

## Nitrate in Drinking Water

Nitrate is a compound that both occurs naturally and has many human-made sources. Nitrate is in some lakes, rivers, and groundwater in Minnesota. You cannot taste, smell, or see nitrate in water. Consuming too much nitrate can be harmful—especially for babies.

### Health Effects

Consuming too much nitrate can affect how blood carries oxygen and cause methemoglobinemia (also known as a blue baby syndrome). Bottle-fed babies under six months old are at the highest risk of getting this illness. Methemoglobinemia can result in serious illness or death. It can cause the lips and skin to turn a bluish color but may be difficult to detect in infants. Symptoms will often resolve once the nitrate source is removed. People with glucose-6-phosphate-dehydrogenase deficiency or other metabolic conditions may be at higher risk of getting this illness<sup>1</sup>.

Science has emerged recently describing possible health impacts of long-term exposure to nitrate in drinking water at concentrations below the current regulatory standard. Potential health impacts include associations with thyroid problems, adverse pregnancy outcomes, and cancers (particularly colorectal)<sup>2</sup>. Further research is necessary to confirm these observations. Minnesota Department of Health (MDH) continues to follow the research and will provide updated guidance when adequate data are available.

### How to Protect Yourself and Your Family

The U.S. Environmental Protection Agency (EPA) standard for nitrate in drinking water is 10 milligrams of nitrate (measured as nitrogen)

per liter of drinking water (mg/L). 1 milligram per liter (mg/L) is the same as 1 part per million.

Based on the data available at this time, this standard protects infants against methemoglobinemia. Infants are the most sensitive group of people for known health effects.

### If you have a private well

The following types of wells are the most vulnerable to nitrate contamination, especially if they are an older well (prior to 1974), are near septic systems, or are in areas with agricultural activities:

- Shallow wells.
- Wells in sand, karst, and fractured rock aquifers.
- Dug wells with casings that are not watertight.
- Wells with damaged or leaking casings or fittings.

See information below for steps you can take to prevent and address contamination in your well.

### Prevent contamination

- **Construct your well in a safe spot.** See the *Protecting Your Well* webpage for guidance.
- **Keep nitrate sources away from your well.** Sources may include fertilizer, septic systems, and animal waste. See *Protecting Your Well* for tips.
- **Regularly inspect your well for damage** (see *Protecting Your Well*). Contact a licensed well

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<sup>1</sup>Agency for Toxic Substances and Disease Registry (ATSDR). 2021. [ATSDR Toxic Substances Portal: Nitrate and Nitrite.](http://www.atsdr.cdc.gov/csem/nitrate_2013/docs/nitrite.pdf) ([http://www.atsdr.cdc.gov/csem/nitrate\\_2013/docs/nitrite.pdf](http://www.atsdr.cdc.gov/csem/nitrate_2013/docs/nitrite.pdf)). Accessed January 2025.

<sup>2</sup>Ward, M. H., et. al (2018). [Drinking Water Nitrate and Human Health: An Updated Review.](https://pmc.ncbi.nlm.nih.gov/articles/PMC6068531/) *International journal of environmental research and public health*, 15(7), 1557. (<https://pmc.ncbi.nlm.nih.gov/articles/PMC6068531/>). Accessed January 2025.

contractor if you find any damage (see *Licensed Well and Boring Contractor Directory*).

- **Test for nitrate every year.** You are responsible for regularly testing your well water (See *Water Quality and Testing* for guidance). Nitrate above 3 mg/L in your well water suggests that additional testing may be a good idea. If nitrate is present, then other contaminants such as pesticides may be as well. If you have recently had a baby, test your well before bringing your baby home.

MDH recommends using an accredited laboratory to test your well water (see *Search for Accredited Labs*). Contact the laboratory to get sample containers and instructions or ask your county environmental or public health services if they provide well water testing services.

#### Address contamination

If nitrate is detected in your water at levels above 10 mg/L, follow these steps:

- **Get your drinking water from another source**, such as bottled water, until you can fix your system. This is especially important if babies under six months old drink formula made with the water. Boiled water is not a safe option because boiling water may make nitrate more concentrated.
- **Have a licensed well contractor inspect your well.**
- **Find and remove potential sources of nitrate** contamination on your property (see *Protecting Your Well* webpage for sources to check).
- **Consider installing a home water treatment system.** This may be an option if you have taken steps to reduce or eliminate all potential sources of nitrate and a licensed well contractor inspected your well and determined it is working properly. To be safe, MDH recommends that no babies under six

months old drink the treated water; bottled water may be a safer alternative for them in case the treatment stops working.

#### If you are on a community water system

Your water system tests for nitrate at least once a year to make sure levels meet the EPA standard and that your drinking water is safe.

If your drinking water is above the standard, your water system will notify customers and include the following message from the EPA: “Nitrate is considered to be an acute contaminant. Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.”

You can find the level of nitrate detected in the system serving where you live by reading the system's water quality report (also known as a Consumer Confidence Report [CCR]). Contact your water system to get a paper copy of your CCR or find it online (see *Consumer Confidence Report*).

If you want to find the nitrate level for a place other than your home, contact the water system serving that location.

#### Nitrate in the Environment

Nitrate occurs naturally in the environment. It is found in some foods (e.g., spinach and carrots) and comes from natural processes, like plant decay and lightning. Nitrate is in many fertilizers used on yards, gardens, golf courses, and crops. Other sources of nitrate include discharge from sewage systems and animal wastes.

Nitrate has been detected in groundwater and surface water in many places in Minnesota. Land use and hydrogeology affect the levels of nitrate in water.

The Minnesota Pollution Control Agency found that 27 percent of surface water samples had nitrate levels above 10 mg/L. Southern Minnesota had the highest levels of nitrate in surface water (see *Report on Nitrogen in Surface Water*).

### Nitrate in drinking water

Natural processes can cause low levels of nitrate in drinking water - usually less than 3 mg/L. High levels of nitrate - over 10 mg/L in water - can be from runoff or leakage from fertilized soil, wastewater, landfills, animal feedlots, septic systems, or urban drainage.

About 4 percent of private wells constructed in Minnesota since 1991 have nitrate levels above 3 mg/L. While 3 mg/L is less than the EPA standard, it suggests human-made sources of nitrate may have contaminated the water, and the level could increase over time. Minnesota Department of Agriculture Township Testing Program found that over 10 percent of the private wells sampled in some townships in southwestern, southeastern, central, and north-central Minnesota have nitrate levels above 10 mg/L.

Over the past 20 years, some public water systems in Minnesota have detected nitrate levels above 10 mg/L in treated water; they have worked to address the issue. See *Nitrate in community water systems: facts and figures* and *MDH Drinking Water Protection Annual Reports* for more information.

### Resources

Helpful links included in text above.

- [Accredited Labs in Minnesota Accepting Drinking Water Samples from Private Well Users](http://www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/labmap.pdf) ([www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/labmap.pdf](http://www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/labmap.pdf))

- [Consumer Confidence Reports](http://www.health.state.mn.us/ccr) ([www.health.state.mn.us/ccr](http://www.health.state.mn.us/ccr))
- [Drinking Water Protection Annual Reports](http://www.health.state.mn.us/communities/environment/water/dwar.html) ([www.health.state.mn.us/communities/environment/water/dwar.html](http://www.health.state.mn.us/communities/environment/water/dwar.html))
- [Home Water Treatment](http://www.health.state.mn.us/communities/environment/water/factsheet/hometreatment.html) ([www.health.state.mn.us/communities/environment/water/factsheet/hometreatment.html](http://www.health.state.mn.us/communities/environment/water/factsheet/hometreatment.html))
- [Licensed Well and Boring Contractor Directory](http://www.health.state.mn.us/communities/environment/water/wells/lwc/index.html) ([www.health.state.mn.us/communities/environment/water/wells/lwc/index.html](http://www.health.state.mn.us/communities/environment/water/wells/lwc/index.html))
- [Nitrate in community water systems](https://data.web.health.state.mn.us/nitrate-messaging) (<https://data.web.health.state.mn.us/nitrate-messaging>)
- [Nitrate in Well Water \(PDF\)](http://www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/nitrate.pdf) ([www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/nitrate.pdf](http://www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/nitrate.pdf))
- [Protecting Your Well](http://www.health.state.mn.us/communities/environment/water/wells/construction/protect.html) ([www.health.state.mn.us/communities/environment/water/wells/construction/protect.html](http://www.health.state.mn.us/communities/environment/water/wells/construction/protect.html))
- [Report on Nitrogen in Surface Water](http://www.pca.state.mn.us/pollutants-and-contaminants/nitrogen) ([www.pca.state.mn.us/pollutants-and-contaminants/nitrogen](http://www.pca.state.mn.us/pollutants-and-contaminants/nitrogen))
- [Subsurface Sewage Treatment Systems](http://www.pca.state.mn.us/business-with-us/septic-systems) ([www.pca.state.mn.us/business-with-us/septic-systems](http://www.pca.state.mn.us/business-with-us/septic-systems))
- [Township Testing Program](http://www.mda.state.mn.us/townshiptesting) ([www.mda.state.mn.us/townshiptesting](http://www.mda.state.mn.us/townshiptesting))
- [Water Quality and Testing](http://www.health.state.mn.us/wellwater) ([www.health.state.mn.us/wellwater](http://www.health.state.mn.us/wellwater))

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To obtain this information in a different format, call: 651-201-4700.