

Disinfection by-products (THMs and HAAs) in Manitoba Water Supplies

What are disinfection by-products?

All drinking water sources have potential to contain microorganisms, such as bacteria, viruses, and protozoa that may cause serious illnesses. Drinking water is disinfected to destroy or inactivate those microorganisms.

Chlorine is the most common disinfectant added to drinking water in the world. It is an effective disinfectant. However, when it is added to water with organic matter (ex: decaying plants and algae), by-products can form. Trihalomethanes (THMs) and haloacetic acids (HAAs) are the most common types of disinfection by-products found in chlorinated drinking water.

Why is chlorine added to drinking water?

Chlorine has been added to drinking water to get rid of harmful micro-organisms since the early 1900s. If harmful bacteria, viruses, or protozoa are distributed through a drinking water supply, a lot of people can get sick very quickly. Using chlorine has greatly reduced the number of waterborne disease outbreaks (illnesses caused by micro-organisms in water) for over a century.

While there are other disinfectants, chlorine is used the most to disinfect water because it works, it's low-cost, and it's easy to use. It also helps in keeping the pipes that carry water to communities free of harmful microorganisms that can get into the water after it leaves the treatment plant. Other disinfectants, such as ozone or ultraviolet (UV) light, can't help protect the water after it leaves the treatment plant.

What water sources are most likely to have THMs and HAAs?

Water with high levels of organic matter will generally form more disinfection by-products than water with low organic content. Water sources with higher organic content include:

- surface water (ex: lakes, reservoirs, rivers, streams)
- shallow or poorly-built wells or springs that may be at risk of contamination from surface water.

Filtering water before adding chlorine helps reduce the organic content and the potential for formation of disinfection by-products.

Groundwater from deeper wells usually has lower organic content and less potential for forming disinfection by-products.

What are the standards for THMs and HAAs in drinking water?

The current Canadian guideline for THMs is 100 micrograms per litre ($\mu\text{g/L}$) or 0.1 milligrams per litre (mg/L) based on an annual average of four tests a year from the point in the distribution system where THMs are likely to be the highest - usually on the outskirts of the distribution system.

The Canadian guideline for HAAs is 80 µg/L or 0.08 mg/L based on an annual average of four tests a year from the point in the distribution system where HAAs are likely to be the highest - usually the mid-point of the distribution system.

These guidelines are the same as the standards for water systems in Manitoba, set by regulation under The Drinking Water Safety Act.

What are the potential health concerns related to THMs and HAAs?

While there is not enough evidence to indicate that THMs cause cancer in people, cancers have been detected in some studies in which animals (mice and rats) were exposed to high doses. Further study is needed. As a precautionary measure, drinking water guidelines are set to ensure a very low level of potential health risk over a typical lifetime of exposure (70 years).

The health effects associated with exposure to HAAs vary with the specific compound. Long-term exposure to some of types of HAAs may increase the risk of liver cancer. The guideline level for HAAs has been set at a level where exposure over a lifetime (70 years) may have a low level of risk for the development of cancer.

Short-term use of drinking water that exceeds the guidelines is unlikely to have an impact on human health.

How could I be exposed to THMs and HAAs?

Drinking tap water containing THMs or HAAs can increase your exposure to these compounds. Since THMs are volatile, they can also be absorbed through skin or inhaled by breathing water vapour when showering or bathing. Exposure from a 10-minute shower or 30-minute bath is about the same as drinking two and a half litres of tap water. As HAAs are not volatile, the risk of exposure from showering and bathing is low. All of these types of exposures and normal daily activities were considered when setting the Canadian guidelines and Manitoba standards for THMs and HAAs in drinking water.

Are THMs and HAAs monitored in Manitoba water supplies?

Water systems that rely on surface water sources, or groundwater sources that can be affected by surface water, test for THMs and HAAs regularly. Most surface water systems have to measure THMs and HAAs four times a year, every other year. Larger surface water systems measure THMs and HAAs four times a year, every year.

Samples must be taken four times a year because water quality changes over the year - THMs and HAAs are usually higher in the summer and lower in the winter. The average THM and HAA values for the year must be below the provincial standards.

What can be done to reduce THMs and HAAs in community water supplies?

THMs and HAAs can be reduced by removing organics from the water source before adding chlorine. This can be costly or complicated.

Once the organics are removed, chlorine can be added to disinfect the water without forming high THM or HAA levels. For information on existing treatment processes or plans for upgrading treatment processes for your water system, contact your water supplier.

How do I know if my water has high THMs or HAAs?

For information on the THM and HAA levels in your water system, contact your water supplier. Large public water suppliers must make an annual report available to the public and post a copy of that report on the Internet. The report contains drinking water quality information. Small public water suppliers must make test results available to the public upon request during normal business hours but do not have to post them on the Internet.

How can I reduce my exposure to THMs and HAAs?

There are several easy ways to reduce exposure to THMs and HAAs in your home.

Since THMs are volatile, you can store drinking water overnight in an open container in the fridge and the THMs will evaporate. You can also reduce your THM exposure by taking shorter shower or baths and by installing a fan in the bathroom to ensure it is well ventilated.

You can reduce your exposure to both THMs and HAAs by using bottled water for drinking and food preparation or by using a home water treatment system such as a filter. Filters are available in point-of-use models that attach to the kitchen tap or fit under the sink, or point-of-entry filters that treat all the water in the house.

Look for filters or equipment that have been certified by an accredited organization, such as NSF International, to remove THMs. There is no certification standard for removal of HAAs at present. However, activated carbon and reverse osmosis filters are available that are certified to reduce THMs to acceptable levels, and these systems will also reduce HAAs.

Simple, low-cost activated carbon filters, including pour-through pitcher-type filters, or filters that fit on the kitchen tap work well.

Point-of-entry or whole-house activated carbon filters are available, but are not generally recommended as the filter material may need to be replaced often. Reverse osmosis filters should only be installed at the point of use.

The THM removal standards are set by NSF International (NSF) and the American National Standards Institute (ANSI). Organizations that are accredited to certify devices to the NSF/ANSI standard (including NSF itself) are listed below. See the organizations' websites for listings of certified products:

- NSF International (NSF) - www.nsf.org
- Canadian Standards Association (CSA) - www.csagroup.org
- Underwriters Laboratories Incorporated (UL) - www.ul.com
- Water Quality Association (WQA) - www.wqa.org
- International Association of Plumbing and Mechanical Officials (IAPMO) - www.iapmo.org
- ALS - Truesdail Laboratories - www.truesdail.com
- Bureau de Normalisation du Québec (BNQ) - www.bnq.qc.ca/en

An up-to-date list of accredited certification organizations is available from the Standards Council of Canada (SCC) website at: www.scc.ca

Quotes may be obtained from reputable water treatment equipment suppliers. Suppliers should provide information on removal rates, maintenance requirements, and costs.

Once installed, follow the manufacturer's instructions on the use and maintenance of treatment devices and disposal of filter media.

Where can I get more information?

For information on disinfection by-products in drinking water, see Health Canada's website at: www.sac-isc.gc.ca/eng/1563307885242/1563307933110

For additional information on THMs and HAAs in drinking water, see:

- THMs - www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-trihalomethanes.html
- HAAs - www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-haloacetic-acids.html

For information on certification of residential water treatment devices, call NSF International's toll free hotline at 1-877-867-3435, or visit www.nsf.org or the websites of other certifying bodies (listed above).

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

For questions or concerns about THM or HAA exposure and your health, speak with your health care provider.

For other information on drinking water in Manitoba, contact the Office of Drinking Water at 204-945-5762, or refer to the website at www.manitoba.ca/drinkingwater to find a local office near you.