



Regulatory Announcement

Final Phase 2 Standards for Small Spark-Ignition Handheld Engines

The U.S. Environmental Protection Agency (EPA) is adopting a second phase of more stringent emission standards for nonroad small spark ignition (SI) handheld engines (such as trimmers, brush cutters, and chainsaws). In addition, EPA is revising the compliance program provisions to be similar to those already adopted for nonhandheld engines and reflect closer harmonization with those required by the State of California. Small SI engines produce approximately one tenth of U.S. mobile source hydrocarbon (HC) emissions and are the largest single contributor to nonroad HC inventories. Thus, these standards will help the States in their progress towards compliance with the National Ambient Air Quality Standard (NAAQS) for ozone.

This final rule will reduce hydrocarbons plus oxides of nitrogen (HC+NOx) by an additional 70 percent beyond the current Phase 1 standards. The final rulemaking includes provisions that give industry flexibility and ease the transition to the more stringent Phase 2 program, especially for small volume engine and equipment manufacturers. The new standards will be phased in beginning with the 2002 model year. EPA is also adopting standards for two additional classes of nonhandheld engines that will apply to engines below 100 cubic centimeters displacement used in nonhandheld equipment applications.

History of Rulemaking

In July 1995, EPA finalized the first federal regulations affecting small nonroad SI engines at or below 19 kilowatts (kW), or 25 horsepower. The regulations, commonly known as “Phase 1,” took effect for most new handheld and nonhandheld engines beginning in model year 1997 and are expected to result in a 32 percent reduction in HC emissions from these engines. Table 1 lists the different small SI engine categories, including the newly proposed Class I-A and I-B designations. For the nonhandheld categories, Class I engines are used primarily in walk-behind lawnmowers and Class II engines are used primarily in lawn and garden tractors. For the handheld categories, Class III and IV engines are used primarily in residential equipment such as string trimmers, leaf blowers and chainsaws. Class V engines are used primarily in commercial equipment such as chainsaws.

Table 1: Small SI Engine Classes						
Nonhandheld				Handheld		
Class I-A	Class I-B	Class I	Class II	Class III	Class IV	Class V
<66cc	66 to <100cc	100 to <225 cc	≥225 cc	< 20 cc	20cc to <50cc	≥50 cc

In September 1993, EPA initiated a regulatory negotiation (or “reg-neg”) to develop a framework for a “Phase 2” rule that would further reduce emissions from these engines. The reg-neg ended in February 1996 without a consensus among all the participants on a Phase 2 program. However, the Agency continued to work with several former reg-neg members.

In March 1997, EPA published an Advance Notice of Proposed Rulemaking (ANPRM) announcing the Agency’s intent to issue a Notice of Proposed Rulemaking (NPRM) which would cover both handheld and nonhandheld engines. The ANPRM also published the text of two Statements of Principles (SOPs) which were developed between the Agency and interested parties in 1996. In January of 1998, the Agency published the proposed rule for the Phase 2 regulations for small SI engines, both handheld and nonhandheld engines, based on the SOPs.

Since the publication of the January 1998 NPRM, there have been rapid and dramatic advances in emission reduction technologies for handheld engines used in applications such as trimmers, brush cutters, and chainsaws.

EPA had not been able to fully evaluate these technologies or discuss their possible availability at the time of the January 1998 NPRM. Having reviewed the available information regarding these new technologies, EPA believes this new information supported Phase 2 standards for handheld engines that are significantly more stringent than those proposed in the January 1998 proposal. In light of this information, and in the interest of providing an opportunity for public comment on the stringent levels being considered for the Phase 2 handheld engine emission standards and the technologies available for meeting these standards, EPA repropoed Phase 2 regulations for handheld engines in a July 1999 Supplemental Notice of Proposed Rulemaking (SNPRM). This final rule adopts the final Phase 2 requirements for handheld engines. EPA already finalized Phase 2 regulations for nonhandheld engines in March 1999.

Overview of the Final Phase 2 Rule for Handheld Class III, IV and V Engines

This final rule adopts emission standards and other regulatory requirements for Class III, IV and V engines as used in handheld equipment applications. The Phase 2 program for handheld engines is expected to result in a shift to dramatically cleaner engine technology. In addition, the Phase 2 rule includes new programmatic requirements to ensure that engines meet the tighter standards throughout the useful life of the equipment. Highlights of the Phase 2 final rule include:

- Tighter emission standards for HC+NO_x (in grams per kilowatt-hour (g/kW-hr)) to be phased-in over a number of years, allowing the manufacturers an orderly and efficient transition of engine designs and technologies from those complying with the existing Phase 1 standards to those necessary to meet the Phase 2 requirements. Table 2 contains the Phase 2 emission standards for handheld engines.

Table 2: Phase 2 HC+NO _x Emission Standards for Handheld Engines (in g/kW-hr) by Model Year						
Engine Class	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

- Three useful life categories for handheld engines to account for widely varying product lives as noted in Table 3.

Table 3: Useful Life Categories for Handheld Engines (hours of use)			
All Handheld Classes	50	125	300

- A compliance program to ensure engines continue meeting the standards for the useful life of the engine, including certification, production line testing, and voluntary in-use testing.
- An Averaging, Banking, and Trading (ABT) program to provide engine manufacturers with additional flexibility in meeting the Phase 2 handheld standards.

Health and Environmental Benefits

The Phase 2 handheld engine standards will result in a 70 percent reduction in HC+NOx emissions from these engines beyond the 32 percent reduction expected from the Phase 1 standards. This is equivalent to an annual reduction of 500,000 tons of exhaust HC+NOx emissions by the year 2027. This reduction in HC+NOx emissions will be accompanied by an overall reduction in fuel consumption.

Small SI engines currently produce approximately one tenth of U.S. mobile source HC emissions and are the largest single contributor to nonroad HC inventories. Thus, the Phase 2 standards will help the States in their progress towards compliance with the NAAQS for ozone.

Both HC and NOx contribute to the formation of tropospheric ozone through a complex series of reactions. In a recent report, researchers emphasize that both HC and NOx controls are needed in most areas of the United States. EPA's primary reason for controlling emissions from small SI handheld engines is the role of their HC emissions in forming ozone. Of the major air pollutants for which National Ambient Air Quality Standards have been designated under the Clean Air Act, the most widespread problem continues to be ozone, which is the most important component of smog.

The Phase 2 standards will generate significant reductions in emissions from these engines with small increases in cost. Table 4 presents the estimated average price increase for handheld equipment due to the Phase 2 standards.

Table 4: Estimated Handheld Equipment Price Increase Due to Phase 2 Standards		
Class III	Class IV	Class V
\$23	\$20	\$56

In addition, the technological changes necessary to bring these engines into compliance with the new emission standards would cause a decrease in fuel consumption of approximately 30 percent for handheld engines, resulting in lower operating costs to the consumer. Table 5 presents the cost effectiveness of the Phase 2 program for handheld engines.

Table 5: Cost Effectiveness of Phase 2 Handheld Engine Final Rulemaking	
Without Fuel Savings	\$830 per ton HC+NOx
With Fuel Savings	\$560 per ton HC+NOx

Effect on Industry

The final rule requires engine manufacturers to:

- build significantly cleaner, more durable engines
- certify that those engines will meet standards for their full regulatory useful lives

Some of the technologies currently in development to achieve these standards with the use of a catalyst (e.g., John Deere’s “LE technology” and Komatsu Zenoah’s “Stratified Scavenged” design) are anticipated to be a primary choice for manufacturers of Class III and IV engines to meet their Phase 2 emission levels. Class V engines are expected to use the same technologies without catalysts to meet their Phase 2 emission levels.

The rule includes provisions to ease the transition from the Phase 1 program to the Phase 2 program to ensure that the Phase 2 standards are cost-effective and achievable, and to minimize the compliance burden while maintaining the environmental benefits of the rule. These provisions include a declining set of average standards, a certification ABT program, and special provisions to ease and/or delay the impact of the rule on small volume engine families and equipment models.

For More Information

You can access additional documents on small nonroad SI engine rulemakings electronically on the Office of Transportation and Air Quality Web site at:

<http://www.epa.gov/otaq/equip-ld.htm>

You can also contact the NVFEL Library for document information at:

U.S. Environmental Protection Agency
Office of Transportation and Air Quality
NVFEL Library
2000 Traverwood Road
Ann Arbor, Michigan 48105
(734) 214-4311