

Small Drinking Water Systems: Treatment Options

Working Together to Safeguard our Health

What are the treatment requirements for my small drinking water system (SDWS)?

Did you know that effective December 1, 2008, the Ministry of Health and Long-Term Care (MOHLTC) has oversight of small drinking water systems (SDWS) in Ontario? The MOHLTC has prepared a brochure – *An Introduction to Operating a Small Drinking Water System* to help you to become familiar with the changes to Ontario’s drinking water legislation. Reading this brochure is a good beginning.

Under the Health Protection and Promotion Act, Ontario Regulation 318/08 (*Transitional – Small Drinking Water Systems*) and Ontario Regulation 319/08 (Small Drinking Water Systems) as an owner or operator of a SDWS, you are required to provide users with safe drinking water at all times and to know your responsibilities for the type of system that you operate. A public health inspector will conduct a site-specific risk assessment and issue a “directive” for each SDWS, in accordance with section 7 of Ontario Regulation 319/08, that outlines the operational requirements that must be carried out by the owner/operator. The type of source water you use and the design of your SDWS will be important considerations in determining your operational requirements, including any treatment devices that are necessary for providing safe drinking water to users at all times.

To know if you require a treatment device for your SDWS, you should begin with regular testing of your drinking water for bacteria. Testing must be carried out by an Ontario laboratory that is

licensed by the Ministry of the Environment (MOE) or an out-of-province laboratory that has been approved by the MOE. Contact your local public health unit to discuss your specific circumstances and ensure you are on their list for a site specific risk assessment.

Do you know the quality of your source water?

In Ontario, most SDWS operators obtain their water from two main sources, groundwater or surface water. The type and quality of source water used and the design of your SDWS usually determines the treatment required:

Secure Groundwater: Treatment may not be required for water that is obtained from a secure, well-constructed and maintained groundwater source, such as a drilled well.

Non-secure groundwater: Treatment may be required if the source water supplying your SDWS is from a non-secure groundwater source, e.g., a dug or bored well. If the construction or design of your well allows contamination by surface water, then you may be required to provide filtration and disinfection to the well.

Surface water: Treatment must be provided if the source water supplying your SDWS is from a surface water source such as a lake or river. For surface water, you will be required to provide mechanical or chemical-assisted

filtration and primary disinfection. If your SDWS has a distribution system, you may be required to provide secondary disinfection.

To help you make the right choices about the treatment requirements that are appropriate for your SDWS, contact the local public health unit and speak to a public health inspector. Following the site-specific risk assessment, the inspector will issue you a directive which will set out any treatment requirements for operating your SDWS.

Choosing a treatment device that is best for your drinking water system

There are two types of drinking water treatment devices available: (1) disinfecting devices that are used to inactivate or remove harmful microorganisms, and (2) water conditioning devices that are used for the control or removal of chemical, taste and odour problems. Before you choose a device, it is important to have your water tested and speak with a water treatment specialist. Look for a device that has been certified by an accredited certification body. They provide standards that have been designed to safeguard drinking water by helping to ensure the material safety and performance of products that come into contact with drinking water.

Remember, these steps are a simplification of water treatment. To find additional information on treatment devices please refer to the MOE website at www.ene.gov.on.ca

There are two main processes that are used to adequately treat your SDWS supply, filtration and disinfection. The following table is a guide for choosing the most appropriate treatment device. It is based on the premise that it is practical and efficient to treat some water quality problems before others. For example, you must control turbidity, acidity, hardness or iron before water conditioners such as activated carbon filters, reverse osmosis units, or distillers can operate efficiently.

Contaminant	Possible removal technologies
Turbidity (suspended material, dirt)	Filtration
Fecal coliform (coliforms and E. coli)	Disinfection
Viruses (Enteroviruses)	Filtration and disinfection
Parasites (Cryptosporidium oocysts and Giardia cysts)	Filtration and disinfection
Chemicals (Arsenic, Fluoride, Lead, Nitrate and Nitrite, Sodium, Uranium)	Contact a water treatment specialist to determine which device would be most suitable for your system Submicron Filtration, Anion Ion Exchange, Activated Alumina, Reverse Osmosis, Micro-filtration

Filtration

- This process uses a filter to remove particulates and reduce the number of parasites from the source water. Filtration is required for all surface water systems and for non-secure groundwater systems that are vulnerable to surface water contamination.
- Filtration is the simplest method for removing suspended particles and turbidity from a drinking water supply to allow for successful disinfection. Filtration methods include slow and rapid sand filtration, diatomaceous earth filtration, direct filtration, membrane filtration, and cartridge filtration.

Disinfection

- This process reduces or eliminates the number of harmful microorganisms in water. Disinfection is required for all surface water systems and for non-secure groundwater systems that are vulnerable to surface water contamination;
- Disinfection can be achieved by means of chemical or physical disinfectants such as chlorine, chlorine dioxide, ozone, and ultraviolet (UV) light. The most common disinfectants used to treat water for small systems are chlorine and UV light.

There are two types of treatment systems commonly used to treat your SDWS supply: point-of-entry or point-of-use.

Point-of-entry

- This device is installed where the water enters the home or building. All water used within the home or building will be treated, including water used for bathing and laundry.
- Point-of-entry systems tend to be larger and more expensive than alternative systems.

Point-of-use

- This device is installed at the tap where the water is being used for drinking or cooking. Only water used from this tap is treated.
- Water from all other taps will be untreated and should not be used for drinking purposes.

Specific examples of treatment systems are outlined below:

1. Ultraviolet (UV) Light

- Ultraviolet treatment is the disinfection process of passing water by a special light source – UV radiation. The special light is immersed in the water in a protective transparent sleeve and emits UV waves that can destroy harmful microorganisms. This type of treatment is highly favoured since it does not require the addition of chemicals and therefore leaves no disinfection by-products. It is required that an alarm be used on UV devices to alert when there is a failure.
- The UV device works by emitting similar UV radiation to the sun. This radiation alters the genetic material of viruses, bacteria, molds or parasites, so that they cannot reproduce and are considered inactivated. UV treatment does not alter the water chemically as nothing is added except energy. UV treatment does not remove dirt particles, metals such as lead or iron, or hard minerals such as calcium. Other devices are required to remove particles, metals and minerals.
- This is a point-of-entry device that can be easily installed. UV devices are not effective at treating water that is highly contaminated, heavily cloudy or turbid, or high in iron. To increase the effectiveness of the UV device, the water may have to be pretreated. UV lamps should be checked and cleaned periodically, or replaced where necessary in accordance with the manufacturer's instructions.

Disinfection and water conditioning devices for treating your SDWS

UV devices only destroy microbes at the point of entry into the system and do not provide any residual disinfection downstream in the drinking water system. A drinking water system that uses UV devices should be periodically sanitized with a chemical disinfection to remove the microbes that are destroyed by UV radiation.

2. Chlorinators

- Chlorination devices provide continuous disinfection to a system by continuously adding a chlorinated product to all water that is drawn from the system. Treatment is provided by thoroughly mixing all water in the system with a specific amount (concentration) of chlorine for a sufficient (contact) time period.
- The time that is required for disinfection depends on the concentration of the chlorine solution, the quality of the water entering the system, the pH of the water, the temperature and the discharge rate of the pump. Disinfection of most disease-causing microbes occurs after 20 minutes of contact time if the pH is between 6 and 8 and the free residual chlorine is in the range of 0.2 mg/L to 0.4 mg/L. Frequent monitoring of the water chemistry is necessary to ensure that there is adequate disinfection being continuously provided.

Note: There may be an after-taste produced by the disinfection process. To effectively remove these disinfectant by-products, activated carbon filtration or reverse osmosis devices (discussed below) may be used.

Chlorine	UV light
<p><u>Advantages</u></p> <ul style="list-style-type: none"> • disinfection residual; provides for continuous protection and easy monitoring 	<p><u>Advantages</u></p> <ul style="list-style-type: none"> • simple to operate • does not require the addition of chemicals • requires very little contact time (seconds versus minutes for chemical disinfection);
<p><u>Disadvantages</u></p> <ul style="list-style-type: none"> • requires a constant supply of chemicals requires longer contact time (minutes versus seconds for UV light) 	<p><u>Disadvantages</u></p> <ul style="list-style-type: none"> • no disinfection residual; does not provide for continuous protection if drinking water system has a distribution system, secondary disinfection will be required

Table 2: Comparison of UV and chlorine disinfection processes

3. Ozonators

- This device uses ozone to inactivate microorganisms and provide some residual protection.
- The device is sealed and requires moderate amounts of electricity to produce ozone. Caution must be used to prevent the leakage of excess ozone from the unit into environment.
- Although the device is easy to install and maintain, it may be quite expensive.

4. Other Treatment Devices

These include ceramic filters, chlorine or iodine tablets, special cups or straws along with other filters supplemented with a



chemical disinfectant. These devices must be used in accordance with the manufacturer's instructions.

a) Devices for removal of chemicals, taste and odour

- The appearance, taste and smell of drinking water are usually more obvious to the consumer than the bacterial quality. Chemicals such as iron, manganese, sulphide, and calcium hardness can cause odour and taste problems. There are several devices available to remedy these problems; however, these units deal mainly with poor odour and taste problems and do not provide disinfection. If not used correctly, they may even increase existing problems with bacterial contamination in some circumstances.

b) Activated carbon or charcoal filters

- These devices are used to remove chlorine, odour and taste caused by organic materials. The efficiency of the device depends on the quality of the source water used by your SDWS, e.g., if water is dirty or has sediment plugging the filter, you will need to change the cartridge filters often.
- They are inexpensive and easy to install and require no power to operate. Because they are not disinfection devices, they should only be used on water that is already disinfected and safe to drink.
- If you are using these devices for water conditioning, you should know that:
 - The bacterial levels in your drinking water may increase because of the dirt and organic material that are trapped in the filters; and
 - You must use only filters that remove particles one micrometer or less in diameter if you use these devices for the removal of *Cryptosporidium* oocysts and *Giardia* cysts.

c) Reverse Osmosis

- This device conditions your SDWS supply by forcing water through a filtering membrane to remove most microbiological (bacteria, viruses and protozoa) and chemical (metals and minerals salts) parameters.
- It is easy to install and maintain, but the water must be pretreated to increase the life of the membrane filters that may clog or rupture if the water is of poor quality.

d) Water Softener

- This process is used to remove inorganic contaminants that cannot be removed adequately by filtration or sedimentation. It is also used to treat hard water and can be used to remove arsenic, chromium, excess fluoride, nitrates, radium and uranium.
- Softened water is not recommended for drinking because increased sodium content can pose health risks if exceeding the upper limit of 20 mg/L.
- This process may use and discharge significant amounts of salt; however, sodium-free softeners are available.
- Backwash from softener should not be discharged into private sewage disposal system (septic tanks).

Where can I find additional information?

Please remember...

This fact sheet is only a summary of your responsibilities as the owner or operator of a SDWS and is not a substitute for legal advice.



For a more complete understanding of your legal responsibilities as an owner or operator, refer to Ontario Regulation 318/08 and Ontario Regulation 319/08 or any directives issued on your system.

In addition, you should become familiar with the procedure documents produced to help you efficiently operate a SDWS:

- Procedure for Disinfection of Drinking Water in Ontario.
- Procedure for Corrective Action for Small Drinking Water Systems that are Not Currently Using Chlorine.

For general information about well water safety, ask your health unit staff for a copy of:

- Keeping Your Well Water Safe to Drink: An information kit to help you care for your well.

You may also find additional information on the following Ontario ministry websites:

Acts and Regulations:

www.e-laws.gov.on.ca/index.html

Ministry of Health and Long-Term Care (MOHLTC):

www.health.gov.on.ca

- Current list of local public health units:

www.health.gov.on.ca/english/public/contact/phu/phuloc_mn.html

Ministry of the Environment (MOE):

www.ene.gov.on.ca/en/index.php

- Current list of licensed private laboratories:

www.ene.gov.on.ca/en/water/sdwa/licensedlabs.php

Ministry of Agriculture, Food and Rural Affairs (OMAFRA):

www.omafra.gov.on.ca/english/

