

# Nitrate/Nitrite - ToxFAQs™

**CAS # 14797-55-8 (nitrate), 14797-65-0 (nitrite)**

This fact sheet answers the most frequently asked health questions (FAQs) about inorganic nitrate and nitrite. For more information, call the Agency for Toxic Substances and Disease Registry (ATSDR) Information Center at 1-800-232-4636. 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 these substances 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 possible exposure to other chemicals.

**HIGHLIGHTS:** Exposure to nitrate and nitrite mainly occurs by ingestion of water and foods that contain these chemicals. Excess nitrate and nitrite can cause methemoglobinemia, which decreases the ability of the blood to transport oxygen. Ammonium nitrate, sodium nitrate, sodium nitrite, and potassium nitrite have been identified in 7, 4, 2, and 1, respectively, of the 1,699 National Priorities List sites identified by the Environmental Protection Agency (EPA).

## What are nitrate and nitrite?

Plants and animals require nitrogen to live and grow. However, nitrogen gas, which is abundant in the air we breathe, must first be converted to nitrogen compounds that can be used by plants and animals as sources of nitrogen. This process is called nitrogen fixation. Nitrate and nitrite are two of the nitrogen compounds that are used by plants and animals and eventually return to the air as nitrogen gas. Nitrate and nitrite can also be produced in the body.

In nature, plants utilize nitrate as an essential nutrient. In commerce, the majority of nitrate is used in inorganic fertilizers. Nitrate and nitrite are also used in food preservation, some pharmaceutical drugs, and the production of munitions and explosives.

## What happens to nitrate and nitrite when they enter the environment?

- Nitrogen exists naturally in soils, typically bound to organic matter and mineral soil material. Available forms of nitrogen, including nitrate and nitrite, are present in soils, water, air, plants, and meat products.
- In nature, nitrate and nitrite can be found in igneous and volcanic rocks.
- Nitrate and nitrite salts completely dissolve in water.
- Bacteria in soil and plants use oxygen to change nitrite into more stable nitrate, which can be converted back to nitrite by other bacteria when oxygen is lacking.
- Animal wastes and nitrogen-containing fertilizers increase concentrations of nitrate in the environment.

## How might I be exposed to nitrate and nitrite?

- Nitrate and nitrite are found in diets through vegetables (especially celery, lettuce, and spinach), fruits, cured meats, fish, dairy products, beers, and cereals.
- Some meats and meat products contain sodium nitrate and/or sodium nitrite as preservatives.
- Your body naturally produces some nitrate and nitrite.
- You can be exposed by drinking water from wells containing nitrate from sources such as animal waste and/or fertilizer runoff.
- Release of nitrate and/or nitrite to soil and water at waste disposal sites could result in contamination of drinking water sources and increased uptake by plants you eat.
- Inhaling nitrate or nitrite is not a likely exposure route of concern for the general population, although nitrates are sometimes inhaled to relieve painful angina attacks.

## How can nitrate and nitrite affect my health?

Most people are not exposed to levels that would cause adverse health effects.

Some people who ate food or drank fluids that contained unusually high levels of nitrite experienced methemoglobinemia (decreased ability of the blood to carry oxygen to tissues) and related symptoms such as decreases in blood pressure, increased heart rate, headaches, abdominal cramps, and vomiting; some people died.

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## How likely are nitrate and nitrite to cause cancer?

There is limited evidence that nitrite may cause some cancers of the gastrointestinal tract in humans and mice.

The International Agency for Research on Cancer (IARC) noted that the presence of nitrite and some types of amines or amides in the acid environment of the stomach may result in the production of some cancer-causing N-nitroso compounds; under these conditions, IARC determined that ingested nitrate and nitrite is probably carcinogenic to humans. The EPA has not classified nitrate or nitrite for carcinogenicity.

## How can nitrate and nitrite affect children?

Children can experience the same effects as adults from overexposure to nitrate or nitrite.

Young infants (<6 months of age) appeared to be particularly sensitive to the effects of nitrite on hemoglobin after consuming formula prepared with drinking water that contained nitrate at levels higher than recommended limits; some of these infants died.

It is not known whether nitrate or nitrite can cause birth defects. Some studies suggest that ingesting relatively high levels of nitrate or nitrite could cause developmental effects, but other studies found no evidence for this.

## How can families reduce the risk of exposure to nitrate and nitrite?

- Consider eating less of those foods that contain high levels of nitrate or nitrite. This consideration is particularly relevant to infants and small children.
- Do not drink water containing levels of nitrate or nitrite higher than guideline levels for drinking water.

## Is there a medical test to show whether I've been exposed to nitrate and nitrite?

Methods are available to detect nitrate and nitrite in plasma and urine; however, these are usually not available at a doctor's office and are not clinically useful.

Routine blood tests are available to detect the medical condition, methemoglobinemia. However, these tests cannot tell whether the high methemoglobin levels were caused by nitrate and nitrite or by some other substance or disease.

## Has the federal government made recommendations to protect human health?

The EPA has established maximum contaminant level (MCL) and maximum contaminant level goal (MCLG) values of 10 mg/L (as nitrogen) for nitrate (approximately 44 mg nitrate/L), 1 mg/L (as nitrogen) for nitrite (approximately 3.3 mg nitrite/L), and 10 mg/L (as nitrogen) for total nitrate and nitrite.

The Food and Drug Administration allowable levels in bottled water are 10 mg/L (as nitrogen) for nitrate (approximately 44 mg nitrate/L), 1 mg/L (as nitrogen) for nitrite (approximately 3.3 mg nitrite/L), and 10 mg/L (as nitrogen) for total nitrate and nitrite.

The Occupational Safety and Health Administration has not set a legal limit for nitrate or nitrite in workplace air.

The National Institute for Occupational Safety and Health has not set a recommended limit for nitrate or nitrite in workplace air.

## Reference

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Nitrate and Nitrite (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services in Atlanta, GA.

## Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333-4027.

Phone: 1-800-232-4636.

ToxFAQs™ on the web: [www.atsdr.cdc.gov/toxFAQs](http://www.atsdr.cdc.gov/toxFAQs)

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.