United States Environmental Protection Agency | Air and Radiation | EPA420-F-01-030 September 2001

Office of Transportation and Air Quality

Environmental Fact Sheet

Frequently Asked Questions: Environmental Impacts of Recreational Vehicles and Other Nonroad Engines

In September 2001, the U.S. Environmental Protection Agency (EPA) published a Notice of Proposed Rulemaking (NPRM) seeking public comment on our plan to set emission control standards for recreational and other nonroad vehicles. This information sheet addresses common questions about the environmental impacts of this proposal.

What vehicles and engines are covered in this proposal?

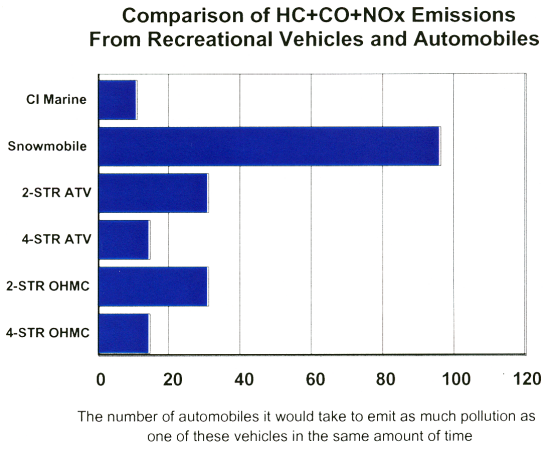
We are proposing new emission control standards for three groups of previously unregulated nonroad engines and vehicles that cause or contribute to air pollution:

- Large Industrial SI Engines: Spark-ignition nonroad engines rated over 25 horsepower (19 kW) used in commercial and industrial applications, including forklifts, electric generators, airport baggage transport vehicles, and a variety of other construction, farm, and industrial equipment.
- Recreational Vehicles: Spark-ignition nonroad engines used in off-highway motorcycles, all-terrain-vehicles (ATVs), and snowmobiles.
- Diesel Marine Engines: Diesel engines rated at or above 50 horsepower (37 kW) used in recreational boats.

How do these engines and vehicles affect air quality?

Nationwide, these engines and vehicles are a significant source of mobile-source air pollution. In 2000, they accounted for about 13 percent of national mobile-source hydrocarbon (HC) emissions, 6 percent of mobile-source carbon monoxide (CO) emissions, 3 percent of mobile-source oxides of nitrogen (NOx) emissions, and 1 percent of mobile-source particulate matter (PM) emissions. Recreational vehicles by themselves account for nearly 10 percent of national mobile-source HC emissions and about 3 percent of national mobile-source CO emissions. If left uncontrolled, these engines will contribute 33 percent of national mobile source HC emissions, 9 percent of CO emissions, 9 percent of NOx emissions, and 2 percent of PM emissions in 2020.

On an individual basis, these vehicles can have very high emission rates. This is illustrated in the figure below, which shows that a two-stroke ATV or motorcycle can emit as much pollution in one hour as over 30 automobiles operating for one hour. Similarly, a snowmobile can emit as much as nearly 100 automobiles.



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

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

- **Ozone.** Ground-level ozone, the main ingredient in smog, is formed by complex chemical reactions of volatile organic compounds (VOC) and NOx in the presence of heat and sunlight. Ozone forms readily in the lower atmosphere, usually during hot summer weather. Volatile organic compounds are emitted from a variety of sources, including motor vehicles, chemical plants, refineries, factories, consumer and commercial products, and other industrial sources. Volatile organic compounds also are emitted by natural sources such as vegetation. Oxides of nitrogen are emitted largely from motor vehicles, off-highway equipment, power plants, and other sources of combustion. Hydrocarbons (HC) are a large subset of VOC, and to reduce mobile source VOC levels we set maximum emissions limits for hydrocarbon as well as particulate matter emissions.

  Elevated ozone concentrations remain a serious public health concern throughout the nation. In 1999, 90.8 million people lived in 31 areas designated nonattainment under the 1-hour ozone NAAQS. Increases in ozone concentrations in the air have been associated with increases in hospitalization for respiratory causes for individuals with asthma, worsening of symptoms, decrements in lung function, and increased medication use, and chronic exposure may cause permanent lung damage. The risk of suffering these effects is particularly high for children and for people with compromised respiratory systems. There is strong and convincing evidence that exposure to ozone is associated with exacerbation of asthma-related symptoms.

- **Carbon Monoxide.** Carbon monoxide (CO) is a colorless, odorless gas produced through the incomplete combustion of carbon-based fuels. Carbon monoxide 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 1999, 30.5 million people lived in 17 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. Snowmobiles, which have relatively high per engine CO emissions, contribute to ambient CO levels in CO nonattainment areas.

- **Particulate Matter.** Particulate matter represents a broad class of chemically and physically diverse substances. It can be principally characterized as discrete particles that exist in the condensed (liquid or solid) phase spanning several orders of magnitude in size. All particles equal to and less than 10 microns are called PM_{10}. Fine particles can be generally defined as those particles with an aerodynamic diameter of 2.5 microns or less (also known as $PM_{2.5}$), and coarse fraction particles are those particles with an aerodynamic diameter greater than 2.5 microns, but equal to or less than a nominal 10 microns.

  Particulate matter, like ozone, has been linked to a range of serious respiratory health problems, including premature mortality, aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days), aggravated asthma, acute respiratory symptoms, including aggravated coughing and difficult or painful breathing, chronic bronchitis, and decreased lung function that can be experienced as shortness of breath.

  The most recent PM_{10} monitoring data indicate that 14 designated PM_{10} nonattainment areas with a population of 23 million violated the PM_{10} NAAQS in the period 1997-99. In addition, there are 25 unclassifiable areas that have recently recorded ambient concentrations of PM_{10} above the PM_{10} NAAQS. According to our national modeled predictions, there were a total of 76 million people (1996 population) living in areas with modeled annual average $PM_{2.5}$ concentrations at or above 16 $\mu g/m^3$ (29 percent of the population), a level that is associated with harmful human health effects, including premature mortality.

Sources contribute to ambient PM levels directly, through PM in their emissions, and indirectly, through their emissions of organic carbon, especially NOx and SOx. Organic carbon accounts for between 27 and 36 percent of fine particle mass depending on the area of the country. Secondary PM is dominated by sulfate in the eastern U.S. and nitrate in the western U.S. The vast majority (>90 percent) of the direct mobile source PM emissions are in the fine PM size range.

- **Air Toxics.** Emissions from the engines covered by this proposal also contain several Mobile Source Air Toxics, including benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein. Users of these engines and vehicles can 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, snowmobile HC emissions 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 proposed standards affect emissions and air quality?

When the proposed emission standards for Large SI, recreational engines, and marine diesel engines are fully implemented in 2020, we expect a 70 percent reduction in HC emissions from these engines, a 75 percent reduction in NOx emissions, and a 56 percent reduction in CO emissions. These emission reductions will help reduce ambient concentrations of ozone, CO, and fine PM. In addition, they will reduce personal exposure for people who operate or who work with or are otherwise in close proximity to these engines and vehicles. They will also improve visibility in national parks.

For More Information:

See Chapter 1, Health and Welfare Concerns, of the Draft Regulatory Support Document for this proposal. That document can be found on our website: http://www.epa.gov/otaq/nonroad. You can also obtain additional information by contacting Margaret Borushko at:

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