United States
Environmental Protection
Agency

Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

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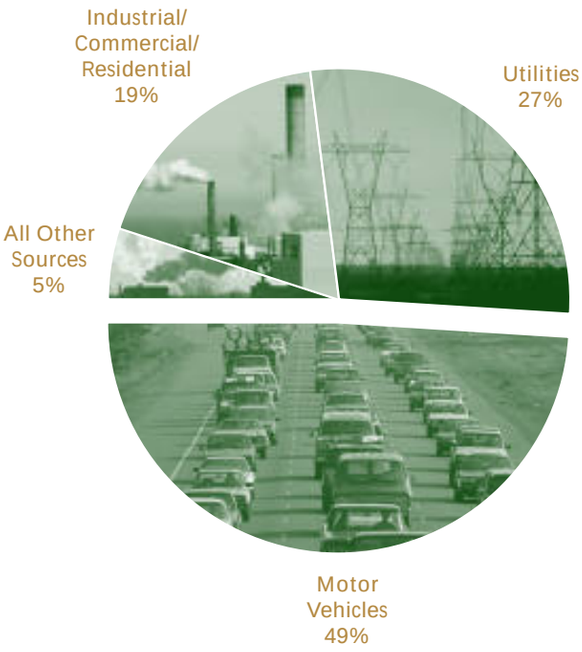
NO_x

How nitrogen oxides affect the way we live and breathe

NO_x What is it? Where does it come from?

Nitrogen oxides, or NO_x, 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_2) 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_x are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.



Chief Causes for Concern

NO_x

- 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_2, which also cause respiratory problems.
- contributes to formation of acid rain.
- contributes to nutrient overload that deteriorates water quality.
- contributes to atmospheric particles, that cause visibility impairment most noticeable in national parks.
- reacts to form toxic chemicals.
- contributes to global warming.

NO_x and the pollutants formed from NO_x can be transported over long distances, following the pattern of prevailing winds in the U.S. This means that problems associated with NO_x are not confined to areas where NO_x are emitted. Therefore, controlling NO_x is often most effective if done from a regional perspective, rather than focusing on sources in one local area.

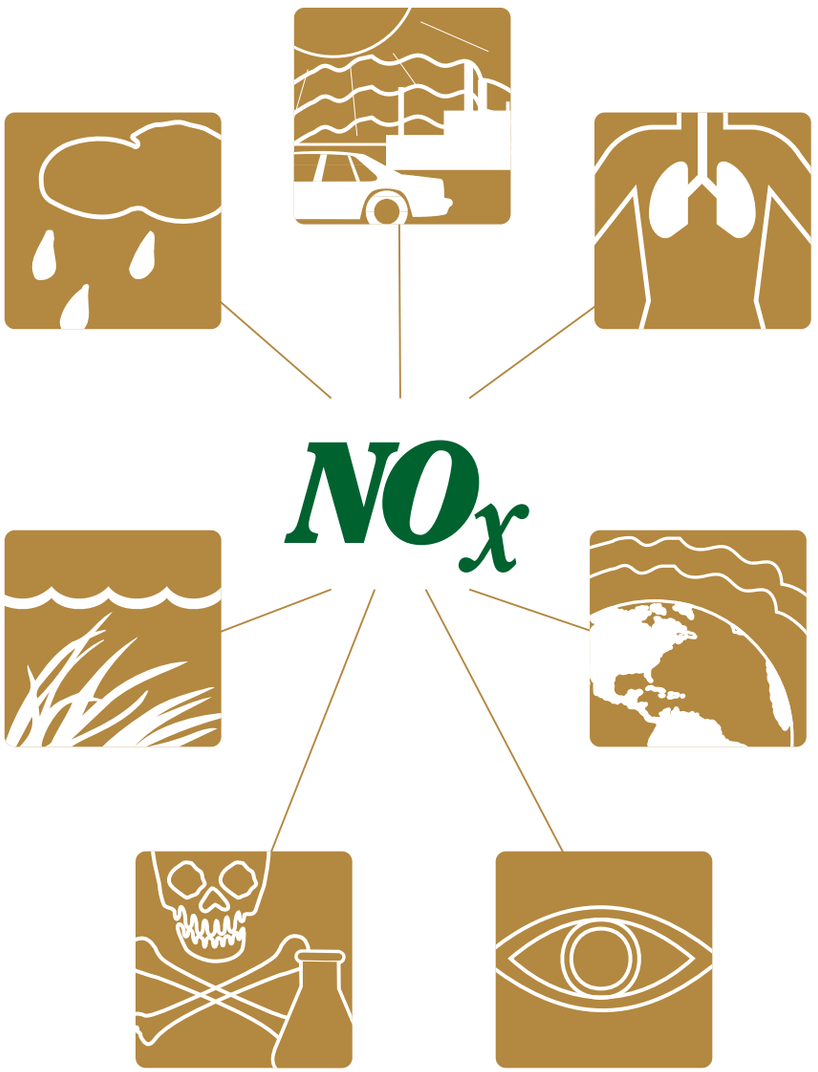
NO_x emissions are increasing. Since 1970, EPA has tracked emissions of the six principal air pollutants - carbon monoxide, lead, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds. Emissions of all of these pollutants have decreased significantly except for NO_x which has increased approximately 10 percent over this period.

Reducing emissions of NO_x is a **crucial** component of EPA's strategy for cleaner air.

Health and Environmental Impacts of NO_x

NO_x 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_x 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_x 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_x 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_x emissions in the air are one of the largest sources of nitrogen pollution to the Chesapeake Bay.

Global Warming - One member of the NO_x 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_x 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_x

The U.S. Environmental Protection Agency (EPA), states, and local governments work as partners to reduce emissions of NO_x. Reducing emissions of NO_x 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_x emissions from cars and trucks.

Reductions achieved through auto emissions control are significant. In the last ten years, NO_x 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.

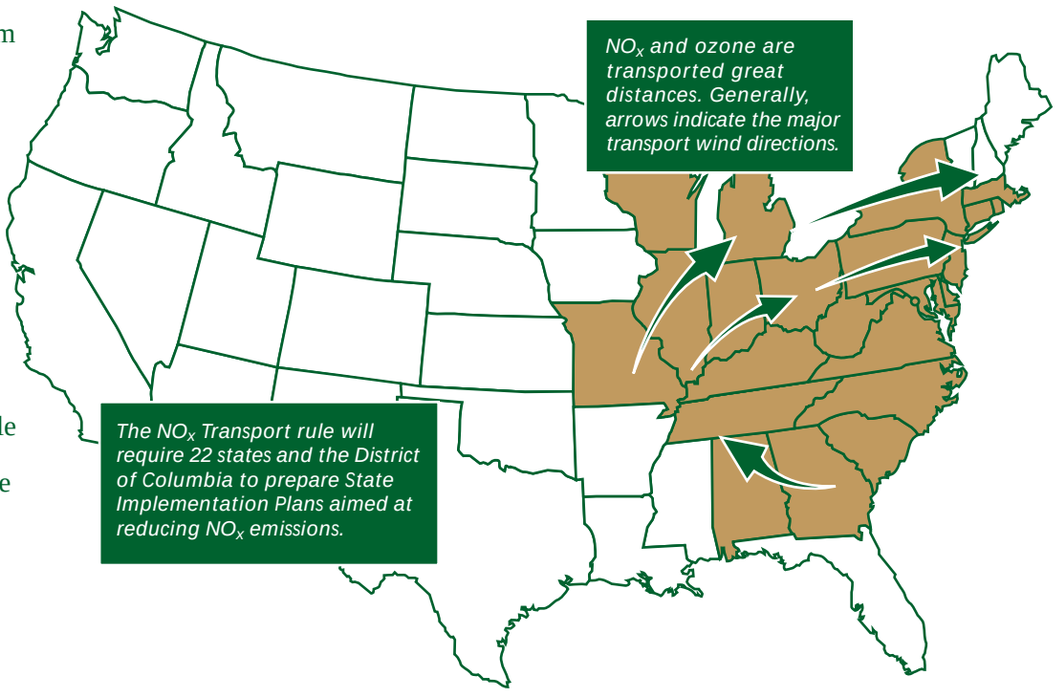
Emission standards for electric utilities

- To help reduce acid rain, EPA devised a two-phased strategy to cut NO_x emissions from coal-fired power plants. The first phase, finalized in a rulemaking in 1995, aimed to reduce NO_x 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_x Transport rule for 22 States

- The Clean Air Act requires states to reduce ground-level ozone. Since NO_x 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_x 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_x emission target. States have flexibility in determining how to reduce emissions. The goal of this rule is to reduce total emissions of NO_x by 1.2 million tons in the affected states by 2007.



U.S. EPA Offices

Region 1

(Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
John F. Kennedy Federal Building
One Congress Street
Boston, MA 02203
(617) 565-3476

Region 2

(New Jersey, New York, Puerto Rico, Virgin Islands)
290 Broadway
New York, NY 10007-3198
(212) 637-3725

Region 3

(Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)
1650 Arch Street
Philadelphia, PA 19103-2029
(215) 814-2100

Region 4

(Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)
61 Forsyth Street
Atlanta, GA 30303
(404) 562-9077

Region 5

(Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)
77 West Jackson Boulevard
Chicago, IL 60604-3507
(312) 353-2212

Region 6

(Arkansas, Louisiana, New Mexico, Oklahoma, Texas)
Fountain Place, 12th Floor, Suite 1200
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 665-7200

Region 7

(Iowa, Kansas, Missouri, Nebraska)
726 Minnesota Avenue
Kansas City, KS 66101
(913) 551-7020

Region 8

(Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)
999 18th Street, Suite 500
Denver, CO 80202-2466
(303) 312-6041

Region 9

(Arizona, California, Hawaii, Nevada, Guam, American Somoa)
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-1219

Region 10

(Alaska, Idaho, Oregon, Washington)
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-4273

EPA Headquarters

U.S. EPA

401 M Street, SW
Washington, DC 20460
(202) 260-7400
Homepage: http://www.epa.gov/oar

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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