

**Criteria Pollutants: Nitrogen Dioxide (NO₂)**

Office of Air Quality - Air Programs Branch

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Description:

- Nitrogen dioxide (NO₂) is one of a group of highly reactive gases known as nitrogen oxides (NO_x). Highly reactive gases are those that have a high potential to change in composition under certain conditions of pressure, temperature, or light, or upon contact with another chemical.
- NO_x emissions can be carried by the wind and affect air quality in downwind locations. This is known as regional transport.
- Of all the NO_x gases, NO₂ is the component of greatest concern and is currently used as the indicator for the larger group. NO₂ is emitted from many different sources when fuel is burned at high temperatures. These sources include industrial, commercial, and residential combustion units, motor vehicles, and electric utilities.
- Federal and state control measures, including federal emission standards for motor vehicles, regulations for electric utilities, and programs to reduce the regional transport of NO_x have resulted in substantial reductions in NO₂ over the past 30 years.

National Ambient Air Quality Standards (NAAQS) for NO₂:

- The federal Clean Air Act (CAA) requires United States Environmental Protection Agency (U.S. EPA) to set National Ambient Air Quality Standards (NAAQS) for six criteria pollutants that are considered harmful to public health and the environment. These include NO₂, as well as carbon monoxide, lead, ozone at ground level, particulate matter, and sulfur dioxide (SO₂).
- The NAAQS set limits for the criteria pollutants in the ambient air. Limits established to protect human health are referred to as “primary standards.” Limits established to prevent environmental damage are referred to as “secondary standards.”
- The CAA requires periodic review of the science upon which the NAAQS are based, as well as the standards themselves. Annual primary and secondary NAAQS were first established for NO₂ in 1971. The most recent revision to the NO₂ NAAQS was in January 2010, when U.S. EPA established a new one-hour primary standard to supplement the existing annual standard.
- To attain the primary NAAQS for NO₂, air quality must meet both the one-hour and annual standards.
- Under the primary one-hour NO₂ standards, the three-year average of the 98th percentile of the daily maximum one-hour concentrations cannot exceed 100 parts per billion (ppb) of air.
- Under the primary and secondary annual NO₂ standards, the annual mean concentration of hourly data cannot exceed 53 ppb.
- U.S. EPA designates areas that meet air quality standards as “attainment” and areas that violate air quality standards as “nonattainment.” Nonattainment areas must take steps to attain the standards.
- The NAAQS for NO₂ is designed to protect against exposure to the entire group of NO_x.

Environmental Impacts:

- Breathing NO₂ has been linked to adverse respiratory effects, including:
 - Increased asthma symptoms.
 - Worsened control of asthma.
 - Increases in respiratory illnesses and symptoms.
 - Increased emergency department visits and hospital admissions for all respiratory illnesses and asthma.
- NO₂, along with other NO_x, reacts with other chemicals in the air to form particulate matter and ozone, which are harmful to inhale and cause adverse environmental impacts.

- NO₂, along with SO₂, is a primary contributor to acid rain. Acid rain is a term for rain, snow, fog, and hail that contain sulfuric and nitric acids formed by the chemical reaction of NO_x and SO₂ with water, oxygen, and other chemicals in the atmosphere. Acid rain causes acidification of lakes and streams, damages trees at high elevations, and damages sensitive forest soils. NO_x and SO₂ gases can be transformed into sulfate and nitrate particles that contribute to impaired visibility and regional haze. Acid rain and particles that fall to the ground can land on statues, monuments, buildings, and manmade structures, causing damage to surfaces and paints.

IDEM's Role:

The Indiana Department of Environmental Management (IDEM) is responsible for protecting human health and the environment while providing for safe industrial, agricultural, commercial, and governmental operations vital to a prosperous economy. IDEM works in many ways to protect air quality:

- Implements federal, regional, and state control measures and regulations.
- Operates an extensive monitoring network to gather data on levels of criteria pollutants in the ambient air, identify air quality trends, and provide quality assured data to U.S. EPA for air quality designations.
- Issues air permits to regulated sources that detail restrictions on NO_x emissions.
- Works with communities in nonattainment areas to implement programs to achieve the standards as quickly as possible.
- Educates citizens and businesses about their roles in improving air quality.

Citizen's Role:

There are many actions every citizen can take to reduce their contribution or exposure to NO₂:

- Keep automobiles properly maintained, including tire pressure.
- Buy vehicles with low exhaust emissions and high fuel efficiency.
- Carpool, walk, bike, or use public transit when possible.
- Avoid idling by turning off the engine while waiting in drive-thru lanes (banks and restaurants) or picking up children from school. Combine errands and avoid fast starts.
- Reduce home energy consumption by turning off lights, televisions, and other appliances when not in use to reduce emissions from energy production. Set your thermostat lower in the winter and higher in the summer. Insulate your home as best as you can. Use energy efficient lighting and appliances, such as those with the ENERGYSTAR® label.

Additional Information:

- IDEM's website provides additional information concerning air quality including:
 - Overviews for the criteria pollutants including NO₂, and state implementation plans for attaining the NAAQS: www.in.gov/idem/sips/common-criteria-pollutants/.
 - Air quality monitoring data and reports: www.in.gov/idem/airmonitoring/air-quality-data/.
 - The nonattainment status for Indiana counties or townships: www.in.gov/idem/sips/nonattainment-status-of-counties/.
- U.S. EPA provides further information on the NAAQS process at: www.epa.gov/naaqs.
- ENERGY STAR® certified products are listed online at: www.energystar.gov/.
- U.S. EPA provides information concerning vehicles with improved fuel efficiency and lower emissions at: www.epa.gov/greenvehicles.
- For questions and concerns, feel free to call IDEM's Office of Air Quality at 317-233-0178 or 800-451-6027, option 4.