

FACT SHEET: NITRATE IN DRINKING WATER

Nitrate is a compound that is formed naturally when nitrogen combines with oxygen or ozone. Nitrogen is essential for all living things, but high levels of nitrate in drinking water can be dangerous to health, especially for infants and pregnant women. Nitrates are also made in large amounts by plants and animals, and are released in smoke and industrial or automotive exhaust. The air we breathe contains 78 percent nitrogen gas.

Nitrate and Your Diet

Nitrate is found in many food items. The major intake of nitrate in adults is from food rather than water. Vegetables such as spinach, lettuce, beets, carrots, celery, and potatoes have significant nitrate concentrations. Drinking water normally contributes only a very small percentage of the total nitrate intake.

Sources of Nitrate in Water

Nitrate is formed during the decay of organic matter, such as sewage, animal wastes, and fertilizers. Low levels of nitrate in shallow, unprotected aquifers are naturally occurring. Most groundwater in Washington County contains less than one milligram per liter (1 mg/L) of nitrate-nitrogen. (One mg/L is equivalent to one part per million [1 ppm] or one part nitrate for every one million parts of water.)

However, higher levels of nitrate indicate poor sanitary quality of water. It is often difficult to pinpoint the source because there are so many possibilities. In urban or suburban areas nitrate can result from excessive lawn fertilization or a concentration of individual sewage treatment systems in a small area. In rural areas excessive crop fertilization, animal feedlots, municipal or industrial wastewater or landfills, or a malfunctioning septic system can cause high levels of nitrate.

Health Concerns

Too much nitrate in drinking water poses a risk to infants under six months of age. If an infant is fed water or formula made with water that is high in nitrate, a condition known as **methemoglobinemia** or blue baby syndrome can develop. Bacteria which are present in an infant's digestive system can convert nitrate to nitrite, a chemical which can interfere with the ability of the infant's blood to carry oxygen. As the condition worsens, the baby's skin turns a bluish color, particularly around the eyes and mouth. If this condition is observed, seek medical help immediately. The infant is becoming asphyxiated because oxygen cannot be transported by the blood. Left untreated methemoglobinemia can result in death. However, prompt medical attention with an injection of methylene blue normally results in quick recovery of the patient.

Pregnant women, people with reduced stomach acidity, and people with certain blood disorders may also be susceptible to nitrate-induced methemoglobinemia. Some research has suggested that nitrate may also play a role in the development of some cancers. However, at this time there is no clear evidence that nitrate ingestion results in an increased cancer risk.

Why are infants more susceptible?

There are four reasons:

1. Infant stomachs have less acidity which allows the growth of certain bacteria which are capable of converting nitrate to the more toxic nitrite.
2. Infants have a significant amount of fetal hemoglobin which is more easily converted to methemoglobin than adult hemoglobin.
3. Infants have not yet developed certain enzymes that are able to convert methemoglobin back to normal hemoglobin.
4. In relation to body weight, an infant consumes a much larger volume of water than an adult.

Recommended Drinking Water Limits

The U.S. Environmental Protection Agency and the Minnesota Department of Health have recommended a maximum contaminant level of 10 mg/L for nitrate-nitrogen. This level was established to prevent the occurrence of methemoglobinemia. Water containing over 10 mg/L nitrate-nitrogen should not be used in preparing formula for infants.

Interpreting Your Results: Recommended Precautions and Procedures

If nitrate results range between 0-4.9 ppm or mg/L:

1. Continue to test your water for nitrate every year or every other year, and annually for bacteria.
2. Properly manage nitrogen sources when used near your well.
3. Continue to monitor your septic tank (if applicable). Sewage from improperly maintained septic tanks may contaminate your water.

If your nitrate results range between 5 to 9.9ppm or mg/L:

1. Presently the nitrate nitrogen level in your water is safe, but you may have a source of contamination which could include: contributions from fertilized lawns or fields, septic tanks, animal wastes or decaying plants.
2. Continue to test **annually** for nitrates and bacteria.
3. Do not boil high nitrate water to reduce the nitrate level. **Boiling actually increases the nitrate level due to evaporation of the water.**

If your nitrate results exceed 10 mg/L, a number of important points should be remembered:

1. Do not give the water to infants under six months of age, either directly or in formula. Use only safe water from a known low nitrate source.
2. Do not boil high nitrate water to reduce the nitrate level. **Boiling actually increases the nitrate level due to evaporation of the water.**
3. Seek medical help if the skin of an infant takes on a blue tone or tint.
4. Consider having your well inspected. It's a good idea to have your well inspected by a licensed well contractor if the well is old, or you do not know if it is structurally sound. Nitrate and bacteria problems are sometimes caused by structural flaws which allow contaminated surface water to enter the well.

NOTE: As nitrate levels increase, especially in wells near cropped fields, the probability of detecting pesticides also increases. Minnesota Department of Agriculture (MDA) monitoring data indicates that pesticide levels are usually below state and federal drinking water guidelines. For more information on testing and health risks from pesticides in groundwater go to: <http://www.mda.state.mn.us/protecting/waterprotection/pesticides.aspx>

Pesticide testing is available from the University of Wisconsin – Steven's Point Water & Environmental Analysis Lab, ranging from \$75-175. Call the lab at 715-346-3209, or send an e-mail to: weal@uwsp.edu

Testing for Nitrate in Water

Nitrate cannot be seen in water. The only method to determine the amount of nitrate in drinking water is to collect a sample and submit it to a qualified laboratory. Because the presence of nitrate in well water may indicate pollution, the water should also be checked for other contaminants. Coliform bacteria are indicator organisms that provide additional information regarding the sanitary quality of drinking water.

The Washington County Public Health and Environment Department provides sampling kits to County residents for testing well water. For more information about this service contact the Public Health and Environment Department at 651-430-6655.

Treatment of Drinking Water

Although the technology for nitrate removal from water exists, it is generally not practical or economical to treat the water. Point-of-use treatment systems for nitrate removal are expensive and require frequent maintenance and sampling to achieve effective operation.