ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NITROGEN OXIDES (nitric oxide, nitrogen dioxide, etc.)

CAS #10102-43-9 (nitric oxide);
CAS #10102-44-0 (nitrogen dioxide)

Division of Toxicology ToxFAQs™ **April 2002**

This fact sheet answers the most frequently asked health questions (FAQs) about nitrogen oxides (nitric oxide, nitrogen dioxide, etc.). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Everybody is exposed to small amounts of nitrogen oxides in ambient air. Higher exposure may occur by burning wood or kerosene or near gas stoves or if you smoke. Exposure to high levels of nitrogen oxides can damage the respiratory airways. Contact with the skin or eyes can cause burns. Nitrogen dioxide and nitric oxide have been found in at least 9 and 6 of the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA), respectively.

What are nitrogen oxides?

Nitrogen oxides are a mixture of gases that are composed of nitrogen and oxygen. Two of the most toxicologically significant nitrogen oxides are nitric oxide and nitrogen dioxide; both are nonflammable and colorless to brown at room temperature. Nitric oxide is a sharp sweet-smelling gas at room temperature, whereas nitrogen dioxide has a strong, harsh odor and is a liquid at room temperature, becoming a reddish-brown gas above 70 °F.

Nitrogen oxides are released to the air from the exhaust of motor vehicles, the burning of coal, oil, or natural gas, and during processes such as arc welding, electroplating, engraving, and dynamite blasting. They are also produced commercially by reacting nitric acid with metals or cellulose.

Nitrogen oxides are used in the production of nitric acid, lacquers, dyes, and other chemicals. Nitrogen oxides are also used in rocket fuels, nitration of organic chemicals, and the manufacture of explosives.

What happens to nitrogen oxides when they enter the environment?

❑ Nitrogen oxides are broken down rapidly in the atmosphere by reacting with other substances commonly found in the air. The reaction of nitrogen dioxide with chemicals produced by sunlight leads to the formation of nitric acid, which is a major constituent of acid rain. Nitrogen dioxide also reacts with sunlight, which leads to the formation of ozone and smog conditions in the air we breathe.
❑ Small amounts of nitrogen oxides may evaporate from water, but most of it will react with water and form nitric acid.
❑ When released to soil, small amounts of nitrogen oxides may evaporate into air. However, most of it will be converted to nitric acid or other compounds.
❑ Nitrogen oxides do not build up in the food chain.

How might I be exposed to nitrogen oxides?

❑ The general population is primarily exposed to nitrogen oxides by breathing in air. People who live near combustion sources such as coal burning power plants or areas with heavy motor vehicle use may be exposed to higher levels of nitrogen oxides.
❑ Households that burn a lot of wood or use kerosene heaters and gas stoves tend to have higher levels of nitrogen oxides in them when compared to houses without these appliances.
❑ Nitric oxide and nitrogen dioxide are found in tobacco smoke, so people who smoke or breathe in second-hand smoke may be exposed to nitrogen oxides.

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❑ Workers employed in facilities that produce nitric acid or certain explosives like dynamite and trinitrotoluene (TNT), as well as workers involved in the welding of metals may breath in nitrogen oxides during their work.

How can nitrogen oxides affect my health?

Low levels of nitrogen oxides in the air can irritate your eyes, nose, throat, and lungs, possibly causing you to cough and experience shortness of breath, tiredness, and nausea. Exposure to low levels can also result in fluid build-up in the lungs 1 or 2 days after exposure. Breathing high levels of nitrogen oxides can cause rapid burning, spasms, and swelling of tissues in the throat and upper respiratory tract, reduced oxygenation of body tissues, a build-up of fluid in your lungs, and death.

If you were to come into skin or eye contact with high concentrations of nitrogen oxide gases or nitrogen dioxide liquid, you would likely experience serious burns.

We do not know if exposure to nitrogen oxides will result in reproductive effects in humans.

How likely are nitrogen oxides to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified nitrogen oxides for potential carcinogenicity.

How can nitrogen oxides affect children?

Children would probably be affected by exposure to nitrogen oxides in the same ways as adults. But we do not know whether children differ from adults in their susceptibility to nitrogen oxides.

Exposure of pregnant animals to nitrogen oxides has resulted in toxic effects in developing fetuses. Nitrogen oxides have also caused changes in the genetic material of animal cells. But we do not know if exposure to nitrogen oxides might cause developmental effects in humans.

How can families reduce the risk of exposure to nitrogen oxides?

Families with indoor gas stoves, space heaters, or indoor cigarette smoke can minimize indoor exposure to nitrogen oxides by periodically allowing fresh outdoor air into the home. Farm families should not allow children to play near silos that contain silage.

Is there a medical test to show whether I've been exposed to nitrogen oxides?

Specific tests for the presence of nitrogen oxides in blood or urine are not generally useful to the doctor. If a severe exposure has occurred, blood and urine analyses and other tests may show whether damage has been done to your respiratory airways. Some of these tests may be done at the doctor's office, others may require a clinic or hospital that have specialized equipment.

Has the federal government made recommendations to protect human health?

The EPA has established that the average concentration of nitrogen dioxide in ambient air in a calendar year should not exceed 0.053 parts of nitrogen dioxide per million parts of air (0.053 ppm).

The Occupational Safety and Health Administration (OSHA) has set a limit of 25 ppm of nitric oxide in workplace air during an 8-hour workday, 40-hour work week. OSHA has also set a 15-minute exposure limit of 5 ppm for nitrogen dioxide in workplace air.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.