

# EPA Finalizes Emission Standards for New Nonroad Spark-Ignition Engines, Equipment, and Vessels

The U.S. Environmental Protection Agency (EPA) is adopting new exhaust emission standards for marine spark-ignition engines and small land-based nonroad engines. EPA is also adopting evaporative emission standards for equipment and vessels using these engines. These standards apply only to newly manufactured products. The standards will reduce the harmful health effects of ozone and carbon monoxide from these engines, equipment, and vessels.

## Which engines and vehicles are affected?

We are adopting new standards for emissions of hydrocarbons (HC), nitrogen oxides (NO<sub>x</sub>), and carbon monoxide (CO) from a variety of nonroad engines, equipment, and vessels that cause or contribute to air pollution. The controls for these products have been combined into one rulemaking because these engines and vehicles share many common characteristics. Differences in their design and use led us to adopt separate emission standards for each group.

- Small Nonroad Spark-Ignition Engines and Equipment: Spark-ignition (SI) nonroad engines rated below 25 horsepower (19 kW) used in household and commercial applications, including lawn and garden equipment, utility vehicles, generators, and a variety of other construction, farm, and industrial equipment.
- Marine Spark-Ignition Engines and Vessels: Spark-ignition engines used in marine vessels, including outboard engines, personal watercraft, and sterndrive/inboard engines.

## **What are the differences between the final rule and the proposed rule?**

Several minor changes from the proposed rule are being adopted in the final rule. These changes reflect important cooperative efforts between EPA and the regulated industries to implement cleaner technology as early as possible while still providing communities across the United States with needed emissions reductions.

First, the implementation dates for Marine Outboard/Personal Watercraft (OB/PWC) and Sterndrive/Inboard (SD/I) exhaust emissions standards are being delayed one year to allow sufficient time for manufacturers to convert their entire product line-ups to lower emissions simultaneously while adopting to supplier changes. Second, modifications are being made to the Marine SD/I High Performance (>373 kW) exhaust emissions requirements to reflect the limitations of catalyst technology on these engines. Lastly, we are adopting provisions for cold weather evaporative emission standards to reflect the capability of fuel line materials and adding a phase-in for marine diurnal standards. Both of these changes will enhance the safety of the new requirements.

## **Why is EPA regulating these engines, equipment, and vessels?**

The engines and vehicles covered by this rule are significant sources of air pollution. They account for about 26 percent of mobile source VOC emissions and 23 percent of mobile source carbon monoxide emissions. With the new controls, VOC pollutants will be further reduced by 34 percent for Small SI engines and 70 percent for Marine SI engines by 2030. With the new controls, CO pollutants will be further reduced by 9 percent for Small SI engines and 19 percent for Marine SI engines by 2030.

The new standards continue the process of establishing nonroad standards as required by the Clean Air Act. We are required to study emissions from nonroad engines and vehicles and to set emissions standards if the level of pollutants from these sources cause or significantly contribute to air pollution and, more specifically, if the emissions of CO, NO<sub>x</sub> or hydrocarbons contribute significantly to the formation of ozone and carbon monoxide in more than one area of the country currently not meeting ozone and carbon monoxide standards. We completed the Nonroad Engine and Vehicle Emission Study in 1991, and in 1994 determined that these sources contribute significantly to ozone or CO nonattainment. We have already set emission standards for most nonroad engines, including farm and construction equipment, locomotives, commercial marine, and recreational vehicles.

## **What are the New Requirements?**

The new requirements vary depending on the kind of engine or vehicle. In developing these requirements, we considered specific factors for each type. Among the factors considered were the environmental impacts, the number of hours each year that the engine is used, the need for high-performance operation, and the costs. The new requirements for each type of engine and vehicle are:

## **Small Nonroad Engines**

We are adopting HC+NO<sub>x</sub> exhaust emission standards of 10 g/kW-hr for Class I engines starting in the 2012 model year and 8 g/kW-hr for Class II engines starting in the 2011 model year. We expect manufacturers to meet these standards by improving fuel systems, engine combustion and in some cases adding catalysts. These standards are consistent with the requirements recently adopted by the California Air Resources Board (ARB). We are not adopting new exhaust emission standards for handheld emissions.

For spark-ignition engines used in marine generators, we are adopting a more stringent Phase 3 CO emission standard of 5 g/kW-hr. This applies equally to all sizes of small SI engines used in marine generators.

We are adopting new evaporative emission standards for both handheld and nonhandheld equipment. The new standards include requirements to control fuel tank permeation, fuel line permeation, and diffusion emissions. For nonhandheld engines we also require control of running losses.

When fully implemented, the new standards will result in a 35 percent reduction in HC+NO<sub>x</sub> emissions from new engines' exhaust. The new standards will reduce evaporative emissions by 45 percent.

## **Marine spark-ignition engines and vessels**

We are adopting a more stringent level of emission standards for outboard and personal watercraft engines starting with the 2010 model year. The HC+NO<sub>x</sub> standard for engines producing less than or equal to 4.3 kW maximum power is 30 g/kWh and for engines producing greater than 4.3 kW have a standard that gradually increases based on the engine's maximum power. The CO standard for engines producing less than or equal to 40 kW gradually increases based on the engine's maximum power. The CO standard for engines with maximum power greater than 40 kW is 300 g/kWh. We expect manufacturers to meet these standards with improved fueling systems and other in-cylinder controls. The federal levels of the HC+NO<sub>x</sub> standards are consistent with the requirements recently adopted by California ARB with the addition of a first-ever CO standard for this category of nonroad engines.

We are adopting new exhaust emission standards for sterndrive and inboard marine engines. The standards are 5 g/kW-hr for HC+NO<sub>x</sub> and 75 g/kW-hr for CO starting with the 2010 model year. We expect manufacturers to meet these standards with three-way catalysts and closed-loop fuel injection. To ensure proper functioning of these emission control systems in use, we will require manufacturers to diagnose engines for failure in the emission control system.

For sterndrive and inboard marine engines above 373 kW with high-performance characteristics (generally referred to as "SD/I high-performance engines"), we are adopting a CO standard of 350 g/kW-hr. We are adopting a HC+NO<sub>x</sub> standard of 20 g/kWh for high-performance engines producing between 373 and 485 kW in 2010 followed by a tightened standard of 16 g/kWh in 2011. For high-performance engines producing greater than 485 kW, we are adopting a HC+NO<sub>x</sub> standard of 25 g/kWh in 2010 and 22 g/kWh in 2011. We are also adopting a variety of other special provisions for high-performance engines to reflect unique operating characteristics.

The emission standards described above relate to engine operation over a prescribed duty cycle for testing in the laboratory. We are also adopting “not-to-exceed” standards that require manufacturers to maintain a certain level of emission control when engines operate under normal speed-load combinations that are not included in the certification duty cycle.

We are also adopting new standards to control evaporative emissions for all vessels using marine spark-ignition engines. The new standards include requirements to control fuel tank permeation, fuel line permeation, and diurnal fuel tank vapor emissions, including provisions to ensure that refueling emissions do not increase.

When fully implemented, the new standards will result in an estimated 70 percent reduction in HC+NO<sub>x</sub> emissions and a 50 percent reduction in CO from new SD/I engines’ exhaust. The standards will also result in a 60 percent reduction in HC+NO<sub>x</sub> emissions from OB/PWC engines. The new standards will reduce evaporative emissions by about 70 percent.

## Health and Environmental Benefits

We estimate that by 2030, the new standards will result in significant annual reductions of pollutant emissions from regulated engine and equipment sources nationwide, including approximately 600,000 tons of volatile organic hydrocarbon emissions, 130,000 tons of NO<sub>x</sub> emissions, and 5,500 tons of direct particulate matter (PM<sub>2.5</sub>) emissions. These reductions correspond to significant reductions in the formation of ground-level ozone and ambient PM<sub>2.5</sub>. We also expect to see annual reductions of 1.5 million tons of carbon monoxide emissions, with the greatest reductions in situations where there have been problems with individual exposures. The final rule will result in substantial benefits to public health and welfare and the environment. We estimate that by 2030, on an annual basis, these emission reductions will prevent 230 PM-related premature deaths, between 77 and 350 ozone-related premature deaths, approximately 1,700 hospitalizations and emergency room visits, 23,000 work days lost, 180,000 lost school days, 590,000 acute respiratory symptoms, and other quantifiable benefits every year. The total estimated annual benefits of this rule in 2030 are approximately between \$1.6 and \$4.4 billion. Estimated costs in 2030 are many times less, at approximately \$190 million.

## Costs

The estimated annualized cost of the new exhaust and evaporative emissions standards is \$391 million, assuming a seven percent discount rate over 30 years. The corresponding annualized fuel savings due to more efficient controls is \$155 million. As a result, the net annualized cost of the program is \$236 million.

The results of the economic impact modeling performed for the Small SI and Marine SI engines and equipment control programs suggest that the social costs of those programs are expected to be about \$459 million in 2030 with consumers of these products expected to bear about 86 percent of these costs. We estimate fuel savings of about \$273 million in 2030 that will accrue to consumers.

## **For More Information**

You can access the rule and related documents on EPA's Office of Transportation and Air Quality (OTAQ) Web site at:

[www.epa.gov/otaq/equip-ld.htm](http://www.epa.gov/otaq/equip-ld.htm) or [www.epa.gov/otaq/marinesi.htm](http://www.epa.gov/otaq/marinesi.htm)

For more information on this rule, please contact the Assessment and Standards Division at:

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