BTEX in Manitoba Well Water

The quality of groundwater in Manitoba is typically good. However, the quality of the water can be influenced by both natural conditions and man-made sources of pollution. BTEX contamination has been found in well water in some areas of Manitoba. Exposure to BTEX may cause adverse health effects.

What is BTEX?

BTEX refers to the chemicals benzene, toluene, ethylbenzene and xylenes. Each chemical is a volatile organic compound (VOC) meaning that it can easily evaporate and affect air quality.

Benzene

Benzene is an organic chemical, liquid in form, which is nearly colourless at room temperature. It has a sweet odour and is highly flammable. Benzene is found in fuel oil and gasoline, is a frequently used industrial chemical, and is a component of tobacco smoke.

Toluene, ethylbenzene and xylenes (TEX)

TEX are primarily synthetic chemicals. They are volatile, flammable and colourless liquids with a sweet, pungent, or gasoline-like odour. These compounds are mainly found in petroleum hydrocarbons, such as gasoline and diesel fuel. They may also be used as industrial solvents or in the production of styrene and benzene. Toluene is a common solvent used in making paints, paint thinners, fingernail polish, lacquers, adhesives and rubber, as well as in some printing and leather-tanning procedures. Ethylbenzene is used in the production of styrene which is used in the manufacture of a number of products. Xylenes are frequently used as solvents and in paint thinners, varnishes, and cleaning agents. All are fuel additives.

Exposure to BTEX

Benzene

For non-smoking Canadians, exposure to benzene is primarily from air (98-99%), with a small amount from drinking water (1-2%). Benzene has also been detected in some foods. Smokers may be exposed to much higher levels of benzene, in the range of 10 times the daily intake of a non-smoker. Exposure may also occur through automobile-related activities such as driving and refuelling. Indoor air represents the largest source of exposure to benzene for Canadians, with attached garages and smoking representing the largest contributors to indoor air levels. Other sources of benzene in indoor air may include glues, paints, furniture wax, or detergents.

Exposure to benzene will increase if benzene-contaminated water is used for domestic purposes, such as showering, bathing, drinking, and cooking. Since benzene evaporates easily in air, exposure from showering and bathing may be higher than exposure from drinking water consumption. Skin adsorption of benzene can also occur.

TEX

Canadians are most often exposed to TEX from inhalation of ambient air and usage of various products, including gasoline, diesel fuels, and solvents, particularly in indoor environments Cigarette smoking can be an important source of TEX. To a lesser extent, exposure can also occur from contaminated drinking water, food or soil. Canadians may also be exposed to TEX from drinking water through inhalation and dermal absorption.

If BTEX is in the drinking water, exposure can occur by drinking it, inhaling it or contact with the skin. The drinking water quality standard level is based on estimates of ways of exposure.

How do BTEX get into well water?

BTEX compounds mix easily with water and break down more slowly in water than in air. The compounds can move from soil to groundwater, particularly if the soil is porous. Gasoline or fuel oil that has spilled on the ground and has not been cleaned up properly, can work its way down to an underlying aquifer. Gasoline stored in older leaking underground storage tanks is a common source of BTEX contamination in groundwater.

BTEX-contaminated water will be produced from a well located within a contaminated area of the aquifer. The pumping effect of a well located near a source of BTEX contamination may draw the contaminant toward and into the well.

What are the drinking water quality standards for BTEX?

Manitoba has adopted Health Canada's maximum acceptable concentration (MAC) for each BTEX compound as a drinking water quality standard. Public and semi-public water systems are legally required to meet these standards. Private well owners are not legally required to meet the standards but, where concentrations are above the MAC or aesthetic objective (AO), a treatment device or other corrective action is recommended. The maximum acceptable concentrations (MACs) for BTEX are set at levels where long-term exposure over 70 years would pose a minimal health risk. MACs are set based on the most sensitive potential health effect and are considered protective of other potential health impacts as well.

The aesthetic objectives (AOs) for TEX are set at the lowest reported odour thresholds for each parameter. At levels above the AO, consumers may start to complain about the smell of the water.

Parameter	Guidelines for Canadian Drinking Water Quality	
	Maximum Acceptable Concentration (health based guideline)	*Aesthetic Objective*
Benzene	0.005 mg/L	N/A
Toluene	0.06 mg/L	0.024 mg/L
Ethylbenzene	0.14 mg/L	0.0016 mg/L
Total Xylenes	0.09 mg/L	0.02 mg/L

Health effects of BTEX

The effect of BTEX on human health depends on factors such as the concentration and length and type of exposure.

Benzene

Benzene is a known human carcinogen. The most sensitive health effects related to benzene exposure are effects on the blood cell formation. Exposure to elevated levels of benzene over a long period of time may lead to blood disorders, such as anemia, an increased risk of infection, and an increased risk for some cancers, such as leukemia. The MAC for benzene was set at a level intended to minimize cancer risks following long-term exposure and is also considered protective of other potential health effects. Exposure to very high levels of benzene can cause dizziness, nausea, headache, and drowsiness.

TEX

The MACs for TEX are based on the most sensitive potential health effects.

Ethylbenzene: There are limited studies of ethylbenzene in humans. Animal studies indicate exposure to ethylbenzene can have effects on the liver and the kidney which may lead to tumor formation. Therefore, ethylbenzene is considered possibly carcinogenic to humans. The MAC is set at a level below which no effects on the liver and pituitary gland would be expected.

Toluene: Long-term inhalation of toluene may lead to neurological effects including loss of colour vision, and disturbances in memory, concentration, and thinking ability. The MAC for toluene is set at a level below which no neurological effects would be expected. There is not enough information available to determine if toluene can cause cancer.

Xylenes: Limited human and animal studies indicate Xylenes can affect the central nervous system affect the respiratory tract if inhaled, and reduce the weight of the liver, kidney, and the body when consumed by animals. There is not enough information available to determine if toluene can cause cancer. The MAC is set a precautionary level based on estimated central nervous system effects.

Should I be testing my well water for BTEX?

Private well owners are responsible for testing their water and, if necessary, treating their water for domestic use which includes: drinking, making infant formula or juice, mixing with food, washing fruits or vegetables, brushing teeth, soaking false teeth, bathing, and showering.

A test for BTEX should be conducted if you suspect your well water has been contaminated by a petroleum product or if you notice a gasoline odour coming from the well water.

How to test well water for BTEX

There are three laboratories in Manitoba accredited for the analysis of BTEX in drinking water:

ALS Environmental
12-1329 Niakwa Road E.
Winnipeg, MB R2J 3T4
204-255-9720

Horizon Lab
4055 Portage Avenue
Winnipeg, MB R3K 2E8
204-488-4772

Bureau Veritas Canada (2019) Inc.
Unit D, 675 Berry Street
Winnipeg, MB R3H 1A7
204-772-7676

Test costs may vary, and well owners should contact the laboratories directly for an estimate and sample submission requirements.

What to do if BTEX is found in your well water?

If the BTEX concentration in the water is above drinking water quality guidelines, private well owners should consider options to increase the safety of the water for domestic use. These options include:

- Connecting to a public (municipal) water system if access to one is available and then properly seal the contaminated well.
- Purchasing bottled water for consumptive purposes.
- Installing and maintaining in good working order a carbon filtration system designed for the removal of volatile organic compounds (VOCs), including BTEX.

To find out if a water main is available to your home, contact your Rural Municipality Office.

Homeowners can also contact Manitoba Sustainable Development to help determine potential sources of contamination. See contact information at the end of this fact sheet.

Treating the well water

Water treatment systems like water softeners and sediment filters do not remove BTEX from well water. Boiling the water transfers volatile BTEX compounds to the air. The most common and effective residential water treatment system for reducing concentrations of BTEX in drinking water is granular activated carbon (GAC) filters.

Treatment devices may be installed at the faucet (point-of-use) or where water enters the home (point-of-entry). Point-of-entry systems are preferred for volatile organic compounds such as BTEX because they minimize inhalation and dermal exposure associated with bathing, showering and laundry, while also making the water safe for cooking and drinking. Treatment devices are available for purchase at most stores that sell water treatment equipment.

Quotes for point-of-entry systems should be obtained from reputable water treatment equipment suppliers. The supplier should provide information on how much BTEX will be removed, maintenance requirements, and costs.

Treatment devices should be certified to meet the NSF International (NSF)/American National Standards Institute (ANSI) standard 53 for removal of VOCs, which includes BTEX. Certified devices are tested to ensure they perform as claimed, and to ensure the materials used in the devices are safe for contact with drinking water.

Once installed, follow manufacturers' instructions on the use and maintenance of treatment devices and disposal of filter media. The raw well water and treated drinking water should be tested regularly (at least annually, preferably quarterly to semi-annually) for BTEX to confirm that the treatment system is working properly.

Other recommendations for testing well water

Private well owners are reminded that as part of regular well management, they should test their well water for bacteria (total coliforms and *E. coli*) on an annual basis. Testing is recommended during times of high surface runoff such as following the spring snow melt or heavy rainfalls. You should also test for bacteria if you see any changes in the water (ex: change in taste, clarity, colour, or smell).

Water should be tested for nitrate every three to five years or if someone who drinks the water is pregnant, nursing or planning a pregnancy, or there is an infant or toddler less than a year old drinking the water.

Trace elements (such as arsenic, barium, boron, fluoride, and uranium) should be tested at least once (preferably at the time of commissioning the well) to ensure there are no concerns. In general, well water should be tested for trace elements every three to five years in areas known to have elevated levels. More frequent testing is recommended if levels are at or near the MACs for those parameters.

For additional information on bacteria, nitrate, and trace elements, please visit the Office of Drinking Water website at **manitoba.ca/drinkingwater**.

For more information

For detailed information on benzene or TEX in drinking water, refer to Health Canada's guideline technical documents at: **www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html**

For more information on well water treatment, recommendations for additional testing, or assistance with understanding test results, contact the Office of Drinking Water at 204-945-5762.

Information on well construction and well maintenance is available at **https://www.gov.mb.ca/sd/water/groundwater/wells_groundwater/index.html** or to get a copy of a well record, contact the Groundwater Management Section at 204-945-6959 or email your request to **groundwater@gov.mb.ca**.

For more information on certification of water treatment devices, visit **www.nsf.org** or the websites of other certifying bodies:

- Canadian Standards Association (CSA) – **csagroup.org**
- Underwriters Laboratories Incorporated (UL) – **ul.com**
- International Association of Plumbing and Mechanical Officials (IAPMO) – **iapmo.org**
- Water Quality Association (WQA) – **wqa.org**

To report a gasoline or other petroleum product spill, or for help in determining potential sources of contamination, contact a local Environment Officer. Regional contact information is available at **www.gov.mb.ca/sd/ece/contact.html**.

If you have health concerns related to BTEX exposure, discuss them with your health care provider or contact Health Links-Info Santé at 1-888-315-9257

June 2019
Prepared by Manitoba Sustainable Development and
Manitoba Health, Seniors and Active Living