



# Nonroad Engines and Air Pollution

## What is a Nonroad Engine

“Nonroad” is a relatively new term that covers a diverse collection of engines, equipment, and vehicles. Also referred to as “off-road” or “off-highway,” the nonroad category includes outdoor power equipment, recreational vehicles, farm and construction equipment, boats, and locomotives.

## Nonroad Engines and Air Pollution

Most nonroad equipment and vehicles are powered by engines that burn gasoline or diesel fuel. Pollution from these engines comes from by-products of the combustion process (exhaust) and, for gasoline-fueled engines, from evaporation of the fuel itself.

Electric equipment is cleaner than equipment powered by gasoline engines. Electrically-powered lawn and garden tools produce essentially no pollution from exhaust emissions or from fuel evaporation. However, even electric equipment is not pollution-free, because power plants that generate the electricity do pollute.

Emission control for nonroad engines has not been a major design consideration until now because of their relatively lower overall contribution to air pollution. Consequently, these engines are much less clean than highway vehicles, which have been subject to regulatory controls for more than 20 years. Emissions from nonroad engines contribute as much as 15 to 20 percent of unhealthy pollution in cities across the United States.

## Pollutants From Nonroad Engines

Pollutants from nonroad sources include:

**Hydrocarbons** - unburned or partially burned fuel molecules that react in the atmosphere to form ground-level ozone, a major component of smog. Some hydrocarbons are toxic and may cause cancer or other health problems. Another source of hydrocarbon pollution from nonroad engines is fuel evaporation, which occurs when gasoline vapors are forced out of the fuel tank (as, for instance, during refueling) or when gasoline is spilled and evaporates.

**Particulate matter** - an exhaust product primarily from diesel-fueled vehicles, these microscopic airborne particles damage the respiratory system and

contribute to the smoke and odor associated with diesel exhaust.

**Nitrogen oxides** - the result of subjecting nitrogen and oxygen in the air to the high temperature and high pressure conditions in an internal-combustion engine. Nitrogen oxides react with hydrocarbons in the atmosphere to form ground-level ozone. Nitrogen oxides also contribute to acid rain.

**Carbon monoxide** - a colorless, odorless, poisonous gas that results from incomplete fuel combustion.

**Carbon dioxide** - the ultimate product of burning carbon-based fuel. Carbon dioxide does not directly impair human health, but it is a “greenhouse gas” that contributes to the potential for global warming. As engine fuel economy declines, carbon dioxide emissions increase.

### **Controlling Nonroad Emissions**

The 1990 Clean Air Act specifically directs the U.S. Environmental Protection Agency (EPA) to study, and regulate if warranted, the contribution of nonroad engines to urban air pollution. A 1991 EPA study documented higher than expected emission levels across a broad spectrum of engines and equipment. Emission reductions are being sought from the following engine types:

- Small spark-ignition (mostly gasoline-fueled lawn and garden equipment)
- Large compression-ignition (mostly diesel-fueled farm and construction equipment and commercial marine vessels)
- Marine propulsion engines (mostly gasoline-fueled pleasure craft)
- Recreational spark-ignition (mostly used in snowmobiles, all-terrain vehicles, dirt bikes, and go-carts)
- Locomotives

EPA and industry are working together on a comprehensive strategy to reduce these emissions. One part of that strategy is a public information program to show consumers how to prevent pollution from nonroad engines by reducing gasoline spillage and choosing clean equipment. Another part of the strategy will establish a regulatory process that sets emission standards for several categories of nonroad engines.

### **For More Information:**

*The Office of Mobile Sources is the national center for research and policy on air pollution from highway and off-highway motor vehicles and equipment. You can write to us at the EPA National Vehicle and Fuel Emissions Laboratory, 2565 Plymouth Road, Ann Arbor, MI 48105. Our phone number is (313) 668-4333.*