

Nitrate in Manitoba Well Water

In some Manitoba wells, nitrate has been found at concentrations exceeding health guidelines. High nitrate levels are a particular concern for pregnant or nursing women and for infants less than one year old.

What is nitrate?

Nitrate and nitrite are naturally occurring forms of nitrogen found in the environment. Nitrate is essential for plant growth and is present in all vegetables and grains. Nitrate is commonly used in fertilizer. Nitrite is less stable and therefore less common in the environment.

Common sources of nitrate in well water are:

- chemical fertilizers used to improve plant growth
- animal waste from livestock barns and manure storage areas
- manure applied to land
- human waste from septic fields, leaking septic tanks or holding tanks
- soil that contains nitrogen compounds from naturally decaying organic matter

Exposure to nitrate

Everyone is exposed to small amounts of nitrate. Food contributes about 87 per cent of the average daily intake of nitrate for a typical North American adult. Most of the remaining 13 per cent comes from drinking water and a small contribution comes from the air we breathe. For bottle-fed infants, water used to prepare infant formula is usually the main source of nitrate.

Drinking water standard for nitrate

Health Canada has established a maximum acceptable concentration (MAC) for nitrate in drinking water of 45 milligrams per litre (mg/L). This guideline value is intended to protect infants, the group at risk of nitrate effects. Concentrations of nitrate and nitrite in drinking water are often expressed in units of nitrate-nitrogen or nitrite-nitrogen - 45 mg/L nitrate is equal to 10 mg/L nitrate-nitrogen.

Where nitrate and nitrite are measured separately, the Health Canada Guideline recommends nitrite not exceed 3.2 mg/L (approximately 1 mg/L nitrite-nitrogen).

The provincial standard for all public (municipal) drinking water supplies is 45 mg/L nitrate (10 mg/L nitrate-nitrogen). Private well owners are not legally required to meet the standard but where levels are high, a treatment device or other corrective action is recommended.

Such action could include protecting wells from contamination, finding an alternative safe water supply or installing a treatment device.

Health effects of nitrate

The primary health concern associated with nitrate exposure is methaemoglobinaemia, or blue-baby syndrome. Nitrate is converted to nitrite in the stomach and absorbed into the bloodstream where it interferes with the ability of hemoglobin in red blood cells to carry oxygen. Symptoms of methaemoglobinaemia include cyanosis (bluish discolouration of the skin and mouth), shortness of breath and fatigue. Most cases occur in infants under one year of age. Infants less than three months of age are particularly susceptible.

Water high in nitrate should not be used to prepare infant formula and should not be given to infants to drink. As nitrate may be present in breast milk or transported through the placenta, nursing mothers and pregnant women should also avoid drinking water high in nitrate.

Evidence of other health problems associated with drinking well water with high levels of nitrate or nitrite over a lifetime is inconclusive. Some studies suggest a possible association with stomach cancer, whereas others do not. Overall, evidence of associations with cancer, birth defects and other health effects is insufficient to be able to draw firm conclusions.

How nitrate gets into well water

Nitrate in Manitoba well water tends to be found in groundwaters from shallow wells in rural or agricultural areas. Nitrate moves faster through light, sandy soils than through clay soils. Heavy rains and flooding can increase nitrate levels in well water. Shallow wells are more susceptible than wells drilled into deeper aquifers. Wells drilled into deeper aquifers rarely have a nitrate problem.

Nitrate in Manitoba well water

Manitoba Sustainable Development evaluated the results of groundwater samples collected through a number of regional groundwater quality surveys and its provincial observation well sampling program. A map of the distribution of nitrate in groundwater samples is available online at <http://www.manitoba.ca/sd/water/drinking-water/well-videos/index.html>.

Approximately 16 per cent of the water supply wells sampled in rural Manitoba had nitrate levels above the drinking water standard of 45 mg/L (10 mg/L nitrate- nitrogen). Concentrations more than ten times the Provincial standard have been measured in very poor water sources.

Because high nitrate levels tend to be associated with localized nitrate sources, and shallow or poorly constructed wells, rather than particular aquifers or geologic formations, it is difficult to pinpoint specific areas of the Province that are likely to have nitrate problems. In addition, nitrate levels may change over time, varying with both the season and the weather.

Recommendations for testing well water

Private well owners are responsible for testing and, if necessary, treating their water to ensure it is safe to drink. Well water should be tested for nitrate if:

- someone who drinks the water is pregnant, nursing or planning a pregnancy
- there is an infant or toddler less than a year old drinking the water
- sources of nitrate are present in the area or the area is known to have elevated nitrate levels
- the well is old, shallow or poorly constructed
- contamination of the groundwater is suspected

Wells should be retested every three to five years or whenever there is a change in the taste, smell, colour or clarity of the well water, or if there is a reason to believe the water quality has changed. In

areas where nitrate is a concern, well owners should consider testing for nitrate more often. If nitrate is at or near guidelines levels, well owners should consider testing at different times of year to get a better understanding of seasonal variability.

Public (municipal) water systems that use well water are tested regularly by the water system owner or by the Office of Drinking Water as required under *The Drinking Water Safety Act*.

How to test well water for nitrate

Nitrate does not create a taste or odour in water. The only way to know if well water contains nitrate is to have a water sample tested by a laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA). Information on accredited laboratories is available from your local telephone directory yellow pages (refer to Laboratories - Testing).

Three accredited laboratories in Manitoba test for nitrate:

ALS Environmental

12-1329 Niakwa Road E.
Winnipeg, MB R2J 3T4
Phone: 204-255-9720
Toll Free: 1-800-607-7555
Fax: 204-255-9721

Horizon Lab Ltd.

4055 Portage Avenue
Winnipeg, MB R3K 2E8
Phone: 204-488-2035
Fax: 204-488-4772

Bureau Veritas Canada Inc.

Unit D, 675 Berry Street
Winnipeg, MB R3H 1A7
Phone: 204-772-7276
Fax: 204-772-2386

Test costs will vary from year to year, and well owners should contact the laboratories directly for an estimate.

Well owners should use the bottle(s) provided by the laboratory and should collect samples carefully, following the instructions provided.

What to do if nitrate is found in your well water

If the nitrate level in the well water is above the drinking water standard, private well owners should consider how they are using this water and may wish to contact their local public health office or discuss health risks with their doctor, who can consult their regional medical officer of health for more information.

The presence of nitrate in your well water is often an indicator that your well is impacted by surface water, and possibly human or animal waste. The following steps are recommended:

1. Find another safe source of drinking water. Do not use the well water for preparing infant formula. Bottled water can be used until a long-term safe water supply is identified (see Step 6). Nitrate does not pose a risk when the water is used for washing or bathing.
2. Test the well for bacteria. Nitrate is an indicator of potential contamination from human or animal waste, and bacteria may be present as well.
3. Re-test the well water for nitrate. Nitrate levels can change.
4. Inspect the well. Wells should be constructed and maintained to minimize the risk of contamination. Ensure the well has a secure, watertight cap/lid and that the ground slopes away from the well.
5. Remove or reduce sources of nitrate if present:
 - Avoid over-application of fertilizers.
 - Do not apply fertilizers near the well.
 - Have your septic system inspected and repaired, if required.
 - Ensure manure or other animal or plant waste materials are not stored or applied near the well.

6. Consider options for ensuring a long-term safe water supply, such as:
 - hooking up to a public (municipal) piped water system if one is available in the area
 - installing a water cistern and arranging for the delivery of safe drinking water by a water hauler
 - drilling a new well at a different location or to a different depth. This may or may not solve a nitrate problem. Manitoba Water Stewardship can be consulted for advice.
 - using commercially bottled water from a supplier who is a member of the Canadian Bottled Water Association or International Bottled Water Association
 - treating the well water

Treating well water

Common treatment systems like water softeners, carbon filters and sediment filters cannot properly remove nitrate from drinking water. Boiling will only concentrate the nitrate, it will not remove it.

Water treatment methods that can remove nitrate from drinking water include reverse osmosis, distillation, anion exchange units and special filters. A treatment device may be installed at the kitchen faucet (point-of-use) or where the water enters the home (point-of-entry).

The treatment device should be certified to meet the NSF International (NSF)/American National Standards Institute (ANSI) standard for removal of nitrate. Accredited certification organizations include NSF, the Canadian Standards Association (CSA), Underwriters Laboratories Incorporated (UL), the International Association of Plumbing and Mechanical Officials (IAPMO), and the Water Quality Association (WQA). Certified devices are tested to ensure the safety of the materials used in the devices and to ensure they perform as claimed.

Quotes should be obtained from reputable water treatment equipment suppliers. The supplier should provide information on how much nitrate will be removed, maintenance requirements and costs.

Once installed, manufacturer's instructions on the use and maintenance of treatment devices and disposal of filter media should be followed. The well water and treated drinking water should be tested annually for nitrate to confirm that the treatment system is working properly.

For more information

For more information on nitrate, refer to Health Canada's website at www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-nitrate-nitrite.html.

For more information on well construction or on relocating your well, contact Manitoba Sustainable Development's Groundwater Management Section at 204-945-6959.

For more information on water treatment, contact Manitoba Sustainable Development's Office of Drinking Water at 204-945-5762, or refer to the website at http://www.manitoba.ca/sd/pubs/water/drinking_water/odw_contact.pdf for a local office near you.

For information on certification of water treatment devices visit www.nsf.org.

For health related questions on nitrate, call Health Links/Info Santé at 204-788-8200 or toll free at 1-888-315-9257 or your local public health office.