Water Well Disinfection

Using the Simple Chlorination Method

Water Stewardship Information Series

BRITISH COLUMBIA
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Well disinfection is used to inactivate or control bacteria populations in a well and the distribution system. There are several methods used to disinfect water wells including simple chlorination, shock chlorination or bulk displacement and a procedure for wells that are difficult to disinfect. This brochure describes the simple chlorination method. For information on the treatment of wells that are hard to disinfect see (www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/factsheets/PFRA_well_recovery.pdf).

Are there things I need to do before disinfecting my well?

A well should be tested regularly for water quality. If coliforms or *Escherichia coli (E. coli)* are repeatedly detected in your well water, the first step to take to eliminate them is to look for the following:

- ❑ Are there any potential contamination sources near the well, such as manure or compost piles, septic disposal fields, or hazardous materials storage?
- ❑ Does the ground slope promote drainage of surface water toward the well or ponding of water around the well?
- ❑ Is the well cap missing, cracked or damaged?
- ❑ Does the well cap allow water or vermin to enter into the well?
- ❑ Does the well casing stick up less than 30 cm (12 inches) from the ground surface (see Figure 1) or the floor of the pump house? Can surface or standing water easily flood over the top of the well casing?
- ❑ Is there an unfilled space or gap between the well casing and the ground around the well (see Figure 2) e.g. the surface seal is missing or incomplete?
- ❑ Is the well finished below grade?
- ❑ Are there noticeable cracks in the surface seal around the well casing?

If you answered ***"yes"*** to any of the above questions, fix the problem before proceeding with disinfection. Otherwise the well will continue to be vulnerable to contamination.

Figure 1. Well casing stick up less than 30 cm (12 inches) from the ground surface

Figure 2. Well with gap between casing and ground – no surface seal

Note: *A registered well driller must be hired to repair or install a surface seal for a well, or to add casing to increase the well stickup.*

Are there any safety precautions to take?

Chlorine is very volatile so it is dangerous to work with in confined areas where vapours can accumulate such as well houses, pits and crawl spaces. Caution should be used when working in these situations – WorkSafeBC rules for confined spaced entry should be followed.

Prepare the chlorine solution outside in a well-ventilated area and wear appropriate safety clothing and equipment to protect your eyes and skin from splashes and spills.

If you have any concerns or need help with disinfecting your well contact a registered well driller or pump installer.

What are the limitations of the simple chlorination method?

Simple chlorination only eliminates the bacteria present in the well, on the pumping equipment or in the distribution system. It will not kill bacteria in the aquifer beyond the immediate location of the well. If there is some external source of contamination, the problem will only be solved temporarily. A well must be protected from contamination through proper siting, construction and maintenance.

Nuisance bacteria such as iron-related or sulphate-reducing bacteria are often found in groundwater and water wells. If uncontrolled, these bacteria can colonize the intake area of a well. The colonies form a sticky, slimy substance called biofilm (see Figure 3 below) which can reduce well production and degrade water quality. Also, minerals in groundwater can settle out and accumulate on well screens over time. The simple chlorination method is not effective in penetrating or removing biofilm and mineral build-up. To prevent the accumulation of biofilm and minerals regular disinfection of the well is recommended in cases where bacteria have been detected.

Figure 3. Biofilm on well wiring

If the well has never or infrequently been disinfected or coliforms or *E. coli* continue to be detected in the water, hire a registered driller or pump installer to remove the pump and clean the casing and screen before repeating disinfection using either the shock chlorination procedure or the procedure for hard to disinfect wells.

What are the steps for disinfecting a water well?

STEP 1 – Before beginning

Notify all users of the well not to drink the water or bathe in it while the strong solution of chlorine is present in the system and to store sufficient water for use during a 12-hour period.

Bypass or disconnect any carbon filters or water treatment devices before disinfecting. Carbon filters will remove the chlorine from the water – distribution pipes located past these filters will not be disinfected if the filters are not removed.

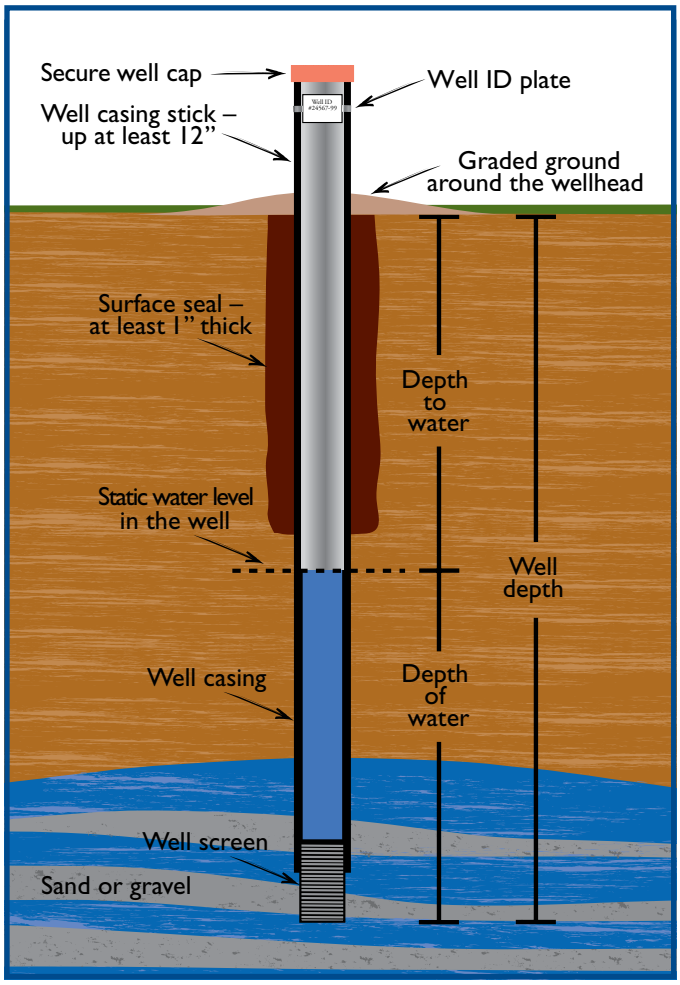

Figure 4. Cross-section of well showing main features and measurements

STEP 2 – Determine the diameter of the well, depth of water in the well and the pH of the well water

Measure or check the driller’s well construction report to determine the diameter and depth of the well and the static water level. The depth of water = well depth – static water level (see Figure 4). If this information is not available contact a registered well driller or pump installer for help.

Test the pH of the well water. Ideally, the pH should be 7 or less. If it is above 7, add one litre of vinegar or citric acid to the well and re-test the pH in the well water before proceeding.

STEP 3 – Add chlorine solution to the well

Estimate the amount of domestic bleach (Table 1) or chlorine tablets or powder (Table 2) needed.

a. **For wells without a pump (e.g. new well) using domestic bleach**

Mix the volume of bleach needed with at least 45 litres (10 gallons) of water. Pour the solution into the well and leave it for approximately 12 hours. When the pump is installed, pump for at least one hour to remove the chlorine solution.

b. **For wells with a pump using domestic bleach**

Turn off power to the pump. Mix the volume of bleach needed with at least 45 litres (10 gallons) of water. Remove the well cap and lift the wires out and pull to one side. Clean the cap to remove debris, dirt and oil and place in a clean container. Pour or siphon the chlorine solution into the well between the drop pipes (pipes that carry water from a pump in a well to the surface) or pour the solution directly into the well. Some wells have a sanitary seal (see Figure 5) with either an air vent or plug that can be removed to add the chlorine mixture – contact a registered well driller or pump installer for assistance if required.

Caution: *Do not remove any of the bolts in the top of the sanitary well seal.*

Figure 5. Well with sanitary seal type cap

Figure 6. Well fitted with pitless adapter, cap has space for wiring

If possible, mix the water in the well by attaching a clean hose to a nearby water tap or hydrant, placing the other end of the hose into the top of the well casing, and then running the water from the well through the hose and back into the well. Note: the power to the pump will need to be turned back on. After mixing, let the water stand in the well for a couple hours before proceeding to the next step.

c. **For wells with a pump using chlorine tablets or powder**

Dissolve the required weight of tablets or powder in warm water, remove the well cap, pour the solution into the well, mix if possible and let stand for two hours (see instructions above).

STEP 4 – Move the chlorinated water into the distribution system

Turn the pump(s) on. Open all water taps one at a time, including outside hose bibs and cold and hot water taps. Flush toilets and fill washing machines and dishwashers. Allow the water to run until a chlorine smell is detected from each faucet or there is a slippery feeling to the water, then turn off each tap. Open the valve or plug at the top of the pressure tank just before stopping the pump to allow the solution to contact the entire inside surface of the tank. Then close the valve or plug. Back flush any water softener devices and all water filters (except carbon filters). Replace carbon filters to avoid reintroducing bacteria into the system. Plumbing grit and solid mineral particles may form during disinfection and may clog faucet aerators, flush valves and equipment using filters. Faucet aerators may need to be removed if clogging occurs. If a strong chlorine odour is not present, return to step 3, add half the amount of chlorine used for the initial treatment to the well and repeat step 4.

Replace the well cap and leave the chlorine solution in the distribution system for at least 12 hours.

STEP 5 – Flush the chlorine out of the well and distribution system

Open an outside tap and run the chlorinated water from the well to an area where plants won't be harmed. Do not run the water into your septic system as the chemicals and the amount of water required to flush the system may overload or damage the septic system. Do not drain the water into a stream, ditch or storm drain that connects with any fish-bearing streams.

When a chlorine smell is no longer present, run the indoor hot and cold water taps to flush out the hot water tank and plumbing (this small amount of chlorine will not harm the septic system). It may take as little as half an hour or as long as four days to completely remove the chlorine odour from the water system.

Do not overpump the well! *If the well is low-yielding or pumps silt or sand, slowly flush the well – watch the water coming from the hose to make sure there is no sediment in it. Over-pumping may worsen the sediment problem. It may be necessary to stop and start the pump if it is losing its prime.*

STEP 6 – Sample the well water

A water sample should be collected for analysis one week after chlorination to verify the water is safe to use. Do not drink the water without boiling it until test results show it is safe to drink. Retest again one month after disinfection to ensure the water is potable.

TABLE 1
Volumes of domestic bleach* needed for a 200 ppm chlorine solution

Well diameter		Domestic bleach* (5-6%) needed per 3 metres (10 feet) of water		
inches	mm	metric	US gallons	other
4	100	100 mL	0.02	5 tbsp
5	130	150 mL	0.04	10 tbsp
6	150	200 mL	0.05	13 tbsp
8	200	360 mL	0.09	1.5 cups
10	250	560 mL	0.15	2.5 cups
12	300	808 mL	0.21	3.5 cups
24	610	3.3 L	0.9	14.6 cups
36	914	7.5 L	2.0	
48	1219	13.3 L	3.5	

***Note:** Domestic bleach has an expiry date and should be used before this date for effective disinfection. Purchase only the amount needed and use it all. Use only unscented plain domestic bleach without fabric softeners or other additives.*

TABLE 2
Dry weight of chlorine tablets* needed for a 200 ppm chlorine solution

Well diameter		Dry weight of chlorine tablets (65-75%) per 3 metres (10 feet) of water	
inches	mm	oz	grams
4	100	0.3	9
5	130	0.5	15
6	150	0.7	20
8	200	1.3	36
10	250	2.0	57
12	300	2.9	82
24	610	11.9	337
36	914	26.7	758
48	1219	47.4	1347

***Note:** Make sure the chlorine tablets are for potable water, e.g. not for swimming pools or hot tubs.*

When should a well be disinfected?

The simple chlorination method is used:

- following construction of a new well,
- following alteration of an existing well,
- following pump installation, maintenance or repair, or
- by homeowners when the well has tested positive for coliforms or *E. coli*.

The bacteria and viruses found in the soil at or near the well site can be picked up on drilling tools, pipes and pumps during construction or servicing of a well. If disease-causing organisms are present they may be introduced into the well. Therefore, every well, after construction or repair, should be disinfected.

For further information

For further information on whether the well water is safe to drink contact your local Health Authority *(look for listings in your local phone directory)*. A list of registered well drillers and pump installers can be found at: www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells.html#reg.

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Photos by Sylvia Kenny, Peter Epp and Greg Farley.