

### **What are Nitrates/Nitrites?**

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 explosions.

### **How do Nitrates get into the environment?**

Nitrates are generally found in surface waters and shallow groundwater. Plants naturally release nitrogen when they die and decompose (rot). The nitrogen from the rotting plants oxidize (combine with oxygen) to form nitrates. During a rainfall, surface water can move through the soil and carry these nitrates down to the underground drinking water (groundwater).

Other ways water can be contaminated with nitrates is through the use of products that contain large amounts of ammonia. Ammonia is oxidized (combines with oxygen) and forms nitrites. Liquid ammonia fertilizer spills can form nitrates that also make their way through the soil to the ground water.

Because humans and animals (mammals) eat vegetables and preserved meats, nitrates and nitrites can be found in human and

animal waste. Old and poorly maintained sewage systems and improper well construction can contaminate ground water with nitrates as well.

### **How can I be exposed to Nitrates?**

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.

### **Can exposure to Nitrates/Nitrites make me sick?**

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.

## **How can nitrate and nitrite affect children?**

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

Young children (<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.

## **Do nitrates/nitrites 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.

## **Is there a medical test to show whether I have been exposed to nitrates/nitrites?**

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 U.S. EPA MCL (maximum contaminate level) requires the amount of nitrates in drinking water be less than 10 ppm (parts

per million). The public drinking water supplies are tested quarterly and the water is treated to remove impurities. Ohio Administrative Code (OAC) Chapter 3701-28-04 established a nitrate standard for private water systems in Ohio of 10 ppm. All new and altered wells are pre-screened and tested for the presence of nitrates (since 2000). Your local health district can assist with nitrate testing.

## **Who is at risk to Nitrate/Nitrite exposure?**

The persons most at risk to exposure to nitrates/nitrites are infants less than six-months old who are fed formula made with nitrate-contaminated water at levels above the U.S. Environmental Protection Agency's (EPA) safe drinking water standards of 10ppm (10 parts per million). **Note: "ppm" is a unit of measurement. An example of 10 parts per million would be having ten beans in a pile of one million beans.**

Infants are more sensitive to nitrates because they take in more water for their body weight. Also, infants' blood contains a form of hemoglobin, fetal hemoglobin, which is more easily changed into methemoglobin than is adults' hemoglobin. In addition, infants' digestive systems have a higher pH, which increase the changing of nitrates into nitrites.

Pregnant women may be more sensitive to nitrates because their blood contains higher levels of methemoglobin. They may be especially sensitive at the 30<sup>th</sup> week of pregnancy. When nursing mothers consume water that contains nitrate, the amount of nitrate in breast milk may increase. It is recommended that nursing women avoid drinking water that contains nitrate levels more than 10 milligrams per liter of nitrate.

## **How can I reduce my intake of Nitrates/Nitrites?**

Keep in mind that healthy vegetables are the main source of nitrates, but vegetables are good for you and we would never suggest removing vegetables from your diet.

However, you can reduce your intake of nitrates by:

- Reducing the amount of preserved meats you eat (such as sausage, bacon, hot dogs, etc.).
- Making sure you are drinking water that is not contaminated with nitrates if you drink well water.
- Infant formula should be made with an alternative approved source when the nitrates are higher than 10 ppm.
- Vitamin C may help prevent the nitrates changing to nitrites. Diets high in vitamin C will reduce the risk of methemoglobinemia.

## **References:**

Agency for Toxic Substances and Disease Registry, Nitrate/Nitrite Toxicity, September, 2015.

Toxics A to Z, University of California Press, 1991.

Handbook of Toxic and Hazardous Chemicals and Carcinogens, 2<sup>nd</sup> edition, Noyes Publications, 1985.

## **Where Can I Get More Information?**

Ohio Department of Health  
Bureau of Environmental Health and Radiation Protection  
Radiological Health and Safety Section  
246 N. High Street  
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