

# Technical Bulletin

## **Wells Regulation – Well Disinfection**

This technical bulletin is one in a series of 11 on well issues created for a person who is considering a new water supply well or who currently owns a water supply well. The purpose of this technical bulletin is to summarize the information on well disinfection found in the *Water Supply Wells – Requirements and Best Management Practices* manual published by the Ministry of the Environment, December 2009.

This technical bulletin provides information relating to disinfection after well construction and pump installation prior to bringing the well into service. It does not include ongoing disinfection treatment of drinking water once the well is operational and begins to provide drinking water.

The disinfection requirements in Regulation 903 (Wells Regulation), as amended, made under the Ontario Water Resources Act are intended to provide for an adequate level of removal of harmful organisms that may be present in the well or groundwater or introduced during the well construction process.

### **When Well Disinfection Requirements Apply**

The Wells Regulation requires that well disinfection be done by the person constructing the well after:

- constructing a new well,
- installing, including re-installing, the pumping equipment in a well,
- deepening or extending a well, or
- conducting other alterations or repairs on an existing well or on equipment in a well other than minor alterations.

There are exemptions from the well disinfection requirements in the Wells Regulation for:

- test holes,
- dewatering wells,
- flowing wells and
- minor alterations of any well.

Further information on the term “minor alteration” is found in the *Wells Regulation – Well Repairs or Other Alterations* technical bulletin.

There is also an exemption from the disinfection requirements for the replacement of a pump, including associated pumping equipment, that is above or adjacent to a well or in a well pit unless the replacement involves the removal of a well cover or well cap.

## **General Information**

### *Process*

With respect to well construction and installation of equipment in a well, it is recommended that the process of well disinfection involve all of the following:

- Initial steps which include:
  - following sanitary practices when constructing a new well
  - properly developing a new well to remove fine particles from the well water
  - removing any debris from a well
- Thorough flushing of the well
- Treatment with a properly prepared chlorine solution, i.e. “shock” chlorination
- Discharge of heavily chlorinated water from the well and the plumbing
- Collection and analysis of water samples for indicator bacterial parameters

Chapter 8: *Well Disinfection of the Water Supply Wells – Requirements and Best Management Practices* manual provides detailed information on the process of well disinfection.

### *Common Products used in Well Disinfection*

Household bleaches containing sodium hypochlorite are routinely used in domestic wells and are recommended in chlorination treatment because:

- they are readily available,
- calculating, measuring and mixing the required volume of liquid to achieve the required dose is less complicated than for other products (e.g. powders or tablets), and
- they are safer to use than liquid chlorine, chlorine gas or calcium hypochlorite.

Only regular, unscented major brand bleach products should be used as most bleach products on the household market contain silicates, surfactants, silicon and/or thickeners. All of these additives could negatively affect both the water quality and the performance of the water supply. The label should always be checked to ensure contents are limited to the active ingredient (i.e. sodium hypochlorite) and water.

## *Free Chlorine Residual*<sup>1</sup>

When a chlorine solution is first added to water (i.e. when the well is dosed) the available chlorine will react with substances in the water, and on the surfaces inside the well. During this reaction, some of the available chlorine is used up by organic and inorganic matter and can no longer kill pathogens such as harmful bacteria and disinfect the well. The remaining available chlorine is the free chlorine residual that can effectively react to any pathogens.

## **Well Disinfection Requirements**

### *After New Well Construction is Complete*

On the day the well's structural stage is complete<sup>2</sup>, the person constructing the well must:

- remove all debris from the well, and
- ensure:
  - the water in the well is dosed to a free chlorine concentration between 50 milligrams per litre (mg/L) and 200 mg/L and is left undisturbed for at least 12 hours and
  - the water in the well is not used for human consumption until steps 1-4 listed below (see “Shock” Chlorination Steps) are followed.

If the water in the well is not to be used for human consumption, no further disinfection steps are required.

If the water in the well is to be used for human consumption, the person must follow the requirements shown in steps 1-4 listed (see “Shock” Chlorination Steps) below.

Steps 1-4 also have to be followed when installing pumping equipment in a well or performing an alteration on an existing well. Steps 1-4 do not apply if the person performs a minor alteration on a well, if the well is considered a flowing well or where the Wells Regulation exempts the installation of equipment for certain sampling, testing or monitoring activities.

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<sup>1</sup> Free chlorine residual consists of two main compounds: hypochlorous acid (HOCl) and hypochlorite ion (OCl<sup>-</sup>). Hypochlorous acid is much more effective (80 to 200 times better) at killing pathogens than the hypochlorite ion.

<sup>2</sup> The structural stage is complete on the day on which the well is capable of being used for the purpose for which it was constructed except for pump installation and disinfection of the water in the well in accordance with the Wells Regulation.

## *“Shock” Chlorination Steps*

Unless otherwise exempt, the person constructing the well must ensure the following steps set out in the Wells Regulation are taken:

1. The well water is dosed to a free chlorine concentration between 50 mg/L and 200 mg/L (initial dose) as soon as possible after the well construction or installation of the pumping equipment, and all debris has been removed from the well.
2. The well water is tested for free chlorine residual at least 12 hours and not more than 24 hours after the water is chlorinated.
3. If the test indicates the concentration of free chlorine residual in the well water is less than 50 mg/L or more than 200 mg/L, the person constructing the well must do the following steps, in the order shown below, as soon as reasonably possible:
  - Pump the water out of the well until the concentration of free chlorine residual in the well water is less than 1 mg/L.
  - Re-dose the well water to a free chlorine concentration of not more than 200 mg/L.
  - Test the well water for a free chlorine residual 12 to 24 hours later.
  - If the test again indicates the concentration of free chlorine residual in the well water is less than 50 mg/L or more than 200 mg/L, these steps must be repeated. The section titled “Alternate Method” on page 5 discusses a possible alternative if the testing repeatedly shows a free chlorine concentration that is too low.
4. If the test indicates the concentration of free chlorine residual in the well water is between 50 mg/L and 200 mg/L, the person constructing the well must do the following:
  - Pump the water out of the well until the concentration of free chlorine residual in the well water is less than 1 mg/L.

All reasonable care should be taken to ensure that chlorinated well water is not pumped out in a quantity, concentration, or under conditions that may impair the quality of surface water or groundwater, or that cause, or are likely to cause, adverse effects to the natural environment.

Chapter 8: *Well Disinfection of the Water Supply Wells – Requirements and Best Management Practices* manual provides detailed information on dosing with chlorine, measuring free chlorine residual, and on discharging the heavily chlorinated water.

### *Use of Well During Dosing and Testing*

In between dosing and testing, the Wells Regulation stipulates that no person shall disturb the well or use the water for any purpose.

### *Written Records of Test Results*

The person who is responsible for ensuring that the water is tested for free chlorine residual must ensure the well purchaser is provided with a written record of the test results before the well is used as a source of water for human consumption.

### *Special Circumstances*

The “shock” chlorination process after the initial dosing (i.e. step 1) does not apply to an alteration of a well if all of the following are satisfied:

- the alteration involves the urgent replacement or repair of a pump, including associated equipment, that unexpectedly failed,
- no water supply is immediately available to the well purchaser as an alternative to the water from the well, and
- the well purchaser provides written instructions to the person who undertakes the well alteration to discontinue the disinfection process after dosing the well to a concentration not less than 50 mg/L and not more than 200 mg/L free chlorine.

In these cases, the following is required:

- The well purchaser must ensure that, before the well water is used for any purpose, water is pumped from the well until no odour of chlorine is detected in the well water.
- The person who undertakes the alteration must retain the written instructions referred to above for two years.

### **Sampling After “Shock” Chlorination**

“Shock” chlorination treatment does not necessarily guarantee the water is bacteriologically safe for human consumption or bathing. For example, a source of contamination may be impairing the quality of the groundwater supplying the well. Also, various chemical reactions between the chlorine solution and materials in the water (e.g. biofilm) may prevent the elimination of all pathogens in the water.

As a final step in the disinfection process, the person constructing the well or the well owner should sample the well water for bacterial indicator parameters. The first sample should occur 24 to 48 hours after the heavily chlorinated water has been pumped from the well, pumping equipment and plumbing. Two more samples should be taken one to three weeks apart.

All samples should be submitted to a public health laboratory or an accredited and licensed private laboratory. The laboratory should analyze the samples for bacterial indicator parameters to verify that the treatment has eliminated indicator bacteria from the well water.

Chapter 8: *Well Disinfection of the Water Supply Wells – Requirements and Best Management Practices* manual provides detailed information on the sampling and the interpretation of analysis results.

### *Alternate Method*

The Wells Regulation requirements for well disinfection using free chlorine are not required to be followed if the Director under the Act gives written approval for another method of disinfection and the approved method is properly followed by the person constructing the well.

Examples may include situations where:

- groundwater contains petroleum hydrocarbons,
- groundwater contains elevated arsenic, or
- the person cannot maintain at least 50 milligrams per litre of free chlorine in the well for 12 hours, for example in highly fractured bedrock environments that allow the chlorinated water to move away from the well.

Chapter 8: *Well Disinfection of the Water Supply Wells – Requirements and Best Management Practices* manual provides detailed information on contacting the Director under the Act and the process used to obtain the Director's approval.

## Additional Information Sources

This technical bulletin on well issues is one in a series of 11 created for owners of water supply wells which are available on the ministry's website:

[http://www.ene.gov.on.ca/environment/en/subject/wells/STDPROD\\_075978.html](http://www.ene.gov.on.ca/environment/en/subject/wells/STDPROD_075978.html)

Further information on well disinfection for water supply wells can be found in Chapter 8: *Well Disinfection of the Water Supply Wells – Requirements and Best Management Practices* manual.

A copy of the *Water Supply Wells – Requirements and Best Management Practices* manual can be obtained from the ministry's web site at

[http://www.ene.gov.on.ca/environment/en/resources/STD01\\_078655.html](http://www.ene.gov.on.ca/environment/en/resources/STD01_078655.html).

For all of the requirements on non water supply wells e.g. test holes or dewatering wells see the Wells Regulation.

A copy of Regulation 903 (Wells Regulation), as amended, made under the Ontario Water Resources Act and other regulations can be obtained from the e-Laws web site at [www.e-laws.gov.on.ca](http://www.e-laws.gov.on.ca).

The publications are also available by calling the Publications Information Centre at 1-800-565-4923 or (416) 325-4000.

For further information about wells, contact the Wells Help Desk at 1-888-396-9355 (Well) or the nearest Ministry of the Environment office listed in the blue pages of the telephone directory.

**Notice: This bulletin is being provided for information purposes only and is not intended, nor should it be construed as providing legal advice in any circumstances. The applicable legislation including the Ontario Water Resources Act and Regulation 903, as amended and made under that Act, should be consulted. Legislation and regulations change from time to time so it is essential that the most current versions be used.**