



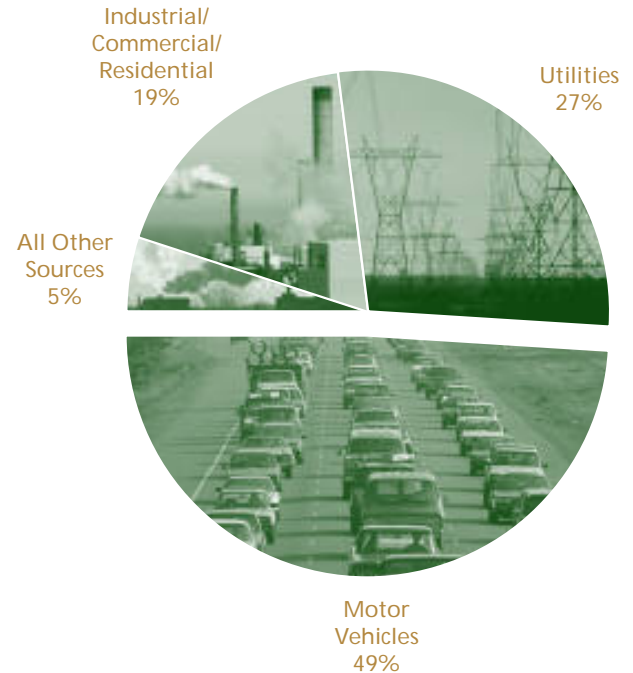
# $\text{NO}_x$

*How nitrogen oxides affect the way we live and breathe*

# NO<sub>x</sub> What is it? Where does it come from?

Nitrogen oxides, or NO<sub>x</sub>, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO<sub>2</sub>) along with particles in the air can often be seen as a reddish-brown layer over many urban areas.

Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources of NO<sub>x</sub> are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.



## Chief Causes for Concern



- contributes to atmospheric particles, that cause visibility impairment most noticeable in national parks.
- reacts to form toxic chemicals.
- contributes to global warming.

**NO<sub>x</sub> and the pollutants formed from NO<sub>x</sub> can be transported over long distances,** following the pattern of prevailing winds in the U.S.

This means that problems associated with NO<sub>x</sub> are not confined to areas where NO<sub>x</sub> are emitted. Therefore, controlling NO<sub>x</sub> is often most effective if done from a regional perspective, rather than focusing on sources in one local area.

### **NO<sub>x</sub> emissions are increasing.**

Since 1970, EPA has tracked emissions of the six principal air pollutants - carbon monoxide, lead, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds. Emissions of all of these pollutants have decreased significantly except for NO<sub>x</sub> which has increased approximately 10 percent over this period.

### **NO<sub>x</sub>**

- is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems.
- reacts to form nitrate particles, acid aerosols, as well as NO<sub>2</sub>, which also cause respiratory problems.
- contributes to formation of acid rain.
- contributes to nutrient overload that deteriorates water quality.

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Reducing emissions of

NO<sub>x</sub> is a **crucial**

component of EPA's

strategy for cleaner air.

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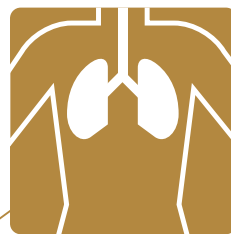


# Health and Environmental Impacts of NO<sub>x</sub>

NO<sub>x</sub> causes a wide variety of health and environmental impacts because of various compounds and derivatives in the family of nitrogen oxides, including nitrogen dioxide, nitric acid, nitrous oxide, nitrates, and nitric oxide.

**Ground-level Ozone (Smog)** - is formed when NO<sub>x</sub> and volatile organic compounds (VOCs) react in the presence of heat and sunlight. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are susceptible to adverse effects such as damage to lung tissue and reduction in lung function. Ozone can be transported by wind currents and cause health impacts far from the original sources. Millions of Americans live in areas that do not meet the health standards for ozone. Other impacts from ozone include damaged vegetation and reduced crop yields.

**Acid Rain** - NO<sub>x</sub> and sulfur dioxide react with other substances in the air to form acids which fall to earth as rain, fog, snow, or dry particles. Some may be carried by the wind for hundreds of miles. Acid rain damages forests; causes deterioration of cars, buildings, and historical monuments; and causes lakes and streams to become acidic and unsuitable for many fish.



**Particles** - NO<sub>x</sub> react with ammonia, moisture, and other compounds to form nitric acid vapor and related particles. Human health concerns include effects on breathing and the respiratory system, damage to lung tissue, and premature death. Small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and aggravate existing heart disease.

**Water Quality Deterioration** - Increased nitrogen loading in water bodies, particularly coastal estuaries, upsets the chemical balance of nutrients used by aquatic plants and animals. Additional nitrogen accelerates "eutrophication," which leads to oxygen depletion and reduces fish and shellfish populations. NO<sub>x</sub> emissions in the air are one of the largest sources of nitrogen pollution to the Chesapeake Bay.



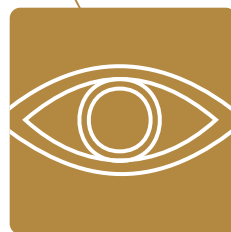
## NO<sub>x</sub>



**Global Warming** - One member of the NO<sub>x</sub> family, nitrous oxide, is a greenhouse gas. It accumulates in the atmosphere with other greenhouse gases causing a gradual rise in the earth's temperature. This will lead to increased risks to human health, a rise in the sea level, and other adverse changes to plant and animal habitat.



**Toxic Chemicals** - In the air, NO<sub>x</sub> reacts readily with common organic chemicals, and even ozone, to form a wide variety of toxic products, some of which may cause biological mutations. Examples of these chemicals include the nitrate radical, nitroarenes, and nitrosamines.



**Visibility Impairment** - Nitrate particles and nitrogen dioxide can block the transmission of light, reducing visibility in urban areas and on a regional scale in our national parks.

# EPA's Efforts to Reduce NO<sub>x</sub>

The U.S. Environmental Protection Agency (EPA), states, and local governments work as partners to reduce emissions of NO<sub>x</sub>. Reducing emissions of NO<sub>x</sub> is a crucial component of EPA's strategy for cleaner air.

## Emissions standards for motor vehicles

- Since the 1970's, EPA has required motor vehicle manufacturers to reduce NO<sub>x</sub> emissions from cars and trucks.



Reductions achieved through auto emissions control are significant. In the last ten years, NO<sub>x</sub> emissions from highway vehicles decreased by more than 5 percent, while vehicle miles traveled increased significantly. In a related effort, the use of reformulated gasolines has resulted in cleaner-burning engines. EPA and states continue to examine vehicle emissions-testing programs to ensure that readings accurately reflect emissions levels.

## Emission standards for electric utilities

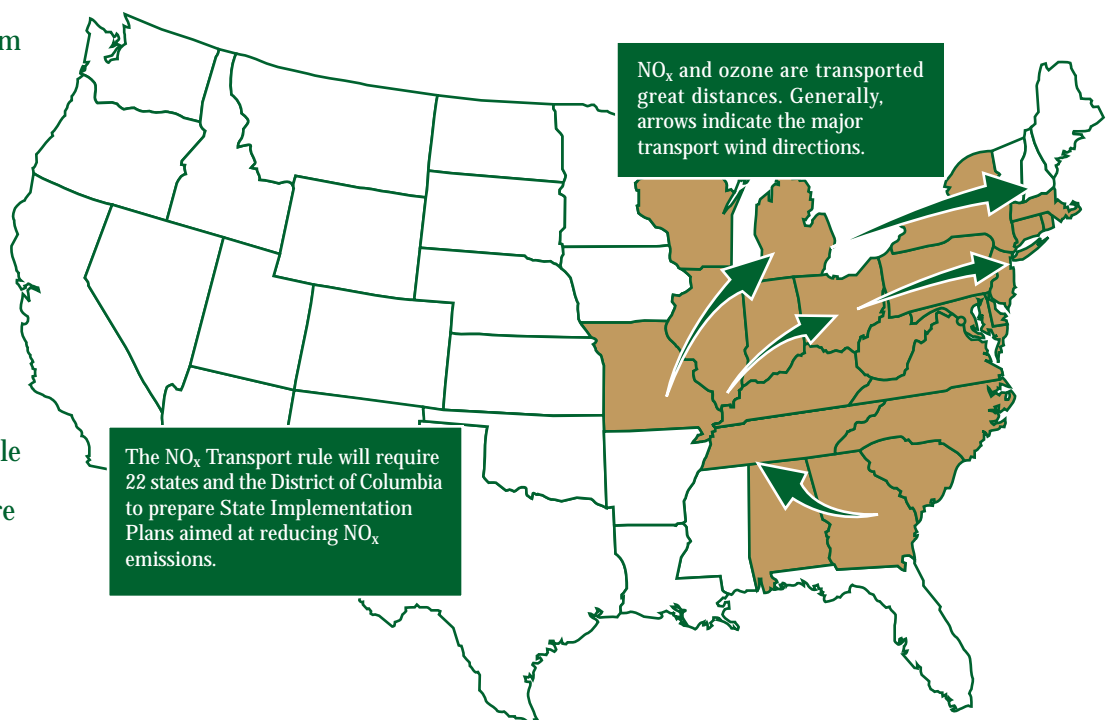
- To help reduce acid rain, EPA devised a two-phased strategy to cut NO<sub>x</sub> emissions from coal-fired power plants. The first phase, finalized in a rulemaking in 1995, aimed to reduce NO<sub>x</sub> emissions by over 400,000 tons per year between 1996 and 1999. The goal of the second phase is to reduce emissions by approximately 1.17 million tons per year beginning in the year 2000.

## NO<sub>x</sub> Transport rule for 22 States

- The Clean Air Act requires states to reduce ground-level ozone. Since NO<sub>x</sub> and ozone can be transported long distances, the Act also requires "upwind" states to implement programs that will help "downwind" states meet the ozone

standards. EPA issued a rule in 1998 that requires 22 states and the District of Columbia to revise their Implementation Plans to further reduce NO<sub>x</sub> emissions by taking advantage of newer, cleaner control strategies.

The rule does not mandate how the reductions are to be achieved, but gives each affected state a NO<sub>x</sub> emission target. States have flexibility in determining how to reduce emissions. The goal of this rule is to reduce total emissions of NO<sub>x</sub> by 1.2 million tons in the affected states by 2007.



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*EPA tracks emissions of six principal air pollutants - carbon monoxide, lead, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds. All have decreased significantly since passage of the Clean Air Act in 1970 -*

***EXCEPT FOR NITROGEN OXIDES.***

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United States

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Research Triangle Park, NC 27711



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