

Nitrate in Groundwater¹

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What is nitrate?

Nitrate is a chemical compound of one part nitrogen and three parts oxygen that is designated the symbol “NO₃.” It is the most common form of nitrogen found in water. Other forms of nitrogen include nitrite (one part nitrogen and two parts oxygen – NO₂) and ammonia (one part nitrogen and three parts hydrogen – NH₃).

In water, nitrate has no taste or scent and can only be detected through a chemical test. The Maximum Acceptable Concentration (MAC) for nitrate in drinking water in British Columbia is 45 milligrams per litre (mg/L). For laboratory tests reported as nitrate-nitrogen (NO₃-N, the amount of nitrogen present in nitrate) the MAC is 10 mg/L.

The nitrate level in most ambient groundwater in British Columbia is very low, generally much less than 1 mg/L. Therefore, the presence of nitrate in groundwater greater than 3 mg/L usually reflects the impact of human activities on well water quality.

What are the known sources of nitrate?

Nitrate is usually introduced into groundwater through widespread or diffuse sources, commonly called non-point sources, which can be hard to detect. These sources can include:

- Leaching of chemical fertilizers
- Leaching of animal manure
- Groundwater pollution from septic and sewage discharges.

What are the environmental health concerns?

Though nitrate is considered relatively non-toxic, a high nitrate concentration in drinking water is an environmental health concern because it can harm infants by reducing the ability of blood to transport oxygen. In babies, especially those under six months old, *methaemoglobinaemia*, commonly called “blue-baby syndrome,” can result from oxygen deprivation caused by drinking water high in nitrate. Death can occur in extreme cases.

Other information sources:

Health Canada, Guidelines for Canadian Drinking Water Quality Supporting Documents. http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/index_e.html

Health Canada, *It's Your Health*. http://www.hc-sc.gc.ca/iyh-vsv/environ/index_e.html

B.C.'s Ground Water Protection Regulation: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.html

B.C. Ministry of Health, “Safe Water Supply Vital to Your Health.” (1999) <http://www.healthservices.gov.bc.ca/protect/pdf/PHI052.pdf>

B.C. Ministry of Health, Health Files. <http://www.bchealthguide.org/healthfiles/index.stm>

Type “water” in the search section and look for various articles including:

- #45 “Should I Get My Well Water Tested?”
- #5 “Nitrate Contamination in Well Water.”



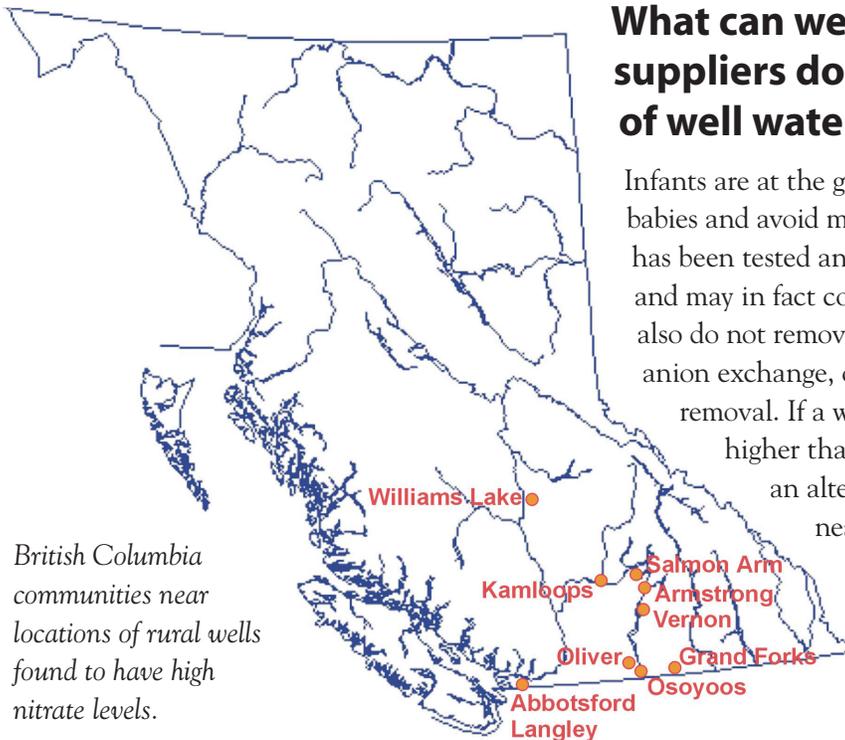
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¹ Information in this fact sheet is generally intended for private wells. Please note that any water supply system or well serving anything other than one single family dwelling is defined as a water supply system under the *Drinking Water Protection Act* and Regulations and must be sampled according to the Act and Regulations. The person operating such a system is defined as a water supplier.

Where have high nitrate levels been found in B.C. well water?

The Ministry of Environment evaluated the results of groundwater samples obtained between 1977 and 1993 through the *Water Quality Check Program*. Of over 12,000 samples analysed for nitrate-nitrogen concentration, 186 or 1.5% had nitrate-nitrogen levels above the Canadian drinking water guideline of 10 mg/L, and 7% of samples had concentrations of nitrate-nitrogen greater than or equal to 3 mg/L, indicative of human impacts. Groundwater concentrations of nitrate-nitrogen above the drinking water guideline were observed in some rural wells near Langley, Abbotsford, Armstrong, Grand Forks, Kamloops, Osoyoos, Salmon Arm, Vernon and Williams Lake, particularly in intensive agricultural areas or locations where septic tanks are the main method of sewage disposal.



British Columbia communities near locations of rural wells found to have high nitrate levels.

What can well owners and water suppliers do about nitrate contamination of well water?

Infants are at the greatest risk from nitrate, so it is best to breastfeed babies and avoid mixing formula with tap water unless the water has been tested and is safe. Boiling water does not remove nitrate, and may in fact concentrate it further. Pitcher-type filtration units also do not remove nitrate. Treatment methods such as distillation, anion exchange, or reverse osmosis are effective methods of removal. If a well supply is found to have nitrate concentrations higher than the drinking water guideline, use water from an alternate source, such as a municipal system, or a nearby well that has been tested and found to be safe, install an effective, in-home water treatment system or use bottled water for infants under 6 months of age. When purchasing a treatment device, you should consider one that has been certified by an organization accredited by the Standards Council of Canada (SCC). The

treatment device should meet the following standards: NSF/ANSI Standard 62 on drinking water distillation systems, or Standard 58 on reverse osmosis drinking water treatment systems, or Standards 53 on drinking water treatment units — with specific designation for the water quality parameters you are trying to remove (e.g. nitrate removal). Certification assures that a device works as the manufacturer or distributor claims. Devices can be certified for treating a range of water quality concerns, so make sure that the device you purchase is explicitly certified for iron and manganese removal. Find an up-to-date list of accredited organizations at www.scc.ca.

Well water testing and source protection

Well owners are encouraged to test their water periodically to ensure the water is safe to drink. Annual testing is recommended for contaminants such as nitrate that can affect human health. Consult Public Health at your local Health Authority for advice regarding the specific parameters to test for and how often testing should be done. Prevention is the best method to safeguard water supplies against nitrate contamination. Shallow, unconfined aquifers in intensive agricultural and unsewered residential areas are thought to be most at risk. Proper well site selection and construction and Agricultural Best Management Practices may help prevent well contamination from shallow sewage discharges. A *Well Protection Toolkit* is available from the Ministry of Environment on the internet: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/wellprotect.html to help water suppliers and communities develop a well protection plan to limit the threat of land use activities on groundwater quality.
