NEBRASKA
DEPT. OF ENVIRONMENT AND ENERGY

NITRATE IN DRINKING WATER

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

Background Information

Nitrate occurs naturally and at safe and healthy levels in some foods (e.g., spinach and carrots) and comes from natural processes, like plant decay. The primary source of inorganic nitrate is from fertilizers used on yards, gardens, golf courses, and crops. Certain industrial processes and leaks from fertilizer storage can also be a source of inorganic nitrate. Common sources of organic nitrate are human and animal waste.

Nitrate in Nebraska Water

Nitrate has been found in groundwater across Nebraska. While nitrate occurs naturally, levels in groundwater above 3 mg/L are considered an indicator of human-driven contamination.

Based on available data, there were 16,403 domestic well nitrate samples collected from 2003-2024. Of all the domestic wells sampled over this period, 6,468 (39.4%) of them were above 3 mg/L for nitrate and 2,775 (16.9%) of them were above 10 mg/L for nitrate. For more information about nitrate in Nebraska surface water and groundwater, see the Nebraska Department of Environment and Energy's (NDEE's) annual water program publications included in the Resources section.

Health Effects

HUMANS: The U.S. Environmental Protection Agency (EPA) established the Maximum Contaminant Level (MCL) for nitrate in drinking water at 10 milligrams of nitrate (measured as nitrogen) per liter of drinking water (mg/L NO3-N).

Drinking water with nitrate above the MCL can affect how blood carries oxygen and may cause methemoglobinemia (also known as blue baby syndrome). Bottle-fed babies under six months old are at the highest risk of getting methemoglobinemia. This illness can cause the skin to turn a bluish color and result in serious illness or death. Other symptoms connected to methemoglobinemia include decreased blood pressure, increased heart rate, headaches, stomach cramps, and vomiting.[1] Pregnant women are also a high-risk group and should not consume water with nitrate above the MCL.[2] The following conditions may also put people at higher risk of developing nitrate-induced methemoglobinemia: anemia, cardiovascular disease, sepsis, glucose-6-phosphate- dehydrogenase deficiency, gastrointestinal diseases and other metabolic problems.[2, 3]

The EPA standard was set based on immediate health effects of consuming nitrate above 10 mg/L. There is additional research being done by others, including the University of Nebraska-Lincoln (UNL), on other potential health effects, including chronic health effects. Chronic health effects occur from ingesting a contaminant over a long period of time.

For more information about other potential health effects, visit the UNL websites located in the Resources section.

LIVESTOCK: It is recommended to not allow livestock to drink water with a nitrate level above 100 mg/L. Nitrate can affect livestock similarly to how it affects humans.[4] Additionally, nitrate levels above 100 mg/L may cause reproductive problems in adult cattle and reduce growth rates in replacement heifers.[5] It is recommended that you consult with a veterinarian if you have questions about an acceptable nitrate level in drinking water for other species of animals.

How to Protect Yourself and Your Family

IF YOU ARE ON A PUBLIC WATER SYSTEM: Your public water system regularly tests for nitrate and makes sure levels meet the EPA standard. You can find the level of nitrate detected in your public water system by reading the system's Consumer Confidence Report (CCR) which is a water quality report that is required to be provided to water customers annually. Call your water system to get a paper copy of your community's most recent report or find drinking water quality information about your system online at the Drinking Water Watch website listed in the Resources section.

IF YOU HAVE A PRIVATE WELL: The following types of wells are the most vulnerable to nitrate contamination, especially if they are near or downgradient of septic tanks and absorption/leach fields, certain industrial areas, areas with agricultural activities, or areas with known high concentrations of nitrate in groundwater:

- Shallow wells 50 feet or less in depth.
- Wells in sand aquifers.
- Dug wells or wells with casings that are not watertight due to damage or construction materials used.
- Wells in a pit.
- Improperly constructed wells.
- Wells constructed prior to the 1988 construction standards.

[1] Agency for Toxic Substances and Disease Registry (ATSDR). 2015: ToxFAQs™ for Nitrate and Nitrite (https://www.atsdr.cdc.gov/toxfaqs/tfacts204.pdf). Accessed April 2024.

[2] ATSDR. 2013. ATSDR Case Studies in Environmental Medicine Nitrate/Nitrite Toxicity (https://www.atsdr.cdc.gov/csem/nitrate_2013/docs/nitrite.pdf). Page 37. Accessed April 2024

[3] U.S. Environmental Protection Agency. 1991. Integrated Risk Information System (IRIS) Chemical Assessment Summary (https://iris.epa.gov/static/pdfs/0076_summary.pdf). Accessed April 2024.

[4] Rasby, R. & Walz, T. 2011. Water Requirements for Beef Cattle. University of Nebraska-Lincoln Extension. (https://extensionpubs.unl.edu/publication/g2060/html/view). Accessed May 2024.

[5] Kononoff, P. & Clark, K. 2017. Water Quality and Requirements for Dairy Cattle. University of Nebraska-Lincoln Extension. (https://extensionpubs.unl.edu/publication/g2292/html/view). Accessed May 2024.

Prevent Contamination

- **Construct your well in a safe spot.** Domestic wells constructed in Nebraska are required to adhere to setback distances and construction standards set in Nebraska Administrative Code (NAC) Title 178, Chapter 12. Ensure your installer is a licensed Water Well Professional using the NDEE website listed in the Resources section or by calling 402-471-0546
- **Keep nitrate sources away from your well**. Sources may include fertilizer application and storage, fuel storage, septic systems, wastewater treatment facilities, and livestock facilities. See NAC Title 178, Chapter 12, Chart 1 for setback distances from common sources of well contamination. Consult with a Certified Onsite Wastewater Treatment (OWT) Professional if you have concerns about the location or condition of your septic system in relation to your well. A link to find a Certified OWT Professional is listed in the Resources section.
- **Get your well inspected.** Work with a licensed professional to take any corrective actions that may be needed. Water Well Professionals with a current license are listed on the NDEE website listed in the Resources section.
- **Test for nitrate and bacteria every year.** You are responsible for regularly testing your well water. NDEE recommends using an accredited laboratory to test your well water. Well owners can request sample kits from the Nebraska Department of Health and Human Services (NDHHS) online at the website listed in the Resources section or by calling 402-471-3935. Additionally, the NDHHS's website has a list of other accredited laboratories. Contact the laboratory to get sample containers and instructions or ask your local Natural Resources District (NRD) or public health services if they provide well water testing services. If you need help finding your local NRD, visit the website in the Resources section.

Address Contamination

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

- **Get your drinking water from a safe source**, such as bottled water, or a public water system including rural water districts. This is especially important if babies under six months old drink the water or formula is made with the water. Pregnant or nursing mothers should consult with their doctor about how elevated nitrate levels in drinking water may affect them. Boiling water is not a solution for elevated nitrate levels as it causes evaporation and concentrates the nitrate in the water.
- **Consider testing the well for other contaminants that commonly occur with nitrate such as bacteria and uranium.** Sample test kits for other contaminants, such as bacteria and uranium may be requested from the Nebraska Department of Health and Human Services online at the website listed in the Resources section or by calling 402-471-3935. For more information about other potential contaminants in your well, visit the NebGuides link under the UNL Resources section.
- **Contact a local rural water district.** Connection to the rural water district-supplied water may be an option in your area.
- **Consider your well construction.** If your existing well is poorly constructed or is located near a contamination source such as a septic system, drilling a new well or rehabilitating your well may be an option. However, this can be costly and is not a guarantee that the new or modified well will have nitrate below 10 mg/L. Water Well Professionals with a current license that can help drill a new well or rehabilitate an existing well are listed on the NDEE website listed in the Resources section.
- **Consider a Point of Use (POU) or Point of Entry (POE) treatment system to remove nitrate from drinking water.** POU treatment systems treat water at one tap while POE treatment systems treat all the water that enters your home. Reverse osmosis, ion exchange, or distillation filtration systems are the typical types of treatment systems used to remove nitrate from drinking water. These systems require regular maintenance and testing to ensure they are working correctly and must be properly installed, operated, and maintained to be effective. You may be able to purchase a basic system from your local home improvement store. Consult with a licensed plumber for help installing a more sophisticated system. Additionally, your local NRD may have assistance available to help fund the installation of a treatment system. If you need help finding your local NRD, visit the website located in the Resources section.

Resources

- Drinking Water Watch
  https://drinkingwater.ne.gov
- Find Your NRD
  https://www.nrdnet.org/
- NDEE Annual Report to the Legislature
  https://dee.nebraska.gov/forms/publications-grants-forms/ndee034
- Groundwater Quality Monitoring Report
  https://dee.nebraska.gov/forms/publications-grants-forms/24-026
- NDEE Water Quality Integrated Report
  https://dee.nebraska.gov/forms/publications-grants-forms/23-012
- NDEE Certified Onsite Wastewater Treatment Professionals Lookup
  https://dee.nebraska.gov/water/wastewater/onsite-wastewater-program/certified-installers-mound-endorsement-and-professional-engineers
- NDEE Water Well Professionals Licensee Lookup
  https://deq-iis.ne.gov/zs/wwp/main_pro.php
- NAC Title 178 (Chapter 12 Setback Distances)
  https://rules.nebraska.gov/rules?agencyId=37&titleId=107
- NDHHS Water Sampling Test Kit Request
  https://www.nebraska.gov/dhhs/water-test-kits/private.html
- NDHHS Certified Labs
  https://dhhs.ne.gov/Pages/Lab-Certification-Requirements.aspx
- EPA Fact Sheet
  https://archive.epa.gov/water/archive/web/pdf/archived-consumer-fact-sheet-on-nitrates-and-or-nitrites.pdf
- UNL Resources:
  https://water.unl.edu/category/water-and-health
  https://water.unl.edu/category/water-and-health/resources
  https://water.unl.edu/article/drinking-water/nebguides

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