United States Environmental Protection Agency
Air and Radiation
EPA420-F-02-033
September 2002
Office of Transportation and Air Quality

Frequently Asked Questions

Environmental Impacts of Newly Regulated Nonroad Engines

The U.S. Environmental Protection Agency (EPA) has adopted emission standards for recreational vehicles, recreational marine diesel engines, and industrial spark-ignition engines. This information sheet addresses questions about the environmental impacts of these engines and how this regulation will improve air quality.

What engines and vehicles are covered by the new standards?

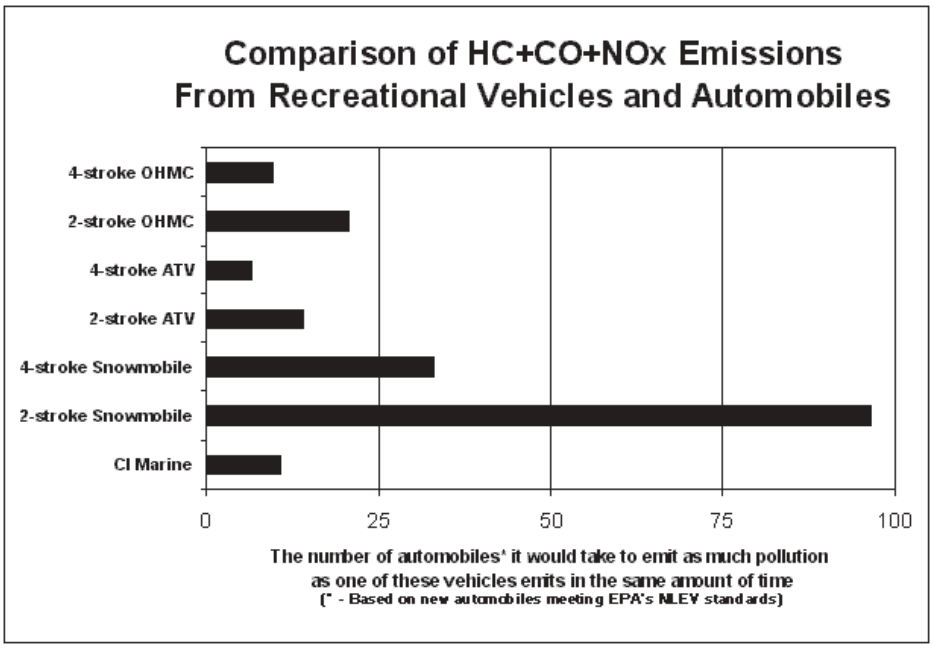
We are adopting new emission standards for the following three groups of previously unregulated nonroad engines and vehicles:

- Large industrial spark-ignition engines: Nonroad engines powered by gasoline, liquid propane gas, or compressed natural gas rated over 19 kilowatts (kW) (or 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: off-highway motorcycles, all-terrain vehicles (ATVs), and snowmobiles.
- Recreational marine diesel engines: Diesel engines rated at or above 50 horsepower (37 kilowatt) used in recreational boats, such as yachts and cruisers.

How do these engines and vehicles affect air quality?

Nationwide, these engines and vehicles are a significant source of air pollution. In 2000, they accounted for about 9 percent of national hydrocarbon (HC) emissions, 4 percent of carbon monoxide (CO) emissions, 3 percent of oxides of nitrogen (NOx) emissions, and 2 percent of particulate matter (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. These estimates for 2020 show higher relative emission levels, both because of expected growth and because emission controls for cars, trucks, and other emission sources will substantially decrease total emissions.

On an individual basis, these vehicles can have very high emission rates. This is illustrated in the figure below, which compares the emissions from unregulated recreational vehicles with the emissions from an automobile meeting our current National Low Emission Vehicle (NLEV) emission standards. As shown in the figure below, an unregulated two-stroke off-highway motorcycle (OHMC) can emit as much pollution in one hour as over 20 automobiles operating for one hour. Similarly, an unregulated two-stroke snowmobile can emit as much as nearly 100 automobiles.



What are the human health and welfare effects of these pollutants?

The engines covered by the new standards generally contribute to ozone formation and ambient PM and CO levels. These pollutants are subject to our National Ambient Air Quality Standards (NAAQS); states that exceed NAAQS levels are required to take measures to reduce emissions. In addition, these engines emit Mobile Source Air Toxics.

Ozone

Ground-level ozone, the main ingredient in smog, is formed by complex chemical reactions of volatile organic compounds (primarily HC) and NOx in the presence of heat and sunlight. Ozone forms readily in the lower atmosphere, usually during hot summer weather. Volatile organic compounds come from some natural sources (such as vegetation), but mostly come from motor vehicles, chemical plants, refineries, factories, consumer and commercial products, and other industrial sources. NOx emissions come largely from motor vehicles, nonroad equipment, power plants, and other sources of combustion.

Elevated ozone concentrations remain a serious public health concern throughout the United States. In 2001, approximately 116 million people lived in 56 areas designated nonattainment under the 1-hour ozone NAAQS. Increased ozone concentrations in the air have been associated with increased hospitalizations for respiratory causes for individuals with asthma, worsening of symptoms, decrements in lung function, and increased medication use; chronic exposure may cause permanent lung damage. Children and people with compromised respiratory systems are particularly at risk.

Carbon Monoxide

CO is a colorless, odorless gas produced from the incomplete combustion of carbon-based fuels. CO enters the bloodstream through the lungs and reduces the delivery of oxygen to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Healthy individuals also are affected, but only at higher CO levels. Exposure to elevated CO levels is associated with impairment of visual perception, work capacity, manual dexterity, learning ability and performance of complex tasks.

In 2001, approximately 22 million people lived in 13 areas designated nonattainment under the CO NAAQS. High concentrations of CO generally occur in areas with elevated mobile-source emissions. Peak

concentrations typically occur during the colder months of the year when mobile-source CO emissions are greater and nighttime inversion conditions are more frequent.

Particulate Matter

Particulate matter represents a broad class of chemically and physically diverse substances. "Fine particulate matter" includes liquid and solid particles with a diameter of 2.5 microns or less (also known as $PM_{2.5}$). Particulate matter, like ozone, has been linked to a range of serious respiratory health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, aggravated asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function.

According to our modeling, there were 65 million people living in areas with annual average $PM_{2.5}$ concentrations at or above the $PM_{2.5}$ NAAQS. PM emissions from various sources contribute directly to ambient PM levels. In addition, emissions of organic carbon, NOx and oxides of sulfur (SOx) indirectly contribute to ambient PM levels through atmospheric activity. Organic carbon accounts for 27 to 36 percent of fine-particle mass, depending on the area of the country. The vast majority (>90 percent) of direct PM emissions from mobile sources are in the fine-PM size range.

Air Toxics

Emissions from the engines covered by this final rule also contain several Mobile Source Air Toxics, including benzene, toluene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein, which cause a variety of health-related problems. Users of these engines and vehicles may experience high levels of personal exposure to these substances. For example, snowmobile riders and those directly exposed to snowmobile exhaust emissions can be exposed to benzene levels two to three orders of magnitude greater than the 1996 national average benzene concentrations. These elevated levels are also known as air toxic "hot spots," which are of particular concern to EPA.

Visibility

Fine PM is the major cause of reduced visibility in parts of the United States, including many of our national parks. In particular, HC emissions from snowmobiles in the winter months can contribute significantly to the organic carbon fraction of fine particles, which are largely responsible for visibility impairment. In Yellowstone National Park, a park with high snowmobile usage during the winter months, HC emissions from snowmobiles can exceed 500 tons per year, as much as several large stationary sources, and account for nearly 65 percent of annual HC emissions in the park.

How would the standards affect emissions and air quality?

When the emission standards for recreational vehicles, recreational marine diesel engines, and industrial spark-ignition engines are fully implemented, we expect an overall 71-percent reduction in HC emissions from these engines, an 80-percent reduction in NOx emissions, and a 57-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.

What are the health benefits of the new standards?

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.

Where Can I Get More Information?

For more information on the environmental and health impacts of these new emission standards, see the Final Regulatory Support Document for this final rule (especially Chapter 1—Health and Welfare Concerns). You can access that document and others related to the rulemaking on our Web site at:

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

You can also contact us at:

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