manufacturers will be allowed to generate early credits from only those engine families with HC+NOx FELs at or below 72 g/kW-hr. However, as proposed, all early credits will be calculated against the first year phase in standards for the applicable engine class until the first year that the Phase 2 standards apply for the appropriate engine class (at which point credits would be calculated against the declining average standard for the appropriate engine class). This approach for early credits from handheld engines is similar to the approach recently finalized for nonhandheld engines, where early credits are generated only from engines with FELs below the final phase in standards, not the initial phase in standards. As discussed above, after considering comments submitted on the SNPRM, we now believe a similar approach is necessary and appropriate for handheld engines in order to provide us with sufficient assurance that the ABT program will not contribute to a significant delay in implementation of the low-emitting technologies envisioned under the Phase 2 program. As noted earlier, we agree with commenters who were concerned that under the proposed program manufacturers could certify marginally cleaner engines that don't implement a low-emitting technology against the relatively high first year phase in standards and generate enough credits to significantly delay implementation of technologies meeting the long term standards (i.e., 50 g/kW-hr for Classes III and IV and 72 g/kW-hr for Class V) for a significant portion of the fleet. Selection of the 72 g/kW-hr cut off level will significantly mitigate this undesirable risk, without unfairly disrupting the production plans or punishing manufacturers who are already targeting their engines to emit below those levels in the near term in order to meet the California ARB's standards.

With regard to the generation of early credits from engines produced prior to the effective date of the Phase 2 regulations, we are not adopting provisions to allow such retroactive credit generation. We believe the early credit provisions as adopted allow for sufficient opportunity to generate early credits. In addition, allowing credits from engines certified prior to the effective date of the Phase 2 standards would require some additional verification and certification that the engines produced before the effective date are exactly identical to Phase 2 engines certified and produced after the effective date of the Phase 2 standards and comply with such standards. We

do not believe that the increased burden on EPA and the manufacturers and, potentially, consumers, to provide and verify such assurance is sufficient to adopt early credit provisions that allow for pre-Phase 2 credit generation.

2.3 Cross-class Averaging

2.3.1 Summary of the Proposal

The July 1999 SNPRM contained provisions to allow manufacturers to average credits across all classes of small SI engines, including nonhandheld engines and handheld engines.

2.3.2 Summary of the Comments

Echo (Item IV-D-37, page 5) comments that they do not support cross-class averaging based on concerns that a manufacturer could sell a Class I 4-stroke product and use the credits to sell a higher emitting 2-stroke design, creating a significant cost differential. Instead of the proposed cross-class averaging provisions, Echo recommended that cross-class averaging be limited to Class III, IV and V (i.e., handheld engines) and to Classes I-A, I-B, I and II (i.e., nonhandheld engines). Suzuki Motor Corporation (Item VI-D-06, page 2) comments that they support cross-class averaging and believe that the standards are sufficiently stringent to prevent a manufacturer from unreasonably delaying the introduction of clean technologies in one engine class by using windfall credits from another engine class.

2.3.3 EPA Response to the Comments

We are adopting the cross-class averaging provisions as proposed in the July 1999 SNPRM. Given the stringency of the Phase 2 standards for both handheld engines and nonhandheld engines and the limited number of manufacturers that sell in both markets, and in light of the limitations on early banking and credit life we are adopting in the final rule in response to the California ARB's and John Deere's comments, we do not believe that there is any significant ability for manufacturers to generate credits from one handheld engine class and significantly delay compliance with the handheld engine requirements, or vice versa. We plan to monitor the ABT program once the Phase 2 standards take effect and make sure it is not being abused. If we learn that manufacturers are able to generate significant amounts of credits in one class that result in inappropriate delay of transition to lower emitting technology in other classes, or if other currently unexpected factors arise that indicate there will be a delay in such transition, we could at that point consider whether further amendments to the Phase 2 program are needed.

2.4 Credit Deficits

2.4.1 Summary of the Proposal

Under the July 1999 SNPRM, a manufacturer would have had to show that it meets the Phase 2 standards in each class on average. In order to demonstrate compliance through the use of the ABT program, a manufacturer would need to have zero or more credits at the end of the

model year. Except for situations arising from a PLT failure or SEA failure, a manufacturer would not be allowed to carryover a negative balance of credits from one model year to the next.

2.4.2 Summary of the Comments

PPEMA (Item VI-D-07, page 11) commented that manufacturers should be allowed to carry ahead negative credit balances without penalty as long as the manufacturer makes up the deficit within the next two years. Stihl (Item IV-D-45, page 5) commented that manufacturers should be allowed to carry a negative credit balance into the next year as long as the manufacturer makes up any deficit by the end of the next year.

2.4.3 EPA Response to the Comments

We are adopting the credit deficit provisions as proposed in the July 1999 SNPRM. We believe that a manufacturer should have to meet the average standards in a given model year. Allowing manufacturers to carry over a credit deficit would allow manufacturers to not meet the average standards in a given model year and could provide such a manufacturer with a competitive advantage compared to another manufacturer that is complying with the standards and has a positive credit balance. (It should be noted that manufacturers will be allowed to carry over a negative credit balance if it arises due to a noncompliance determined as a result of the PLT program or SEA program.)

2.5 FEL Upper Limits

2.5.1 Summary of the Proposal

Under the proposed ABT program, a manufacturer would have to set a family emissions limit (FEL) for each participating engine family. The July 1999 SNPRM proposed FEL upper limits based on a combination of the Phase 1 HC and NOx standards.

2.5.2 Summary of the Comments

Husqvarna/FHP (Item VI-D-08, pages 110-111) supported the proposed FEL upper limits. Tecumseh (Item VI-G-05, page 2) commented that the FEL upper limits should be raised to account for the differences between the Phase 1 and Phase 2 programs (i.e., the full life certification and deterioration requirements, and the new weighting of the certification test modes under the Phase 2 program (i.e., 85/15 weighting of wide open throttle and idle testing under the Phase 2 program, respectively, instead of the 90/10 weighting currently used in the Phase 1 program)). Tecumseh commented that the FEL upper limits should be raised by 12 percent to account for these differences.

2.5.3 EPA Response to the Comments

We are adopting FEL upper limits that differ from those proposed in response to the comments from Tecumseh regarding the differences between Phase 1 and Phase 2 program and

their impact on certification emissions. While most current engines are certified well below the Phase 1 emission standards, certain engines, especially those certified closer to the Phase 1 standards, could exceed the proposed FEL upper limits under the Phase 2 program, primarily because the new weighting of the individual test modes in Phase 2 will lead to a higher certification level for such engines, and to a lesser extent because of potential deterioration over the useful life that must be accounted for under the Phase 2 program. Therefore, we are adopting FEL upper limits suggested by the manufacturer that are slightly higher than those proposed in the July 1999 SNPRM. We believe the 12 percent increase suggested by Tecumseh to account for the differences between the Phase 1 and Phase 2 programs noted above is a good estimate of the potential emissions impact of the Phase 2 program requirements on currently certified Phase 1 engines. Therefore, the HC+NOx FEL upper limits being adopted with today's action are 336 g/kW-hr for Class III engines, 275 g/kW-hr for Class IV engines, and 186 g/kW-hr for Class V engines.

2.6 Definition of "Modal Power"

2.6.1 Summary of the Proposal

When calculating the number of credits being generated by an engine family, or determining the number of credits needed by an engine family, the manufacturer uses a number of pieces of information including the "power" of the certification engine. In the preamble for the July 1999 SNPRM, EPA notes that "power" refers to maximum modal power of the certification test engine over the certification test cycle.

2.6.2 Summary of the Comments

Stihl (Item IV-D-45, page 7) commented that the term "modal power" is not defined and assumes that the term "modal power" means rated power.

2.6.3 EPA Response to the Comments

We are not making any changes to the term "power" used in calculating credits under the ABT program. As proposed, the term "power" still refers to the maximum modal power of the certification test engine over the certification test cycle. For handheld engines, the certification test cycle is a two mode test procedure (i.e., idle and wide open throttle). For handheld engines, the maximum modal power is the power generated during the wide open throttle mode. Therefore, when performing the certification test, the manufacturer will need to measure the power generated by the engine in the wide open throttle mode. This is the value that will be used in the equation for determining the number of credits generated or needed to be used by that specific engine family.

SECTION 3: COMPLIANCE PROGRAM

3.1 Certification Program

3.1.1 Summary of the Proposal

The July 1999 SNPRM contained the provisions regarding how manufacturers would certify their Phase 2 engines with EPA. The proposed provisions for handheld engines were based on the provisions previously adopted for nonhandheld engines in March 1999. In addition, the proposed certification requirements were harmonized with the requirements of the California ARB's regulations for 2000 and later model year small off-road engines. Under the proposed certification provisions, manufacturers of handheld engines would be required to demonstrate that their regulated engines comply with the appropriate emission standards throughout the useful life of the engine family. To account for emission deterioration over time, manufacturers would need to establish deterioration factors for each regulated pollutant for each engine family. Manufacturers would be able to establish deterioration factors by using bench aging procedures which appropriately predict the in-use emission deterioration expected over the useful life of an engine or an in-use evaluation which directly accounts for this deterioration. As is the case with many of our mobile source regulations, the multiplicative deterioration factors could not be less than one. Additionally, where appropriate and with suitable justification, deterioration factors could be carried over from one model year to another and from one engine family to another. As with the Phase 1 program, manufacturers would be allowed to submit Phase 2 certification applications to us electronically, either on a computer disk or through electronic mail, making the certification application process efficient for both manufacturers and for us.

3.1.2 Summary of the Comments

OPEI (Item VI-D-05, page 9) supported the proposed more straightforward certification program. They also supported the proposal to allow either bench or field aging to establish deterioration factors, and the ability to carryover deterioration factors from one model year to the next and from one engine family to another. Husqvarna/FHP (Item VI-D-08, pages 107-108) generally supported the proposed certification program requirements, although they asserted that efforts to harmonize with the California ARB requirements will be of little value if EPA adopts standards more stringent than the California ARB requirements.

3.1.3 EPA Response to the Comments

We are finalizing the certification program provisions as proposed. We continue to believe that even with the final phase in standards being more stringent than the California ARB standards, there is some benefit to manufacturers of having harmonized certification requirements.

3.2 Production Line Testing (PLT) Program

3.2.1 Summary of the Proposal

The July 1999 SNPRM contained provisions that would require manufacturers to conduct manufacturer-run testing programs using the Cumulative Summation Procedure (CumSum). The CumSum program would require manufacturers to conduct testing on each of their engine families (unless they were relieved of this requirement under the flexibility provisions). The maximum sample size that would be required for each engine family is 30 engines or 1 percent of a family's projected production, whichever is smaller. However, the actual number of tests ultimately required would be determined by the results of the testing. The proposed PLT requirements contained in the July 1999 SNPRM for handheld engines mirrored the provisions of the PLT program adopted in March 1999 for nonhandheld engines. In addition, the provisions of the proposed PLT program were the same as the corresponding program implemented by the California ARB. This would allow manufacturers to use the same procedures for testing production engines for both agencies. Manufacturers would be able to submit PLT reports to us electronically, either on a computer disk or through electronic mail, which will save time and money for both the engine manufacturers and for us.

As proposed, manufacturers would be allowed, for a limited amount of production, to use ABT credits to offset the estimated excess emissions of previously produced noncomplying engine designs as determined in the PLT program. (The amount of excess emissions would be determined based on the difference between the new FEL established by the manufacturer as a result of the PLT program and the original FEL established prior to the PLT program.) A manufacturer would be allowed to raise the FEL for one engine family per model year. If a PLT program failure required a manufacturer to raise the FEL for more than one engine family per model year, the manufacturer could do so only if the applicable engine family represents no more than ten percent of the manufacturer's production for that model year. For any additional engine families that are found to be in noncompliance as a result of the PLT program, the engine manufacturer would need to conduct projects approved by EPA that were designed to offset the excess emissions from those engines.

3.2.2 Summary of the Comments

OPEI (Item VI-D-05, pages 9-10) and Husqvarna/FHP (Item VI-D-08, pages 106 and 111) supported the PLT program. However, both of these commenters, along with PPEMA (Item VI-D-07, pages 14-16) and Stihl (Item IV-D-45, pages 6-7), asserted that the limitations on the ability of manufacturers to modify FELs (as a result of a failed PLT) were unduly restrictive and that a manufacturer should be allowed to use any ABT credits available to it to remedy PLT noncompliance.

3.2.3 EPA Response to the Comments

We are adopting the PLT program as proposed in the July 1999 SNPRM, including the limitations on manufacturers' abilities to use ABT credits to offset PLT noncompliance. We believe a major purpose of the PLT program is to help verify that the engine designs certified by manufacturers have been successfully implemented in the manufacturing process. Therefore, we expect few instances in which manufacturers will need to correct a PLT failure through raising the FEL since that would imply the manufacturer incorrectly set the initial FEL for that family.

Frequent use of this remedy would suggest the manufacturer was incapable of correctly setting the FELs for its product, in which case we would have to reconsider allowing a manufacturer to participate in the ABT program at its option.

With regard to future production of engines identified to be in noncompliance as a result of PLT testing, the manufacturer will be expected to correct the problem causing the emission noncompliance either by changing the production process, changing the design (which will require recertification), or raising the FEL to compensate for the higher emissions (also requiring recertification). In the event a manufacturer raises an FEL as a result of a PLT failure, it can do so for future production as well as past production under the provisions described above, which will require a calculation of the number of credits a manufacturer would need to obtain for the past production engines. It can also be noted that compliance with the applicable standard (or the applicable FEL) will be required of every covered engine. Thus, every engine that failed a PLT test will be considered in noncompliance with the standards and must be brought into compliance. Our rules allowing the use of the average of tests to determine compliance with the PLT program is intended only as a tool to decide when it is appropriate to suspend or revoke the certificate of conformity for that engine family, and is not meant to imply that not all engines have to comply with the standards or applicable FEL.

3.3 Voluntary In-Use Testing Program

3.3.1 Summary of the Proposal

The July 1999 SNPRM contained a voluntary in-use testing program that would give engine manufacturers the option of using a portion of their PLT resources to generate field aged emissions data. At the start of each model year, manufacturers could elect to place up to 20 percent of their engine families in this voluntary program. For those families in this program, manufacturers would not be required to conduct PLT for two model years, the current year and the subsequent year. Instead, manufacturers would place a minimum of three randomly selected production engines in existing consumer-owned, independently-owned, or manufacturer-owned fleets. Manufacturers would install the engines in equipment that represents at least 50 percent of the production for an engine family and age the engine/equipment combination in actual field conditions to at least 75 percent of each engine's regulatory useful life. Once an engine in this program had been sufficiently field aged, the manufacturer would conduct an emissions test on that engine. The results of these tests would then be shared with us. If any information derived from this program indicated a potential substantial in-use emission performance problem, we anticipate that the manufacturer would seek to determine the nature of the emission performance problem and what corrective actions might be appropriate. We would also plan to offer our assistance in analysis of the reasons for unexpectedly high in-use emission performance as well, and of what actions might be necessary or appropriate for reducing such high emissions. Manufacturers would have three calendar years from the date they notify us of their intent to include a family in the voluntary in-use testing program to complete the actual in-use testing.

3.3.2 Summary of the Comments

PPEMA (Item VI-D-07, page 14), OPEI (Item VI-D-05, page 10) and Husqvarna/FHP (Item VI-D-08, page 107) commented that they support the proposed voluntary in-use testing program. In addition, OPEI requested that we clarify that we will never rely on data from the program as the basis of determining the existence of any noncompliance.

3.3.3 EPA Response to the Comments

We are adopting the voluntary in-use testing provisions as proposed. It should be noted that we would not expect to use the data from this program as the primary basis for a noncompliance determination. However, neither could we entirely disregard it, and we could always choose to conduct our own in-use compliance program that could form the primary basis for a noncompliance determination. We would expect to conduct such a test program separate from this voluntary manufacturer testing program, to further enable us to determine whether a specific group of engines is complying with applicable in-use standards.

3.4 Selective Enforcement Audits (SEAs)

3.4.1 Summary of the Proposal

As part of the July 1999 SNPRM, we proposed a Phase 2 SEA program for handheld engines. The SEA program would allow EPA to go to a manufacturer's production facilities, pull engines off the assembly line and have them emission tested. If an engine family is determined to be in noncompliance as a result of an SEA, the manufacturer would be required to address the noncompliance situation. EPA proposed to allow manufacturers to use limited number of ABT credits to offset SEA noncompliance situations.

3.4.2 Summary of the Comments

PPEMA (Item VI-D-07, page 16) and OPEI (Item VI-D-05, pages 11-12) submitted comments that argued EPA should eliminate any restriction on the retroactive use of ABT credits for SEA failures. In addition, OPEI claimed that the July 1999 SNPRM was silent on how a manufacturer would offset SEA noncompliance emissions, and requested that EPA include language from the March 1999 FRM for nonhandheld engines stating that a mandatory recall is impractical. OPEI also commented that EPA should state that we will not implement any recall unless a manufacturer has no ABT credits and is completely unwilling to work with EPA to find alternative remedies.

3.4.3 EPA Response to the Comments

We are adopting the SEA provisions as proposed, including the limitations on the retroactive use of ABT credits for SEA failures. We believe the main purpose of an SEA program is to determine whether the engine designs certified by manufacturers have been successfully implemented by manufacturers in the manufacturing process. Therefore, in contrast to the PLT program being adopted today, we do not believe manufacturers who fail an SEA should have the automatic option of using ABT credits to remedy noncomplying engines already

introduced into commerce. The PLT program is designed to allow a manufacturer to continually evaluate its entire production and quickly respond to the results throughout the model year. We believe that allowing a manufacturer to use credits, for a limited amount of engines, to remedy past production emission failures is consistent with the continual evaluation provided by the PLT program. The SEA program, in contrast, is designed to be a one time, unannounced inspection of a manufacturer's production line with definitive passing or failing results. We believe that in this type of a compliance program, where at most only a few engine families might be tested each year, manufacturers must place more emphasis on the transition from certification to the production line and must set initial FELs accurately. Therefore, to encourage accurate FEL settings at the time of certification, the SEA program adopted today will not allow manufacturers to automatically remedy SEA failures by retroactively adjusting FELs. We continue to believe the remedies for an SEA failure will be best determined on a case-by-case basis which may or may not include the use of ABT credits, in our judgment, depending upon our assessment of the specific case.

It should be noted that we did finalize in-use noncompliance provisions for Phase 2 engines as part of the March 1999 final rule for nonhandheld engines (see 64 FR 15208: Subpart I, section 90.808). These provisions will now apply to Phase 2 handheld engines as well. Under these provisions, if we determine that a substantial number of engines within an engine family, although properly used and maintained, do not conform to the appropriate emission standards, the manufacturer will be required to remedy the problem and conduct a recall of the noncomplying engine family as required by CAA section 207. However, we also recognize the practical difficulty in implementing an effective recall program as it would likely be impossible to properly identify all of the owners of equipment using small engines (there is no national requirement to register the ownership of such equipment), and it is also highly questionable whether all owners or operators of such equipment would respond to an emission-related recall notice. Therefore, under the final program, our intent is to generally allow manufacturers to nominate alternative remedial measures to address most potential non-compliance situations, as the January 1998 NPRM discussed (see 63 FR 3992). We expect that, if successfully implemented, the use of appropriate alternatives should obviate the need for us to make findings of substantial nonconformity under section 207. In evaluating manufacturer-nominated alternatives, we would consider those alternatives which (1) represent a new initiative that the manufacturer was not otherwise planning to perform at that time and that has a nexus to the emission problem demonstrated by the subject engine family; (2) cost substantially more than foregone compliance costs and consider the time value of the foregone compliance costs and the foregone environmental benefit of the subject family; (3) offset at least 100 percent of the exceedance of the standard or FEL; and (4) are able to be implemented effectively and expeditiously and completed in a reasonable time. These criteria would guide us in evaluating projects to determine whether their nature and burden is appropriate to remedy the environmental impact of the nonconformity while providing assurance to the manufacturer that we would not require excessive projects.

In addition to being evaluated according to the above criteria, alternatives would be subject to a cost cap. We would expect to generally apply a cost cap of 75 percent above and beyond the foregone costs adjusted to present value, provided the manufacturer can appropriately

itemize and justify these costs. We believe that this is an appropriate value that, in most cases, should be both "substantial" and sufficient to encourage manufacturers to produce emission durable engines. In light of our intent to follow this general approach, we believe it is not necessary or appropriate for us to simply announce that we will never order a recall for a manufacturer with ABT credits or one who has shown some willingness to find an alternative remedy. Determinations for individual manufacturers will have to be made on a case-by-case basis, and it is possible that in a specific case a recall would be an appropriate remedy that should not be arbitrarily ruled out.

SECTION 4: FLEXIBILITIES

4.1 Flexibilities for Small Volume Engine Manufacturers and Small Volume Engine Families

4.1.1 Summary of the Proposal

The July 1999 SNPRM contained a number of proposed flexibilities to help small volume engine manufacturers and small volume engine families transition to the Phase 2 standards. The three proposed flexibilities available to both small volume handheld engine families and small volume handheld engine manufacturers were as follows. First, the eligible family or manufacturer could certify to Phase 1 standards and regulations until the third year after the end of the Phase 2 implementation schedule. Such engines would be excluded from the ABT program until they were certified to the Phase 2 standards. Second, once subject to the Phase 2 standards, the eligible family or manufacturer could certify using assigned deterioration factors. Third, the eligible family or manufacturer could elect to not participate in the Phase 2 PLT program, however, the SEA program would still be applicable. The July 1999 SNPRM discussed these flexibilities at 64 FR 40956-40957. EPA requested comments on the proposed flexibilities. (The July 1999 SNPRM also proposed criteria for determining whether a specific engine family was a small volume engine family or whether an engine manufacturer was a small volume engine manufacturer.)

4.1.2 Summary of the Comments

PPEMA commented that they support the proposed flexibilities (Item VI-D-07, page 11).

OPEI commented that they generally support the proposed flexibilities (Item VI-D-05, page 12).

The California ARB commented that they question the need for such extensive manufacturer flexibilities , since in their view the averaging program provides the necessary flexibility (Item VI-G-21, page 4). Small volume engine families should not be exempt until three years after Phase 2 takes effect, since California ARB believes this encourages manufacturers to differentiate engine families with the sole purpose of avoiding regulation.

Husqvarna/FHP commented that they generally support the proposed flexibilities. They support exclusion of small volume engine families from the PLT program (Item VI-D-08, pages 111, 106).

4.1.3 EPA Response to the Commenters

We are retaining the three flexibilities for small volume handheld engine families and small volume handheld engine manufacturers as proposed with one adjustment. The flexibilities that are available are as follows: First, the eligible family or manufacturer can certify to Phase 1 standards and regulations until the third year after the end of the Phase 2 implementation schedule. Because we are adopting a four year implementation schedule instead of a five year

schedule as proposed in the July 1999 SNPRM, small volume engine families or small volume engine manufacturers will have until the 2008 model year for Classes III and IV and the 2010 model year for Class V engines to comply with the Phase 2 standards. Such engines will be excluded from the ABT program until they are certified to the Phase 2 standards. Second, once subject to the Phase 2 standards, the eligible family or manufacturer can certify using assigned deterioration factors. Third, the eligible family or manufacturer can elect to not participate in the Phase 2 PLT program, however, the SEA program will still be applicable.

Given the stringency of the newly adopted standards for handheld engines, we expect the major engine manufacturers will choose to modify their small volume engine families last as these often represent niche markets. Additionally, these niche applications may represent some of the more difficult engine applications due to their unique requirements. We do not agree that the presence of the ABT program will necessarily provide sufficient flexibility to avoid engine manufacturers from deciding to stop production for these niche markets entirely. The experience gained in designing, producing and getting in-use feedback on engine family designs with large production volumes should be helpful in minimizing the cost and assuring the performance of the small volume engines. Similarly, the design challenges for the small volume engine manufacturer due to the stringent Phase 2 standards are expected to be significant and, given the limited resources of such manufacturers, suggest that more time to accomplish the transition to Phase 2 standards is warranted. We expect manufacturers will take advantage of the extra time to smooth the transition to Phase 2 standards by bringing the small volume engines into compliance throughout this time period. Due to the fact that circumstances vary greatly from one manufacturer to another, we believe it would be inappropriate to mandate a percent phase-in schedule or some other mandatory rate of phase-in for these small volume engine families and small volume engine manufacturers. Therefore, we are adopting only a final compliance requirement that is effective three years after the end of the Phase 2 phase-in schedule. We believe that a three year delay is appropriate based on discussions with manufacturers and given the number of engine families expected to be eligible for the proposed flexibilities, even with the final implementation schedule.

4.2 Small Volume Engine Family Definition

4.2.1 Summary of the Proposal

In order to qualify as a small volume engine family and be eligible for the flexibilities described earlier, we proposed in the July 1999 SNPRM that a handheld engine family would need to have an annual production level of no more than 5,000 engines.

4.2.2 Summary of the Comments

Husqvarna/FHP commented that the cutoff should be raised to 10,000 (Item VI-D-08, page 113). They asserted that this flexibility is critical to manufacturers with a large number of small volume engine families and would reduce the risk of loss in engine availability without appreciably diminishing the environmental benefits of the rule. Under Husqvarna/FHP's proposal, more than 95% would be covered by the full compliance program, based on PSR data,

according to Husqvarna/FHP.

4.2.3 EPA Response to the Commenters

We believe it is important to set the cutoff level for small volume engine family at a level which provides relief to those manufacturers which genuinely need the relief the flexibilities allow. Given the other provisions being adopted today, including the four year implementation schedule and the ABT program, we continue to believe that the 5,000 unit level for determining whether an engine family is a small volume engine family is most appropriate. Therefore, we are adopting the definition of small volume engine family as contained in the July 1999 SNPRM that includes the annual production cap to 5,000 units for handheld engine families. Based on the cutoff being adopted today, we estimate that 98 percent of handheld engines will still be covered by the full compliance program and subject to the earliest practical implementation of the Phase 2 rule.

4.3 Flexibilities for Small Volume Equipment Manufacturers and Small Volume Equipment Models

4.3.1 Summary of the Proposal

In the July 1999 SNPRM, we proposed three flexibilities aimed at assuring the continued supply under the Phase 2 regulations of engines for unique, typically small volume equipment applications. The three proposed flexibilities available to equipment manufacturers and small volume equipment models under the Phase 2 program for handheld engines were as follows. First, small volume equipment manufacturers would be allowed to continue using Phase 1 compliant engines through the third year after the last applicable phase-in date of the final Phase 2 standards for that engine class if the equipment manufacturer was unable to find a suitable Phase 2 engine before then. Second, individual small volume equipment models would be allowed to continue using Phase 1 compliant engines throughout the time period the Phase 2 regulation is in effect if no suitable Phase 2 engine was available and the equipment was in production at the time we adopted the Phase 2 rules. (If the equipment was "significantly modified" in the future then this exemption would no longer apply.) Third, a hardship provision would be available that allows any equipment manufacturer, regardless of size, for any of its applications, regardless of size, to continue using a Phase 1 engine for up to one more year beyond the last phase-in of the final standard for that engine class if the requirement to otherwise use a Phase 2 compliant engine would cause substantial financial hardship that seriously threatens the continued viability of the manufacturer.

4.3.2 Summary of the Comments

PPEMA commented that they support the proposed flexibilities (Item VI-D-07, page 12).

OPEI commented that they generally support the proposed flexibilities (Item VI-D-05, page 12).

MEPCO commented that they are aware of significant confusion and uncertainty in the auger industry about the equipment flexibilities (Item VI-G-13, page 2). EPA should write the final regulations with sufficient clarity and specificity such that anyone will know immediately, and without question, what they mean.

4.3.3 EPA Response to the Comments

Because all of the comments received on this issue supported the proposed flexibilities, we are retaining the flexibilities as proposed with one minor change. The three flexibilities that will be available to equipment manufacturers and small volume equipment models under the Phase 2 program for handheld engines are as follows. First, small volume equipment manufacturers will be allowed to continue using Phase 1 compliant engines through the third year after the last applicable phase-in date of the final Phase 2 standards for that engine class if the equipment manufacturer is unable to find a suitable Phase 2 engine before then. (because we are adopting a four year phase in schedule instead of a five year phase in, the actual year this flexibility expires is one year earlier than was proposed.) Second, individual small volume equipment models will be allowed to continue using Phase 1 compliant engines throughout the time period the Phase 2 regulation is in effect if no suitable Phase 2 engine is available and the equipment is currently in production at the time we are adopting these Phase 2 rules. If the equipment is "significantly modified" in the future then this exemption will end, because we believe design accommodations can and should be made during such a modification to accept an engine meeting Phase 2 standards. Third, a hardship provision will be available that allows any equipment manufacturer, regardless of size, for any of its applications, regardless of size, to continue using a Phase 1 engine for up to one more year beyond the last phase-in of the final standard for that engine class if the requirement to otherwise use a Phase 2 compliant engine will cause substantial financial hardship. This hardship provision is intended to cover those extreme and unanticipated circumstances which, despite the equipment manufacturer's best efforts, place it in a situation where a lack of Phase 2 complying engines will cause such great harm to the company that the ability of the company to stay in business is at stake. It is not intended to protect an equipment manufacturer against any financial harm or potential loss of market share. It should be noted that the flexibilities for small volume equipment manufacturers and small volume equipment models being adopted today are for equipment manufacturers only and cannot be used by engine manufacturers who also manufacture equipment. (Engine manufacturers may use, as applicable, the flexibilities for small volume engine manufacturers and small volume engine families noted above.)

4.4 Small Volume Equipment Model Definition

4.4.1 Summary of the Proposal

In the July 1999 SNPRM, we proposed that the small volume equipment model definition would cover handheld models of 2,500 or less annual production.

4.4.2 Summary of the Comments

PPEMA commented that due to the vertically integrated nature of the handheld engine/equipment industry, EPA should set the cut off for small volume equipment model at 5,000 (the same as the small volume engine family) (Item VI-D-07, page 12).

OPEI commented that because of the vertically integrated nature of the handheld industry, EPA should set the cut off for small volume equipment model at 5,000 (the same as the small volume engine family) (Item VI-D-05, page 12).

Tecumseh commented that EPA should raise the cut off for small volume equipment model to 5,000 (the same as the cutoff for small volume engine family) (Item VI-G-05, page 3).

Husqvarna/FHP commented that EPA should increase the cut off for small volume equipment model to 5,000 to better preserve the availability of niche products (Item VI-D-08, page 113).

4.4.3 EPA Response to the Comments

Because many of the small volume equipment models use engines specifically designed for that application (i.e., small volume engine families), we believe it would be beneficial to set the cutoff for the small volume handheld engine family and small volume handheld equipment model at the same level. Therefore, with today's action, we are revising the small volume equipment model definition by increasing the cutoff to 5,000 units or less of annual production. Providing the flexibility for small volume equipment models (as described earlier in section 4.3) should allow significant relief to equipment manufacturers while at the same time assuring the vast majority of equipment uses the lowest emitting engines available.

4.5 Assigned DFs

4.5.1 Summary of the Proposal

Under the flexibilities proposed in the July 1999 SNPRM, handheld engine manufacturers would be allowed the option of using assigned deterioration factors established by EPA in the regulations. The deterioration factors, either assigned or generated, would be used to determine whether an engine family complies with the applicable emission standards in the certification program, the PLT program, and the SEA program. The proposed assigned deterioration factors were 1.1 for HC+NOx for two-stroke engines in Classes III-V, 1.1 for CO from two-stroke engines in Classes III-V, 1.5 for HC+NOx for four-stroke engines, and 1.1 for CO from four stroke engines.

4.5.2 Summary of the Comments

Husqvarna/FHP commented that they find the assigned DFs proposed by EPA in the SNPRM to be acceptable for known or existing commercialized technologies (Item VI-D-08,

page 116). However, DFs cannot be assigned to new technologies without testing to ensure they are an accurate reflection. Therefore, they urge EPA to adopt assigned DFs only for known or existing commercialized technologies.

Stihl commented that the California ARB Tier 2 certification data shows every conventional 2-stroke has a DF < 1.0 and therefore they suggest an assigned DF of 1.0 for all conventional 2-strokes without a catalyst (Item IV-D-45, pages 3-4).

4.5.3 EPA Response to the Commenters

We agree with the comment that new technologies which have yet to be developed should not automatically be allowed to use the assigned deterioration factors specified as part of the flexibility regulations. However, based on data from currently available and tested technologies, such as current 4-stroke engines, standard 2-stroke designs (i.e., 2-stroke designs certified under the Phase 1 program), the compression wave technology, and the stratified scavenging with lean combustion design, we believe the assigned deterioration factors as proposed are appropriate. Therefore, we are revising the regulations to note that the assigned deterioration factors may be used by 4-stroke engines, standard 2-stroke designs, the compression wave technology, and the stratified scavenging with lean combustion design. A manufacturer that would like to use assigned deterioration factors for any other technology would need to make a request to us. We would then, with the assistance of the requesting manufacturer, determine whether the existing assigned deterioration factors were appropriate or alternative factors better represented the expected deterioration of the technology.

SECTION 5: MISCELLANEOUS ISSUES

5.1 Definition of Handheld Engines

5.1.1 Summary of the Proposal

In a separate February 3, 1999 NPRM, we proposed to modify the criteria used for determining whether an engine could be classified as handheld. The proposed change was made in response to comments from Honda and others. Under the February 1999 NPRM, a manufacturer would have been permitted to exceed the current handheld engine weight limit of 14 kilograms (kg), or 20 kg for augers, in cases where the manufacturer could demonstrate that the extra weight was the result of using a 4-stroke engine or other technology cleaner than the otherwise allowed 2-stroke engine. As proposed, the revised handheld definition would have been applicable for the remainder of Phase 1 and would also apply for the Phase 2 program. In the July 1999 SNPRM, we retained the existing definition of handheld engine as was in effect for Phase 1 but directed readers to the February 1999 NPRM noting that we had proposed a modification to the definition that, if adopted, would apply for Phase 2.

5.1.2 Summary of the Comments

We did not receive comments objecting to the February 1999 NPRM. We received several comments on the July 1999 SNPRM from manufacturers of handheld engines and equipment as well as two trade associations urging us to raise the weight limits for all handheld equipment. PPEMA (Item VI-D-07, page 7), OPEI (Item VI-D-05, page 5), Stihl (Item IV-D-45, page 3), and Echo (Item IV-D-37, pages 2 and 5) suggested that the weight limit should be raised to 20 kg for all types of equipment but provided no supporting information to explain why that would be a more appropriate cutoff. OPEI and Husqvarna/FHP (Item VI-D-08, pages 113, and 119 through 120) commented that it was not appropriate to provide exceptions to the existing weight limit based on engine technology and that all technologies should be treated the same. Tecumseh (Item VI-G-05, page 3) commented that the treatment afforded augers and compact snow throwers should remain unchanged. PPEMA commented that the cutoff for one person augers should be 22 kg. As an alternative to the use of weight limits, the California ARB (Item VI-G-21, page 3) suggested that we drop the concept of handheld and nonhandheld engines altogether and simply adopt a displacement-based cutoff (at 65 cc) as they have done.

5.1.3 EPA Response to the Comments

We are finalizing the change to the handheld engine definition we proposed in the February 1999 NPRM because we believe it is important from a public policy perspective to prevent situations where manufacturers are prevented from using cleaner engines because they happen to be slightly heavier. We believe it is reasonable to provide an exception to the weight limit to prevent this undesirable situation and to remove any regulatory hurdles to the development of cleaner technologies. We do not believe it is appropriate to change the weight limit for all types of equipment. The commenters have not provided justification to substantiate the need and further, we did not propose or request comment on an across-the-board change and

thus we believe that to make such a change would be beyond the scope of this final rule. As we explain in the preamble text to the February 1999 NPRM, we considered raising the weight limit across the board to address the situation presented by the four-stroke equipment, but we are concerned that such a broad increase "...could, in the long run, encourage manufacturers to convert four-stroke nonhandheld equipment to two-stroke power."

In response to the California ARB comment on dropping the handheld/nonhandheld classifications, while this might promote greater harmony between the Federal and California programs, we did not propose or request comment on such a program structure. Therefore a change to a displacement-based cutoff would be beyond the scope of this final rule. We believe that reasonable harmony will still exist between the Federal and California programs because we have added a Class IA for nonhandheld engines in this Phase 2 rule for handheld engines. Class IA covers engines up through 65 cc that are used in nonhandheld equipment.

5.2 Engine Labeling

5.2.1 Summary of the Proposal

In the July 1999 SNPRM, we proposed that manufacturers would be required to state the useful life hours on the engine label. We also proposed an alternative labeling option under which engine manufacturers could use a designator of useful life hours (e.g., A, B, or C) and then include words on the label which would direct the consumer to the owner's manual for an explanation of the meaning of the useful life designator. Finally, the July 1999 SNPRM contained provisions to allow other labeling options provided the Administrator determined that such options satisfied the information intent of the label. This proposed option was intended to allow for the nationwide use of the California labeling system provided it is appropriate for Federal use. We also noted that in evaluating the adequacy of an alternative label, we would consider the extent to which the manufacturer's alternative engine label combined with other readily accessible consumer information adequately informed the consumer of the emission performance of the engine. The labeling requirements contained in the July 1999 SNPRM for handheld engines were the same as those adopted in the March 1999 final rule for nonhandheld engines.

5.2.2 Summary of the Comments

OPEI (Item VI-D-05, page 13) commented that EPA should state its intention to drop certain boilerplate language requirements and to allow the use of the California labeling system nationwide. Stihl (Item IV-D-45, page 4) noted that EPA requires terms such as "category A, B, or C while CARB allows alternate terms, such as moderate, intermediate, and extended". Stihl commented that EPA should have the same allowances as CARB for the engine label. Echo (Item IV-D-37, page 5) commented that the July 1999 SNPRM preamble is not clear on the use of an air index tag or label to convey durability, as the California ARB allows. If the California ARB's method is acceptable, the regulations should be revised to say so. Finally, Husqvarna/FHP (Item VI-D-08, page 115) commented that they do not believe that putting useful life information on the product label is meaningful to consumers. However, if it is required,

Husqvarna/FHP commented that they support the additional labeling flexibility proposed in the July 1999 SNPRM.

5.2.3 EPA Response to the Comments

We continue to believe the approach to labeling proposed in the July 1999 SNPRM is appropriate and we are adopting the labeling provisions as contained in the July 1999 SNPRM. Therefore, a manufacturer can either state the useful life hours on the engine label, or use a designator of useful life hours (e.g., A, B, or C) and then include words on the label which directs the consumer to the owner's manual for an explanation of the meaning of the useful life designator. Finally, with respect to the California ARB's labeling system, a manufacturer could seek our approval to use the California ARB labeling system on a case by case basis. Based on the current California ARB labeling system, we plan to approve such requests , provided the California System remains appropriate for Federal use. We are not revising the regulations to specifically allow for the California ARB labeling system due to the possibility that the California ARB could amend its labeling system in the future in a manner which we would find unacceptable, requiring us to revise our labeling regulations.

5.3 Emissions Warranty

5.3.1 Summary of the Proposal

Under the Phase 1 regulations, the base emission performance warranty extends for a period of two years of engine use from the date of sale. However, after the original Phase 2 NPRM was issued in January 1998, manufacturers of handheld engines indicated to us that there are applications, particularly for commercial equipment, in which the useful life hours of the entire piece of equipment can be surpassed in one year of typical in-use operation. Therefore, in the July 1999 SNPRM we proposed an option whereby manufacturers of handheld engines could request approval from us to adopt an emission warranty period of one year if they could demonstrate such a shorter warranty period would be appropriate for that engine/equipment combination.

5.3.2 Summary of the Comments

We received comments from PPEMA (Item VI-D-07, pages 12-13) and OPEI (Item VI-D-05, page 13) supporting a warranty period of less than two years, and suggesting that we should allow manufacturers to restrict the warranty coverage to less than one year if the product's normal life is less than one year. Two handheld engine manufacturers, including Stihl (Item IV-D-45, page 7), Husqvarna / FHP (Item VI-D-08, page 109) commented that manufacturers should be allowed to select a warranty period of less than one year, noting that there are some handheld applications which will reach their expected useful life level in as little as 90 days. In addition, we received a comment from Honda (Item VI-D-01, page 3) that this special warranty provision should be available to all classes of small SI engines at or below 19 kW.

5.3.3 EPA Response to the Comments

With today's action, we are finalizing provisions for handheld engines only that would allow a manufacturer to request approval from us to adopt an emissions warranty period of less than two years if the manufacturer can demonstrate such a shorter warranty period is appropriate for that engine/equipment combination. In order to demonstrate that a shorter period is warranted, the manufacturer would need to submit information satisfactory to us demonstrating that the regulatory useful life is reached in less than two years for the typical piece of equipment.

Normally, when we have established emission warranty periods, we have established both a years requirement and a second requirement based on hours of use (or miles in some cases). The emissions warranty lasts until one of the two levels, either years or hours, is reached. However, under the Phase 1 rule for small SI engines, we established only a years requirement for the emissions warranty because there was no useful life requirement under Phase 1 and also because handheld equipment is not equipped with an hour meter. By making this change for handheld engines, and requiring manufacturers to submit information showing that a shorter warranty period is justified, we believe the emissions warranty period will not require a manufacturer to be liable for emissions performance of equipment beyond its regulatory useful life. Alternatively, we are also adopting a provision that would allow a manufacturer to request that the emissions warranty period be the shorter of two years or the regulatory useful life if the engine/equipment is equipped with an hours meter that ensures verification of hours of use.

At this time, these changes to the emission warranty period will only apply to handheld engines. We did not propose such a change for nonhandheld engines in the July 1999 SNPRM and we have not received any information suggesting that such a change for nonhandheld engines is necessary or appropriate at this time other than the unsubstantiated comment from Honda.

5.4 Certification Test Fuel

5.4.1 Summary of the Proposal

The current regulations for small SI engines specify that manufacturers must use a certification test fuel that meets the requirements noted in the regulations (see §90.308(b) for the actual requirements). In addition, under the Phase 1 program, we have provided guidance that allows manufacturers to certify using California Phase II reformulated gasoline if they quantify the emissions impact on CO and suggest a correction factor.

5.4.2 Summary of the Comments

Echo (Item IV-D-37, page 5) commented that we should allow manufacturers to use California Phase II fuel for certification without requiring a CO correction factor. They noted that previous studies have shown the factor for CO is 1.0 and noted that we have stated that CO is not a major concern in non-attainment areas in the summer.

5.4.3 EPA Response to the Comments

At this time we do not believe we can change the provisions governing the use of California Phase II fuel for certification purposes. As a result of the Phase 2 requirements being finalized for handheld engines, we expect a significant change from the current two-stroke engine designs. Without information on how emissions from a Phase 2 handheld engine tested with California's Phase II reformulated gasoline will compare to the emissions of that same engine tested on Indolene, we cannot grant blanket approval for use of the California Phase II fuel and drop the CO correlation requirement. Therefore, we are unable to make a change in the certification test fuel requirements in response to Echo's comment.

5.5 High Altitude Conversion Kits

5.5.1 Summary of the Proposal

Manufacturers are currently required by the Phase 1 rule to certify engines for use at any altitude, but the rule does not specifically address separate high altitude and low altitude configuration testing. The need for the high altitude modifications has been a topic of recent discussions between us and manufacturers. To allow an engine to perform properly and meet emission standards while being operated at high altitudes, many manufacturers have developed special high altitude adjustments or high altitude kits which include replacement of some parts such as carburetor jets. However, if an engine with such a kit installed is operated outside of a high altitude location, the kit would have to be removed and the engine returned to its original configuration for the engine to continue to perform properly and meet emission standards.

Under the July 1999 SNPRM we proposed to allow manufacturers of both handheld and nonhandheld engines to certify an engine for separate standard and high altitude configurations. All engines would be required to meet, under all altitude conditions, the applicable emission standards. The option as proposed would be available for both Phase 1 and Phase 2 handheld and nonhandheld engines. Without such a certification option, we could potentially consider the installation of an altitude kit and other associated modifications as tampering. No test data on engines with high altitude modifications performed would be required as a condition of certification. No special labeling would be required for engines which have such altitude kits certified or for those in-use engines which have had altitude modifications performed. Manufacturers would be required to list these altitude kits with their appropriate part numbers along with all the other certified parts in the certification application. In the application, the manufacturer would have to declare the altitude ranges at which the appropriate kits should be installed on or removed from an engine for proper emission and engine performance. The manufacturer would also be required to include a statement in the owner's manual for the engine or engine/equipment combination (and other maintenance-related literature intended for the consumer) that also declares the altitude ranges at which the appropriate kits must be installed or removed. Finally, the manufacturer, using appropriate engineering judgment which, at the manufacturer's option, could also include test data, would be required to determine that an engine with the altitude kit installed will meet all of the applicable emission standards throughout its useful life. The rationale for this assessment would need to be documented and provided to us

as part of the certification application.

5.5.2 Summary of the Comments

Husqvarna/FHP (Item VI-D-08, page 108) supported the high-altitude certification provisions as proposed. Honda (Item VI-D-01, page 3) recommended that we adopt or accept the high altitude demonstration procedure currently used by the California ARB. Honda also recommended that EPA's application contain a statement of compliance and part number of any part that is replaced of any part that is replaced when using an engine at altitudes above 5,000 feet (instead of allowing the manufacturer to specify the range at which the kits must be installed). Finally, Stihl (Item IV-D-45, page 4) noted that if a manufacturer provides a high-altitude conversion kit, the emissions will be lower due to smaller jets in the carburetor. Therefore, the requested information is not needed. It's only for durability that the original configuration needs to be reinstalled at sea-level. Emissions would be lower at sea-level with the high-altitude kit still in operation.

5.5.3 EPA Response to the Comments

We are retaining the high altitude provisions as proposed in the July 1999 SNPRM without change. In response to Honda's comment regarding the California ARB's high altitude provisions, we are not adopting, nor will we accept, the California provisions for high altitude. The California ARB regulations require "information about high-altitude adjustments, and a engineering evaluation of one engine family within the manufacturer's line that demonstrates the manufacturer's recommended high-altitude adjustments will not increase emissions beyond those of the unadjusted engine at high altitude." We believe this requirement is less stringent than our proposed requirement which requires a manufacturer to make a determination that the engine equipped with the high altitude kit still meets our standard, not that the high-altitude engine doesn't have emission "beyond those of the unadjusted engine at high altitude" which potentially could be above the standard. We also do not believe it is necessary to specify a level at which the high altitude requirement takes effect. Manufacturers have developed such kits already and we believe they have an adequate understanding of when such kits are necessary to be installed to ensure that engines meet the standards at all altitudes. Therefore, we are retaining the provisions that require the manufacturer to establish the altitude range at which the high-altitude should be installed.

In response to Stihl's comments that manufacturers should not need to make a determination that the high-altitude version of the engine complies with the standard, we continue to believe such a determination is necessary. Emissions from an engine equipped with a high-altitude kit will only be at or below the standard version of the engine if the jets in the carburetor are sized appropriately. Therefore, we believe it is important to require than manufacturers make such a determination. (As noted above, no testing is required to meet this determination, although such information would be allowed.)

5.6 Definition of "New" Engine

5.6.1 Summary of the Proposal

Under the current certification requirements (see §90.118(a)(2)), the current SEA requirements (see §90.508(c)), and the proposed PLT requirements (see §90.707(c)), we allow manufacturers to accumulate up to 12 hours of service on a new engine to stabilize emissions before we require a certification, SEA, or PLT test to be performed. If appropriate, a manufacturer may request that the Administrator approve a longer period of time for service accumulation.

5.6.2 Summary of the Comments

Stihl (Item IV-D-45, page 2) commented that to resolve confusion for certification and audits, we should define the term "new" to mean a green engine that has been broken in over a defined duration.

5.6.3 EPA Response to the Comments

We believe that our current requirements specifying the amount of time that may be accumulated before certification, SEA, or PLT testing is sufficiently clear. Therefore, we are not making any revisions to the regulations in response to Stihl's comment.

5.7 Wintertime Exemption/Snowthrower Provisions

5.7.1 Summary of the Proposal

Under the Phase 1 program, engines used in equipment that is used exclusively in wintertime is exempted from complying with the HC and NOx standards. In addition, under the Phase 1 program, snowthrowers are allowed to certify to the handheld engine standards, use Cycle C for certification purposes, and do not need to certify with the HC+NOx standards. In the March 1999 Phase 2 final rule for nonhandheld engines, we adopted the same provisions for "Phase 2 engines." We did not specifically address this issue in the July 1999 SNPRM.

5.7.2 Summary of the Comments

OPEI (Item VI-D-05, pages 4-5) and Tecumseh (Item VI-G-05, page 3) commented that we should continue to allow the same flexibility for products which are used exclusively in wintertime to certify solely to the CO standard. OPEI also commented that we should clarify that snowthrowers will be regulated under the same general framework under the Phase 2 program (i.e., they can meet handheld engine standards, use Cycle C for testing purposes, and they need not certify to the HC and NOx standards.)

5.7.3 EPA Response to the Comments

With the adoption of the Phase 2 requirements for handheld engines, such engines will be subject to the exemptions for equipment that is used exclusively in wintertime, such as

snowthrowers and ice augers, as specified in §90.103(a)(5). In addition, for the Phase 2 program, we are retaining the special provisions that apply to snowthrowers that allow them to certify to the handheld engine standards, use the handheld engine test cycle (i.e., Cycle C) for testing purposes, and not certify to the Phase 2 HC+NOx standards if they choose.

5.8 Snowthrower Test Procedure

5.8.1 Summary of the Proposal

Under the provisions of §90.120, manufacturers may request approval of special test procedures different than the standard test procedures specified in §90.119.

5.8.2 Summary of the Comments

Honda (Item VI-D-01, page 3) commented that we should formalize the test procedure that has been submitted by Honda (i.e., extrapolation of data from an engine tested at a temperature below the prescribed test cell temperature but above the actual temperature experienced in the user's operating environment). It should be used for PLT testing as well. This would eliminate the need for manufacturers to request special test procedure approval every year. Alternatively, Honda commented that we could allow such approvals to be carried over to subsequent model years.

5.8.3 EPA Response to the Comments

We currently approve use of the special test procedures on a case-by-case basis taking into consideration the manufacturer's justification for such a request. While we may have granted approval for one manufacturer to use a special test procedure, another manufacturer with a similar engine or product may or may not believe that the special test procedure is appropriate for its product. We do not believe that we can formalize a special test procedure requested by one manufacturer and apply it to all manufacturers of a similar product without notice and comment of such a change. Therefore, we are not formally adopting the special test procedure for snowthrowers submitted by Honda. It should be noted, that when we approve a special test procedure, that test procedure becomes the test procedure that should be used for all further testing of that product, including PLT testing. Furthermore, as part of the final rule for Phase 2 nonhandheld engines, we revised the special test procedure requirements so that manufacturers can carryover optional test procedures approved during Phase 1 to Phase 2, following advance approval by EPA (see §90.120(c)).

SECTION 6: COST AND COST EFFECTIVENESS

6.1 Handheld Engine Costs

6.1.1 Summary of the Proposal

The July 1999 SNPRM preamble discussed briefly the handheld engine costs analysis. The complete analysis was included in the supplemental draft RIA to the SNPRM. EPA requested comment on its cost effectiveness analysis and on any relevant information that would assist the Agency in revising the analysis as appropriate.

6.1.2 Summary of the Comments

With regard to engine technology costs, Ryobi commented that the current cost differential for a 4-stroke engine (versus a 2-stroke engine) is $15. When production reaches 1 million per year, the cost differential will decrease to $10 (Item IV-D-47, page 3). John Deere commented that they disagree with EPA's cost estimates and reiterates their previous numbers, which they argue support lower cost figures. They note that their royalty schedule was only a proposal and is open to reasonable counteroffers (Item IV-D-48, pages 11-14). Husqvarna/FHP commented that the cost of the compression wave technology in the RIA does not include the cost of ongoing improvements necessary to make the technology viable, nor do they include the cost of catalyst development (Item VI-D-08, pages 84-94, 99 and Appendix B of their comments). Husqvarna asserted that the ICF cost study is outdated and unreliable especially given the more stringent standards proposed and did not address the technologies being considered in the reproposal. Husqvarna/ FHP argued that EPA's cost analysis ignores the variability in the ease in which technologies can be applied and ignores the large variability in production volumes which impacts the per-engine fixed costs. Husqvarna/FHP also referenced a price elasticity study (Item II-D-16) that they claim demonstrates that price is the primary factor in consumer purchasing decisions. Stihl commented that increased costs will put the US at a cost disadvantage compared to other timber producing areas of the world (Item IV-D-45, page 3).

As part of the NERA study, Husqvarna/FHP submitted a list of issues and questions regarding EPA's cost effectiveness analyses of the proposed Phase 2 handheld engine emission standards (Item VI-G-25). The list is included below.

1. NERA requests that EPA explain why the lower bound values for licensing costs were used.
2. NERA requests that EPA clarify the basis for applying the catalyst cost estimate of $6.71 to all engines.
3. NERA requests that EPA explain the basis for the total cost of stratified scavenging of $6.22 (Table 4-09 on page 4-13 of the Supplemental Draft RIA) when a catalyst is estimated to be $6.71.

4a. NERA requests that EPA explain why the additional fuel system costs of the compression wave technology from the Supplemental Draft RIA cost analysis were excluded.

4b. NERA requests that EPA explain the specific estimation process by which additional development costs are included in this $2 million figure.
4c. NERA requests that EPA explain the process by which the Supplemental Draft RIA captures the additional research and development, capital, and other costs associated with accommodating new engine technologies in less common equipment applications.
d. NERA requests that EPA explain why engine design development costs were not estimated for engine changes needed in order to accommodate a catalyst.
4e. NERA requests that EPA explain why the licensing costs (for the technologies of four-stroke and stratified scavenging) were excluded.
4f. NERA requests that EPA explain the basis for the statement in the Supplemental Draft RIA (page 4-3) that the Phase 2 emission control technologies would reduce maintenance costs.
4g. NERA requests that EPA explain the basis for the statement that dealer, technician training, service and consumer manual costs would be covered by an overestimation by EPA of the cost of the Phase 2 standards.
5. NERA requests that EPA explain why the engine and equipment phase-in schedules for Class III engines are different. (Engine models: 2005 (2), 2006 (2), 2009 (3), Equipment models: 2004 (4), 2005 (4), 2009(6))
6. NERA requests that EPA explain how the third "additional" cost component in the total engine variable cost estimate relate to the costs presented in Table 4-09.
7. NERA requests that EPA explain the discrepancy in which the total uniform annualized cost without fuel savings of $331.8 million on page 7-7 or Appendix E Table E-08 cost of $335.6 million.
8. NERA requests that EPA explain the discrepancy that the Class V table in Appendix E, Table E-05, the total column does not equal the horizontal sum of the costs in each year.
9a. NERA requests that EPA explain the methodology for calculating "costs as incurred".
9b. NERA requests that EPA explain the rationale behind the "costs as recovered" calculation

In regard to cost of catalysts, PPEMA commented that EPA's catalyst cost estimates are too low (Item VI-D-07, pages 9-10). PPEMA submitted costs in a 1995 study that claimed costs of applying catalysts were over $50. OPEI commented that the costs of purchasing and installing catalysts appear to be grossly understated (Item VI-D-05, page 6). Husqvarna/FHP claimed that the only catalyst costs included in the RIA is the cost of adding a catalyst element - the cost of exhaust system improvements and redesign of the engine are omitted. They asserted that EPA's analysis assumes all catalyst designs will be low efficiency catalysts, where in fact, medium- or high-efficiency catalysts may be needed. ECHO commented that the cost of a catalyst system (including holder, shrouding, and cooling requirements) is approximately $15 (Item IV-D-37, page 4). MECA commented that they provided a catalyst cost survey in 1998 and continue to believe that this survey fairly reflects catalyst costs. They asserted that catalysts have been sold and/or quoted at costs below the EPA estimated costs (Item VI-G-03, page 3).

6.1.3 EPA Response to the Comments

In response to the comments on the cost of engine technologies, EPA is using the cost estimates for 4-stroke technology and compression wave technology as submitted by Ryobi and John Deere. EPA believes that because these manufacturers have developed these technologies for their own engines, and have also certified them for the California ARB's Tier 2 standards, they are well-qualified to estimate the costs of their respective technologies. In addition to using John Deere's estimates for costs, we continue to include the cost of the licensing fee as proposed by John Deere for manufacturers assumed to use the compression wave technology. The cost analysis of the compression wave technology includes the cost of applying a catalyst where we have determined it is necessary. All Class III engines using the compression wave technology and 50% of Class IV engines using the compression wave technology are assumed to incorporate catalysts, and the costs of catalysts have been included in our cost estimates. In addition, all engines assumed to use stratified scavenging in Class IV are assumed to use a catalyst, and the costs have been included in this analysis.

With regard to the ICF study, EPA has used some information from the study in this cost analysis. These costs include the fixed cost for 4-stroke engine and stratified scavenging engine development, the variable cost for stratified scavenging, and the catalyst cost information (excluding the cost of the catalyst substrate). While it is true that when the ICF study was performed, the level of the standards were not at the levels being finalized for Phase 2 handheld engines. However, we believe that the ICF information we have retained for our analysis is still valid. For example, the fixed cost associated with 4-stroke engine designs is still valid because a 4-stroke engine would easily meet the Phase 2 standards even if those levels were not under consideration at the time of the ICF study. With regard to catalyst costs, we believe the ICF costs for the materials (other than the cost of the catalyst material itself) is the same for whatever standard level is assumed. For stratified scavenging costs, we have not received any adverse comments on the cost assumption from Komatsu Zenoah, a company that has recently introduced stratified scavenging on its engines and we continue to believe that the ICF costs are appropriate for that technology as well.

With respect to the variability in ease in which technologies can be applied, where information was available, we have assumed different costs for engine families with large volumes (using a cutoff of 400,000 for a large family) compared to the cost for engine families with smaller volumes. The costs where this sales volume impacts have been factored in include the variable costs for the compression wave technology, 4-stroke technology, and catalysts.

In regard to the comments regarding the price elasticity, we have not factored any impacts of increased cost on sales. In discussions with EPA, certain manufacturers, including Husqvarna/FHP, have acknowledged that the price elasticity impact on commercial equipment is nonexistent. John Deere, in discussions with EPA, has not supported the study referenced by Husqvarna/FHP, and has noted that the demand for low cost residential equipment is relatively insensitive to cost. In response to the comments that increased costs will put the US at a cost disadvantage compared to other timber producing areas of the world, we do not believe that relatively small incremental equipment cost of the Phase 2 engines compared to the other costs associated with producing timber will have any adverse impact on U.S. forester. In fact, based on the technologies that we expect will be used, equipment operators can expect to have

significantly reduced fuel consumption that will offset the increased cost of the equipment.

With regard to catalysts costs , EPA has revised the estimates for the final rule analysis based on comments received on the SNPRM. For the final rule analysis, the cost of the catalyst materials is based on information provided by MECA. We believe that the manufacturers of catalysts have an adequate understanding of catalyst costs to estimate prices as they would apply to handheld engines. For the catalyst costs associated with the remaining hardware (for both the engine and equipment) and the fixed costs (for both the engine and equipment), we have based the cost estimates on the ICF study noted above. The catalyst costs used in the analysis do include the costs associated with equipment redesign for shroud redesign and the addition of a heat shield. Although Kioritz/Echo commented that a catalyst system is approximately $15.00 for their equipment we believe the estimate is based on their experience with the California ARB Tier 2 standards in which they used a relatively high efficiency catalyst to achieve the standards on relatively small volumes of engines. EPA estimates that the catalysts necessary to comply with the Phase 2 handheld engine standards will be low to medium efficiency catalysts and will be applied in volumes significantly higher than are needed in California.

EPA's responses to the comments submitted by Husqvarna/FHP as part of the NERA study are addressed in the following discussion. The numbers refer back to the list of questions submitted as noted above.

1. The licensing costs assumed for John Deere in the cost analysis vary by class and were based on the schedule of fee proposed by John Deere. Their schedule of fees was based on a percentage of the equipment price that varied based on sales of the unit. John Deere also noted that the fee would be no less than $7.50 per engine. For Class III, where the typical equipment cost is low, we assumed the licensing fee John Deere quoted of $7.50 per engine. For Classes IV and V, we estimated the average licensing fee based on the typical sales volume and price of such pieces of equipment.

2. The catalyst cost of $6.71 was found to be in error and was recalculated to a value of $5.52 for ceramic catalysts on high volume families and $8.35 for ceramic catalysts on low volume families. These costs were calculated based on information contained in Chapter 3 which contains cost estimates for catalysts and related system components and production costs using estimates from MECA and the ICF Cost Study, respectively. The calculation of $5.52 is achieved by utilizing MECA's cost estimate for a 60% conversion efficiency catalyst in high volume application (a more specific and up to date cost estimate than that used in the ICF cost study) and the additional component and production costs from the ICF cost study. The calculation of $8.35 is achieved in the same manner using the information for a low volume application (i.e., 10,000 units per year).

3. EPA has included both the cost of the stratified charge technology and catalyst technology in the cost estimates for the final rule analysis.

4a. EPA believes the cost estimates for the John Deere technology include the cost of the

fuel system modifications. We do not expect that any additional licensing fee from the carburetor manufacturer will be required in order for another manufacturer to utilize their technology.

4b. For the final rule analysis, EPA is not using the estimated capital cost of $2,000,000 per family and used technology-specific cost estimates. For the compression wave technology, the capital cost estimate made by John Deere is only $75,000-$300,000, and that estimate has formed the basis for the capital costs used in our analysis. As discussed in Chapter 4 of the Final RIA, further adjustments to these number were.

4c. The capital costs assumed in the final rule analysis are applied to all engine families, regardless of the sales volume. Therefore, the impact of capital costs, on a per engine basis, will be higher for those families with relatively small number of engine sales. EPA believes that once a manufacturer has developed a technology for one engine family, the cost of applying the technologies to further engines will be subsequently lower. However, we have only accounted for this in our analysis by using a reduced capital cost estimate for engine families of the same displacement as another engine family for which the full capital cost estimate was applied.

d.. As an engine manufacturer is developing its engine to incorporate new technologies, EPA expects that the engine manufacturer will consider all cooling needs when designing the engine and therefore use foresight to consider the cooling requirements of a catalyst. Therefore, for our final rule analysis, we have assumed an engine capital cost of $388,000 per engine family, on top of the other technology capital costs (i.e., compression wave or stratified scavenging) already assumed.

4e. The licensing costs for four-stroke and stratified scavenging have not been included in this analysis because we are not assuming the use of any one manufacturers four-stroke engine or stratified scavenging design to comply with the Phase 2 standards. We do not believe that a manufacturer who employs a four-stroke design or a stratified scavenging type technology will be automatically infringing on any patents. The four-stroke engine is applied in many other markets including nonhandheld engines. In addition, the concept of reducing the amount of scavenging in a two-stroke engine can be employed in a number of ways that will not necessarily infringe on any patents that may already exist. Therefore, we are not including any licensing fee for either of these technologies in the final rule cost analysis.

4f. We do not believe the technologies employed to comply with the Phase 2 standards will results in any significant impact on maintenance costs. For four-stroke engines, one benefits is that consumers will not be required to add special two-stroke oil to the gasoline. Two-stroke oil is more expensive than standard motor oil which can be used in For the final rule cost analysis, a four stroke design. In addition, the two stroke technologies under consideration, the compression wave and stratified scavenging (both with and without catalysts), while potentially more sensitive to A/F ratio changes, will have less oil/fuel consumption due to better fuel management. This in turn will reduce

the carbon deposits in the engine, thereby reducing exhaust port plugging, resulting in less maintenance. Because these maintenance impacts are small, we have not included any impact on maintenance in our analysis.

4g. As a manufacturer revises a design, service manual and training material updates will need to occur. Therefore, the Phase 2 standards will result in a small cost to manufacturers as they update their manuals and training materials to reflect new information related to the new engine design. For this analysis, we have included a capital cost of $25,000 per engine family for updating service manuals and training materials.

5. The estimated phase in of equipment models prior to the phase in of Phase 2 technologies in the engine was an oversight on the part of EPA and has been corrected in the final rulemaking.

6. The variable engine costs are based on the cost of the compression wave technology as presented by John Deere in IV-G-30. The third "additional" cost component in the total engine variable cost estimate is the cost of the compression wave technology. However, there is a discrepancy in that Table 4-09 contains a range in cost of $4.00 to $7.50 and Appendix E uses a range of $4.50 to $8.00 in its calculations. The increase of $0.50 was based on the fact that John Deere had not yet finalized the fuel system design for the compression wave technology engine and EPA assumed that the final design would be slightly more expensive than that contained in the cost estimates from John Deere. EPA has since learned that the cost of the final carburetor design would be at least the same, if not less, than the original cost estimate. Therefore, for the final rule cost analysis we are retaining John Deere's original estimate of $4.00 to $7.50 per engine.

7. EPA looked into the discrepancy of the uniform annualized cost estimates without fuel savings and has corrected it so they are the same in both places based on current cost analyses.

8. EPA has reviewed the discrepancy and found that the source of the problem was a table calculation error and has corrected this error.

9a. EPA has reviewed the discrepancy and found that the estimates in Table E-03d were not referenced to Table E-03c. The tables have been updated to reference Table E-03c.

9b. The costs as recovered factors in both the variable costs which occur once a manufacturer sells a more expensive Phase 2 engine and the capital costs which are incurred prior to the start of Phase 2. For this analysis, the capital costs are assumed to be amortized over 5 years (once sales of the redesigned engine/equipment begin) and at a rate of seven percent.

6.2 Handheld Equipment Costs

6.2.1 Summary of the Proposal

The Draft RIA to the SNPRM contained markup estimates for handheld engines and equipment of 16% from engine/equipment manufacturer to merchandiser and 5% from merchandiser to the customer.

6.2.2 Summary of the Comments

PPEMA commented that EPA's retailer mark-up of 5% is too low. EPA does not consider the role of distributors in the marketing, distribution, and sales process, PPEMA claimed (Item VI-D-07, page 9). OPEI also commented that EPA's retailer mark-up of 5% is unrealistically low (Item VI-D-05, page 6). Husqvarna/FHP claimed the markups assumed by EPA are low. (Item VI-D-08, page 89). Heiden & Associates (from Crowell & Moring on behalf of Husqvarna/FHP) commented that retail markup for consumer handheld equipment is estimated between 25% (WalMart) and 38% (Home Depot). Markup for commercial equipment is in the 40% to 60% range (Item VI-G-08, page 3).

Husqvarna/FHP commented that EPA's cost estimates are based on the most common application of each engine. However, the largest costs will be incurred in connection with the less common applications, according to Husqvarna/FHP. Therefore, the EPA estimates are understated.

6.2.3 EPA Response to the Comments

This analysis accounts for estimates of the increased costs associated with complying with the new emission standards. We avoid predicting actual price increases, since this would depend on an assessment of complex factors such as the availability of competitive models, and the general state of the economy. A 29 percent markup is used in our analysis (increased from 22% in the July 1999 analysis) and the markup is applied to the specific variable engine and equipment manufacturer costs (hardware and production) only) and is related to the changes the engine manufacturers and their dealers (or mass merchandisers) need to make to comply with emission standards. Further downstream markups or other pricing strategies may further increase the price of the product, but these are not necessary or direct impacts of the new emission standards. As explained in Appendix E of the RIA, full cost pass through and profitability on increased costs are assumed. It should be noted that we also assume that the resultant markup is influenced by what the consumer will pay for the product. Therefore, if the cost of producing handheld equipment increases to an extent beyond the point at which the current markups significantly affect equipment sales, then it is assumed that the markups will be lowered.

In regard to the comments on the costs being assumed for the most common application, the equipment costs used in the final rule analysis were based information contained in the ICF study. For four stroke engines, they estimated two capital costs, one for chainsaws and trimmers and one for backpack blowers and pumps. We have used a weighted number based on the current breakdown of such applications. For two stroke designs we have used a cost that ICF determined was applicable across a variety of equipment applications including trimmers,

chainsaws and blowers. Therefore, we believe our equipment cost estimate are not specific to the most common applications but represent the costs across the full range of handheld designs.

6.3 Handheld Operating Costs

6.3.1 Summary of the Proposal

The preamble to the SNPRM discussed handheld operating costs as addressed in terms of reduced fuel consumption.

6.3.2 Summary of the Comments

Husqvarna/FHP commented that EPA's cost analysis assumes that maintenance costs will not be affected by engines meeting the SNPRM (Item VI-D-08, page 92). Such an assertion is implausible for several reasons, according to Husqvarna/FHP - these engines may wear at a faster rate, four-stroke can be expected to require increased maintenance, and the individual parts of more complex engines may be more costly and therefore lead to higher maintenance costs if they need to be replaced. (The NERA study included these costs.) The RIA cost analysis does not include the costs of retraining industry technicians (estimated at $100+ million in II-D-17), additional tools and equipment needed to service the redesigned engines properly, or redoing product manuals for the redesigned equipment, Husqvarna/FHP stated.

6.3.3 EPA Response to the Comments

Maintenance costs are related to the type of use of the equipment. Consumer- use equipment in Classes III and IV is likely not to encounter maintenance issues as those described in the comments due to the fact that it is used much less frequently per year than professional-use equipment. Regarding increased maintenance costs for four-strokes mentioned in the comments, we are confident that engine manufacturers will design systems that result in no additional maintenance costs, and have not included any additional maintenance in the cost analysis for the final rule. In fact, owners of four-stroke engines could use the same oil for the equipment that they use for their automobiles and therefore do not need to purchase specific two stroke oil which can result in a cost savings considering that two-stroke oil is more expensive than standard motor oil.

6.4 Small Business Impacts

6.4.1 Summary of the Proposal

EPA's draft RIA for the SNPRM estimates that 3 small entity engine manufacturers and 6 small entity equipment manufacturers would be impacted by more than one percent of their sales revenue. Also, no more than 4 entities would be impacted by more than three percent of their annual sales revenue. The base case analysis assumes that manufacturers do not take advantage of the flexibilities being offered, but that they would be able to pass through most necessary price increases to the ultimate consumer. Therefore, EPA claimed that we would expect the Phase 2

rule for handheld engines to have a minimal impact on small businesses.

6.4.2 Summary of the Comments

Husqvarna/FHP commented that the RIA grossly underestimates the number of small businesses impacted by the SNPRM. Distributors and dealers of handheld equipment who are not directly regulated, are also affected by the rule. EPA's analysis also underestimates the impact on small businesses because it's cost estimates are too low, according to Husqvarna/FHP (see handheld engine/equipment cost comments above) (Item VI-D-08, page 95).

6.4.3 EPA Response to the Comments

In analyzing the impact of our regulations on small businesses, we only look at the impact on those entities which are directly regulated by our regulations. For this rule making, the engine and equipment manufacturers are the two groups directly affected by our regulations. Therefore, we do not include costs for distributors and dealers of equipment as part of the small business impacts analysis.

6.5 Cost and Cost Effectiveness

6.5.1 Summary of the Proposal

EPA calculated the cost effectiveness of the SNPRM to be $2,146 per ton of HC+NOx if fuel savings are not taken into account and $1,911 per ton if fuel savings are taken into consideration. EPA calculated the cost effectiveness of the proposed rule by estimating costs and emission benefits for these engines. The details of EPA's cost and cost-effectiveness analyses can be found in Chapters 4 and 7 of the Supplemental Draft RIA for the July 1999 SNPRM.

6.5.2 Summary of the Comments

PPEMA commented that EPA's analysis does not address the effect of increased prices on consumer demand. They present price elasticity numbers for chainsaws, trimmers, and blowers from a 1995 study. EPA should address the potential for decreased demand and the consequences for the handheld industry, PPEMA claimed (Item VI-D-07, pages 8-9). Stihl commented that for residential equipment, the projected price increases will lead to significant sales decreases (Item IV-D-45, page 3).

PPEMA commented that EPA's analysis should not rely upon the fuel savings. Consumers tend to focus on the up-front retail price when making a purchase decision, not on the potential fuel savings, they claimed (Item VI-D-07, page 10). OPEI commented that EPA's projected fuel savings appear excessive and potentially skew the cost benefit calculation (Item VI-D-05, page 6).

Stihl commented that due to their small contribution to air quality, the cost/benefit

relationship for professional equipment must be bad (Item IV-D-45, page 3). Echo argued that the cost per ton for reductions in emissions from handheld engines is significantly more than for nonhandheld engines, especially given the relative amount of pollution emitted by handheld versus nonhandheld and other sources. (They present a comparison of handheld emissions versus nonhandheld versus cars/SUVs.) (Item IV-D-37, page 6).

Husqvarna/FHP claimed that the incremental cost per ton for the proposed handheld Phase 2 standards compared to the so-called "Consensus Alternative" standards ranges from $16,000/ton to $64,500/ton, which they claim is much too high compared to other programs (Item VI-D-08, page 7). Husqvarna/FHP also commented that the cost effectiveness of the so-called "Consensus Standards" (i.e., 72/72/87) ranges between $1,500/ton and $6,800/ton (based on their NERA analysis) (Item VI-D-08 , pages 27-28).

6.5.3. Response to the Comments

PPEMA's comments raised reference to a 1995 study which illustrated industry's expectation of market changes due to increases in equipment prices. The report contained the industry's available historical information which was actually based on a study of what happens when a more expensive piece of equipment is introduced in the presence of an opening price point equipment option. No information is presented which accounts for an increase in the price of all equipment simultaneously. EPA is of the opinion that while the per engine cost will increase due to the Phase 2 technologies, consumer demand will not be impacted to any significant degree. Information provided by John Deere to EPA supports this conclusion for residential equipment. For commercial equipment, Husqvarna/FHP and John Deere have all commented that at the levels of the cost increase expected under the Phase 2 rule, sales will not be significantly impacted.

EPA's fuel savings estimates are based on fuel consumption information for Phase 1 engines and for Phase 2 engines. The Phase 1 engine fuel consumption levels were determined as part of the Phase 1 rulemaking. For Phase 2, the estimates are based on EPA and manufacturer testing as presented in the Chapter 4 of the RIA. In addition, the fuel consumption improvement is consistent with estimates made by manufacturer of the Phase 2 technologies. The fuel consumption results are used as inputs to the EPA's NONROAD model and fuel usage is calculated for Phase 1 and Phase 2. EPA presents both cost effectiveness results with and without fuel savings in the final rulemaking.

EPA's review (after publication of the SNPRM) of the Class V contribution shows that the emissions and emission benefits from Class V are nearly the same as those from Class IV, even though the sales are only a fraction of those in Class IV. EPA reviewed the estimates in the professional/residential split for Class V used in the NONROAD model for the July 1999 SNPRM analysis and it resulted in a change from a 10/90 professional/residential split for Class V to a 100/0 professional/residential split (which was confirmed by the major Class V engine producers). This resulted in a marked increase in emissions from Class V in the final rule analysis due to the relatively high power ratings of the equipment and the relatively high number of hours for which professional equipment are used when compared to residential equipment.

Emission benefits from Class V are significant in relation to other classes in this rule making.

With regard to the NERA analysis submitted by Husqvarna/FHP, EPA reviewed the information and responded back to NERA with some comments about several incorrect inputs into their calculations. Husqvarna responded back on November 15, 1999 with a revised analysis from NERA. Table 5 contains the estimates of cost-effectiveness from the revised NERA study (Item VI-G-25).

Table 5
Cost-Effectiveness Estimates from NERA Analysis

	Husqvarna/FHP's preferred 72/72/87 g/kW-hr standards	EPA's proposal 50/50/72 g/kW-hr standards
EPA Data		
Stratified Charge	$810	$8,275
Compression Wave	$2,179	$10,931
EPA Mix	$2,061	$10,702
Industry Data		
Class IV results	$2,568	$33,035
Class V results	$1,701	$23,748

EPA understands that the July 1999 cost effectiveness estimates are based on an incremental change from the standards of 72/72/87 to 50/50/72 and not the difference to the Phase 1 standards. EPA calculates cost effectiveness for a rule making based on the changes from the standards of the existing rule making and not from a different hypothetical emission standard favored by some members of the regulated industry. For the final rule, we have estimated the cost effectiveness of the Phase 2 standards to be to be approximately $830 per ton without consideration of fuel savings, and $560 per ton with fuel savings taken into account.

APPENDIX: DOCKET INFORMATION

All the written comments submitted to EPA, as well as records of all oral comments received during and after the comment period are contained in the docket for EPA's Statements of Principles for Nonroad Phase 2 Small Spark-Ignited Engines (EPA Air Docket A-96-55).