

Water Disinfection in Haines Junction

Why do we disinfect our drinking water?

In North America we are lucky to enjoy safe potable water at our fingertips anytime day or night -- as much as we like -- at a very reasonable price. Most of us never think about getting sick or even dying from drinking water but in many developing countries around the world, diseases associated with dirty water kill more than 5 million people each year, according to the World Health Organization.

Chlorine is used to disinfect drinking water because it effectively kills a large variety of microbial waterborne pathogens, including those that can cause typhoid fever, dysentery, cholera and Legionnaires' disease. According to the US EPA Chlorinated water, with a residual up to 4.0 mg/l, poses no known or expected health risks. The Government of Canada, cites current scientific data that shows that the benefits of chlorinating our drinking water for disease prevention are much greater than any health risks from Trihalomethanes (THMs) and other by-products.

In 1997 *Life* magazine cited that the filtration and disinfection of drinking water by the use of chlorine as "probably the most significant public health advance of the millennium"

How do we disinfect our drinking water?

Disinfection is a process designed for the deliberate reduction of the number of pathogenic microorganisms. The disinfection process has two distinct roles.

- primary disinfection: which instantly kills Giardia, Cysts, Bacteria and viruses; and,
- secondary disinfection: which maintains a disinfectant residual in the distribution system that prevents regrowth and bacterial activity such as biofilm or algae.

Sodium hypochlorite (Cl₂) is the cheapest and safest method of drinking water disinfection. It is also an ingredient in household bleaching and cleaning agents at a concentration of 5%. Commercial sodium hypochlorite is designed for use in water treatment and has a concentration of 12%. Other forms include chlorine gas at 100% and calcium hypochlorite which is granular at 65%.

Disinfection in the VHJ system begins at the well pump houses and utilises the contact time in the transmission mains for two main purposes: both to disinfect and to act as an oxidant to aid in the filtering of suspended solids such as iron and manganese. Cl₂ dosing and setpoints are set and adjusted by operators and are alarm monitored. This ensures a target free chlorine residual throughout, the distribution system, is as near to 0.60 mg/l as reasonably allowable. Fluctuations in free chlorine residuals occur due to the varying age of the disinfectant product.

How much Cl₂ is acceptable?

Though there is **NO** Maximum allowable concentration (MAC) in the legislation, most Canadian water treatment systems operate in a range of 0.4 mg/l to 2.0 mg/l.

Below is an excerpt from the Yukon *Public Health and Safety Act*:

Chlorination

Section 38. "The owner of a large public drinking water system shall ensure that (a) no water enters a piped distribution system or plumbing unless it has been treated with chlorine or another treatment that is as effective as chlorination to achieve disinfection that persists in the distribution system; and (b) the free chlorine residual concentration

throughout the distribution system is no less than 0.2 milligrams per litre (mg/L); or (c) the treatment of water in the system complies with an order of a health officer.

Chlorination of trucked distribution system

Section 39. The owner of a large public drinking water system that includes a trucked distribution system shall ensure that no water enters the water tank unless it has been treated with chlorine and has a free chlorine residual concentration of no less than 0.4 mg/L at the point of loading.

The Haines Junction water treatment plant is automated through a SCADA system which includes an alarm monitoring program and dialer to send alarms to designated phone numbers. Operators also conduct routine daily inspections of the water treatment plant complete with free chlorine, Total Chlorine and combined Chlorine testing. Turbidity and Ph along with multiple flow, volume and pressure readings are also recorded. These results are documented and provided to Environmental Health services for inspections.

Through a recent collation of VHJ 2017 data, the large public drinking water system, operated by the Village of Haines Junction had -- at its highest -- a 0.8 mg/l free Chlorine residual. At no point has the free chlorine residual ever dropped below the minimum requirement of 0.4 mg/l. Taste and odor concerns, due to elevated levels of free chlorine, begin at 4.0 mg/l.

What is the difference between free, total and combined chlorine?

Total Chlorine is the sum of free and combined chlorine.

Combined Chlorine is the amount of chlorine that has attached itself to *anything organic*. In doing so, it creates disinfection by-products such as: monochloramines, dichloramines, trichloramines, haloacetic acids and trihalomethanes. These compounds have a strong chlorine-like taste and odour and are potentially carcinogenic. The Village of Haines Junction water distribution system is tested annually for these disinfection by-products as per Yukon *Public Health and Safety Act* regulations.

Free Chlorine is the amount of Cl₂ available for disinfection after all organic materials have been inactivated. (residual chlorine)

Strong odours may be emitted when safely disinfected water is introduced into a vessel that is un-sanitized. This is the smell of disinfection by products being created. This means that breakpoint chlorination is no longer being achieved and there is not enough chlorine in the water to inactivate the by-products being created by the chlorine combining with the organic material.

At present, there is no legislated requirement for private home owners, who purchase water from a permitted water purveyor (Village of Haines Junction) to test their storage tanks for disinfection by-products. The Village of Haines Junction distributes a document titled "Cleaning and Disinfecting a Water Holding Tank" once per year with water bills and by request at the Village of Haines Junction office.

What can I do about unpleasant taste and odor in my water?

Sodium hypochlorite (Cl₂) in water will dissipate over time at a rate of 0.75 grams per day, keeping a glass pitcher of water in the fridge will lessen any taste/odour concern, also water kept at fridge temperature (5°C) will taste better.

Water stored in a service pipe between a water main and a building can be warmed by your thaw-line transformer -- and the Cl₂ can degrade with heat -- both contributing to taste and odor issues. Running water to waste or using it to water plants or wash dishes until the water in the service pipe is replaced can also help.

Those on bulk water delivery are urged to shock/disinfect all water storage tanks annually, or as needed. Refer to "Cleaning and disinfecting a water storage tank instructions" provided by the Village of Haines Junction.

Activated Carbon is a natural material derived from bituminous coal, lignite, wood and coconut shell. Each material has its own unique adsorption properties. Bituminous carbon is known for its high chlorine reduction capacity and is the material used in BRITA filters. Inline filter housings with replaceable activated carbon filters can be purchased very cheaply and can be sized to filter water for your entire home or as little as one tap used for drinking water.



Legislation is what guides us in operations

Water treatment plant operators are bound by legislation such as the *Guidelines for Canadian Drinking Water Quality* and the *Yukon Public Health and Safety Act*. Under the *Yukon's Public Health and Safety Act* the VHJ must submit 10 samples from verified locations throughout the community per week to Environmental Health Services for routine bacteriological testing. To this date, there has never been a confirmed positive coliform bacteriological sample from the VHJ water distribution system.

Operator Certification

The VHJ Water Treatment Plant is classified as a Level 2 facility and requires at least 2 operators certified at Level 2 in Water Treatment. The VHJ Water Distribution System is classified a Level 2 system and requires at least 2 certified operators in Level 2 Water Distribution. The VHJ Waste Water Collection and the VHJ Waste Water Treatment systems are currently unclassified. Certified individuals who operate and maintain water and wastewater utilities must remain active in their education by achieving 1.2 continuing education units (CEUs) annually.

The water purveyor (Village of Haines Junction) has a legal responsibility to provide clean potable water to their customers. A minimum level of quality and quantity both for consumption and fire flow capacity must be maintained for all users of the water utility.

Recommendations for Public Education and Awareness

- Participate annually in national water week (March)
- Offer tours to members of the community
- Provide tours for school-aged kids
- attaching the tank cleaning instructions twice annually at the beginning of the 2nd and 4th quarter billing period
- When you have questions, engage in discussion with utility operators and learn more about this utility provided by the Village of Haines Junction.

CLEANING AND DISINFECTING A WATER HOLDING TANK

Delivered water should be potable (safe for human consumption) and obtained from an approved source.

It is necessary to clean and disinfect your water holding tank(s) at least once a year or more often, if required. This is to remove algae (plant growth which produces bad tastes and odours), silt, and bacteria which may be harmful.

If the Water Holding Tank is:

*Accessible for Cleaning

1. Empty the tank.
2. Scrub or pressure wash the interior walls to remove dirt and grime.
3. Rinse out the tank.
4. Mix a solution of household bleach and water (1 tablespoon or 15 ml of bleach for every gallon of water).
5. Scrub or pressure wash the interior walls of the tank with this solution, and leave it sit for 2 hours.
6. After 2 hours, thoroughly rinse the tank with clean water.
7. Refill with potable water.

* **Caution is to be taken when using a strong chlorine solution. A water holding tank is a confined space. Under no circumstances should you enter a confined space, unless taking the appropriate precautions (see reverse side).**

Not Accessible for Cleaning

1. Ensure the tank is full of water.
2. Add the required amount of household bleach (see table below to the water in your holding tank. If possible, mix the bleach and water.
3. To disinfect the plumbing lines and fixtures, turn the tap(s) on. Once you smell the chlorine odor at each outlet, close the tap.
4. Leave for 12 hours (generally done overnight).
5. Drain the water tank (but not into a septic tank).
6. Refill with potable water.

Dosage of Household Bleach (5.25% chlorine) required for the Cleaning and Disinfecting of Water Holding Tanks not Accessible for Cleaning

Tank Size		Amount of Household Bleach to Obtain 50 ppm of Chlorine		
Litres	Imp. Gallons	mL	Imp. Ounces	Cups
277	50	264 mL	9	1
455	100	511 mL	16	2
909	200	909 mL	32	4
1137	250	1136 mL (1.2 L)	40	5
2273	500	2273 mL (2.3 L)	80	10
4546	1000	4546 mL (4.5 L)	160	20
6819	1500	6818 mL (6.8 L)	240	30
9092	2000	9091 mL (9.1 L)	320	40
11365	2500	11340 mL (11.5 L)	400	50