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Office of Transportation and Air Quality

Regulatory Announcement

Emission Standards for New Nonroad Engines

The U.S. Environmental Protection Agency (EPA) is adopting emission standards for several types of currently unregulated nonroad engines and vehicles. These standards apply only to newly manufactured products. This fact sheet gives an overview of the new standards. See the fact sheets and other documents referenced below for additional information.

Which engines and vehicles are covered?

We are adopting new standards for emissions of oxides of nitrogen (NOx), hydrocarbons (HC), and carbon monoxide (CO) from several groups of previously unregulated nonroad engines. Even though these different kinds of engines are combined into one rulemaking, the new requirements reflect differences in the way each type of engine is designed and used.

- Large Industrial Spark-Ignition Engines: Spark-ignition nonroad engines powered by gasoline, liquid propane gas, or compressed natural gas rated over 19 kilowatts (kW) (25 horsepower). These engines are used in commercial and industrial applications, including forklifts, electric generators, airport baggage transport vehicles, and a variety of farm and construction applications.
- Recreational Vehicles: Snowmobiles, off-highway motorcycles, and all-terrain-vehicles.
- Diesel Marine Engines: Diesel engines over 37 kilowatts (kW) (50 horsepower) used in recreational boats, such as yachts and cruisers.

Why is EPA regulating these engines?

The engines covered by this rule are a significant source of air pollution. They currently account for about 9 percent of HC emissions, 4 percent of CO emissions, 3 percent of NOx emissions, and 2 percent of PM emissions from mobile sources. If left uncontrolled, by 2020 these engines will contribute 24 percent of national HC emissions, 6 percent of CO emissions, 9 percent of NOx emissions, and 5 percent of PM emissions from mobile sources. HC and NOx emissions form smog and contain toxic compounds such as benzene, so reducing them will benefit our health and environment, especially in terms of respiratory impairment and related illnesses. Some of these engines also emit high levels of CO, which is especially problematic for people who work with or are otherwise active near these engines. Many engines operate in warehouses, ice-skating rinks, or other enclosed areas, where personnel who work with or near the equipment can experience increased exposure. The new standards are expected to reduce HC emissions by 71 percent, NOx emissions by 80 percent, and CO emissions by about 57 percent from these sources.

These new emission standards continue the process of establishing requirements for low-emitting engines as required by Congress. In the Clean Air Act, Congress directed us to study emissions from all nonroad engines and vehicles and to set emission standards if the these sources cause or significantly contribute to air pollution and, more specifically, if the emissions of CO, NOx or HC contribute significantly to ozone and carbon monoxide pollution. In 1991, we published the Nonroad Engine and Vehicle Emission Study. Following that study, we completed a public process in 1994 to conclude that nonroad engines contribute significantly to air quality problems related to ozone, CO, and other pollutants. Since then we have set emission standards for most nonroad engines, including those used in farm and construction equipment, locomotives, commercial marine vessels, and lawnmowers. This final rule sets emission standards for additional categories of nonroad engines and vehicles for which we have not yet set emission standards.

What are the New Requirements?

The new requirements vary depending on the kind of engine or vehicle, taking into account environmental impacts, usage rates, the need for high-performance models, costs and other factors. The emission standards apply to all new engines sold in the United States and any imported engines manufactured after these standards begin. The requirements for each type of engine include the following:

Large industrial spark-ignition engines

These are spark-ignition nonroad engines rated over 19 kW used in a variety of commercial applications (we refer to these as Large SI engines); most use liquefied petroleum gas, with others operating on gasoline or natural gas. These engines contribute to ozone formation and ambient CO and PM levels in urban areas. In addition, many engines operate in warehouses, ice-skating rinks, or other enclosed areas, where personnel who work with or near the equipment can experience increased exposure.

We are adopting two tiers of emission standards for Large SI engines (see Table 1). The first tier of standards, scheduled to start in 2004, are based on a simple laboratory measurement using steady-state procedures. The Tier 1 standards are the same as those adopted earlier by the California Air Resources Board for engines used in California.

The Tier 2 standards starting in 2007 are based on transient testing in the laboratory, which ensures that the engines will control emissions when they operate under changing speeds and loads in the different kinds of equipment. We are including an option for manufacturers to certify their engines to different emission levels to reflect the fact that decreasing NOx emissions tends to increase CO emissions (and vice versa). Manufacturers may generally meet a less stringent CO standard if they certify an engine with lower HC+NOx emissions. This approach adds an incentive for manufacturers to reduce HC+NOx emissions below the standard, without taking away the option of producing engines with very low CO levels for customers concerned about exposing individuals to exhaust emissions. In addition to these exhaust-emission controls, manufacturers must take steps starting in 2007 to reduce evaporative emissions, such as using pressurized fuel tanks.

Table 1: Emission Standards for Large SI Engines*

Tier/Year	HC+NOx	CO
Tier 1 starting in 2004	4.0 g/kW-hr	50 g/kW-hr
Tier 2 starting in 2007	2.7 g/kW-hr	4.4 g/kW-hr

*See 40 CFR part 1048 for additional information about alternate standards and field-testing standards.

We are also adopting requirements to ensure that engines control emissions during all kinds of normal operation in the field. Tier 2 engines must have engine diagnostic capabilities that alert the operator to malfunctions in the engine's emission-control system. The rule also includes special standards and procedures to allow for measuring emissions without removing engines from equipment.

Nonroad recreational engines and vehicles

These recreational applications include snowmobiles, off-highway motorcycles, and all-terrain-vehicles (ATVs). These vehicles contribute to ozone formation and ambient CO and PM levels. They can also contribute to regional haze and other visibility problems in our national and state parks. Table 2 shows the exhaust emission standards that apply to recreational engines. In addition, we are finalizing standards that will minimize fuel lost through the walls of plastic fuel tanks and rubber hoses (permeation). These standards are presented in Table 3.

Table 2:
Recreational Vehicle Exhaust Emission Standards

Vehicle	Model Year	Emission standards		Phase-in
		HC g/kW-hr	CO g/kW-hr	
Snowmobile	2006	100	275	50%
	2007 through 2009	100	275	100%
	2010	75	275	
	2012*	75	200	
		HC+NOx g/km	CO g/km	
Off-highway Motorcycle	2006	2.0	25.0	50%
	2007 and later	2.0	25.0	100%
ATV	2006	1.5	35.0	50%
	2007 and later	1.5	35.0	100%

*or equivalent per § 1051.103

Table 3: Permeation Standards for Recreational Vehicles

Emission Component	Implementation Date	Standard	Test Temperature
Fuel Tank Permeation	2008	1.5 g/m^2/day	28^{0}C (82^{0}F)
Fuel Hose Permeation	2008	15 g/m^2/day	23^{0}C (73^{0}F)

Recreational marine diesel engines

These are marine diesel engines over 37 kW that are used in yachts, cruisers, and other types of pleasure craft. Recreational marine engines contribute to ozone formation and PM levels, especially in marinas, which are often located in areas with air-quality problems. The standards are phased in, beginning in 2006, depending on the size of the engine. Table 4 shows the new standards and implementation dates.

Table 4:
Recreational Marine Diesel Emission Standards and Implementation Dates

Engine Size (based on displacement in liters per cylinder)	Implementation Date	HC+NOx g/kW-hr	PM g/kW-hr	CO g/kW-hr
0.5 L/cyl ≤ displ. < 0.9 L/cyl	2007	7.5	0.40	5.0
0.9 L/cyl ≤ disp. < 1.2 L/cyl	2006	7.2	0.30	5.0
1.2 L/cyl ≤ disp. < 2.5 L/cyl	2006	7.2	0.20	5.0
disp. ≥ 2.5 L/cyl	2009	7.2	0.20	5.0

How Will the Standards Affect These Engines and Vehicles?

The standards will require manufacturers to apply existing engine technologies in varying degrees, depending on the type of engine. These technologies would include modified two-stroke engine technology (such as recalibrating, clean carburetion, fuel system upgrades), changing from two-stroke to four-stroke engine technology, modified four-stroke technology (such as recalibrating, fuel system upgrades), or improved diesel combustion and aftercooling.

Benefits

When the emission standards for recreational vehicles, recreational marine diesel engines, and industrial spark-ignition engines are fully implemented, we expect an overall 72-percent reduction in HC emissions from these engines, an 80-percent reduction in NOx emissions, and a 56-percent reduction in CO emissions in 2020. These controls will help reduce ambient concentrations of ozone, CO and fine PM. In addition, they will reduce personal exposure for people who operate, work with or are otherwise close to these engines and vehicles. They will also improve visibility in national parks.

The human health benefits of this rulemaking include avoiding approximately 1,000 premature deaths, preventing 1,000 hospital admissions, reducing 23,400 cases of asthma attacks, and reducing 200,000 days of lost work. In monetary terms, we estimate these health benefits to be roughly $8 billion in 2030. There are additional health and welfare benefits we are unable to quantify.

Costs

Estimated costs for manufacturers to design, certify, and build their products to meet the new emission standards are expected to range from $50 to $900 per snowmobile, less than $100 on average for an ATV, less than $200 on average for off-highway motorcycles, and about $600 for each recreational marine diesel or Large SI engine. These costs would in many cases be offset by savings from reduced fuel consumption or engine maintenance (or both) resulting from the technology improvements to control emissions. We estimate that nationwide fuel savings will eventually be greater than 800 million gallons annually in the United States as a result of these new technologies. Taken in total, this fuel savings more than exceeds the costs of the rule in any given year.

Where Can I Get More Information?

You can access the final rule and related documents on the Office of Transportation and Air Quality Web site at:

www.epa.gov/otaq/regs/nonroad/2002/cleanrec-final.htm

You can also contact us at:

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See additional fact sheets:

- Environmental Impacts of Newly Regulated Nonroad Engines (EPA420-F-02-033)
- Frequently Asked Questions from ATV Riders (EPA420-F-02-038)
- Frequently Asked Questions from Off-Highway Motorcycle Riders (EPA420-F-02-039)
- Frequently Asked Questions from Snowmobile Owners (EPA420-F-02-040)
- Frequently Asked Questions from Owners of Recreational Boats with Diesel Engines (EPA420-F-02-042)
- Frequently Asked Questions from Facility Managers and Other Owners of Industrial Spark-ignition Engines (EPA420-F-02-041)
- How to Maintain or Rebuild Engines Certified to EPA Standards (EPA420-F-02-035)
- Blue Sky Series Engines (EPA420-F-02-036)
- Emission Regulations for Stationary and Mobile Engines (EPA420-F-02-034)