- 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 living 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.

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 which can cause gradual losses in well production and poor water quality. Also minerals in the groundwater can settle out and accumulate on well screens over time. Chlorine products are not effective at 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.

If the well has never or infrequently been disinfected or continues to have positive detections of coliforms or E. Coli, 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.

Biofilm on well wiring

Are there any safety precautions to take?

Chlorine is very volatile so it is dangerous to work with in confined areas. Dangerous vapours can accumulate in confined spaces such as well houses, pits and crawl spaces and caution should be taken 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 qualified well driller or pump installer.

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 registry of qualified well drillers and pump installers can be found at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells.html#reg.

BRITISH COLUMBIA
The Best Place on Earth

The BRITISH COLUMBIA GROUND WATER ASSOCIATION
GROUND WATER DEVELOPMENT

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Photos inside brochure by Sylvia Kenny and Peter Epp
Graphic by Donna Moreau

Water Stewardship Information Series

Water Well Disinfection

Using the Simple Chlorination Method

BRITISH COLUMBIA
The Best Place on Earth

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. (http://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?

The first step to take if your well has shown repeated positive detections of coliforms or E. Coli is to do a visual inspection of the well to look for the following:

- ❑ Are there any potential contamination sources near the well such as manure piles?
- ❑ Is the area around the well sloped to drain surface water away from the wellhead?
- ❑ Does the well have a cap? If your well does have a cap, is it cracked or damaged?
- ❑ Does the well have a stick-up that is at least 30 cm (12 inches) above ground surface or the floor or the pump house to the top of the casing?
- ❑ Is there a gap between the well casing and the ground around the well, e.g. no surface seal?
- ❑ Are there 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.

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 the well.*

When should my well be disinfected?

The simple chlorination method described in this handout is intended for use:

- following construction of a new well,
- following alteration of an existing well,

What are the steps to take to disinfect a water well?

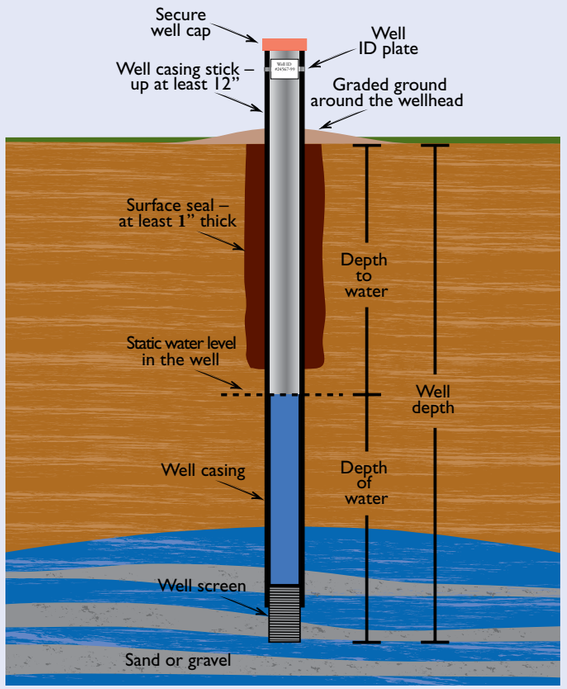
STEP 1 Things to do before beginning

All users of the well should be notified before disinfecting. Users should be advised not to drink or bathe with the water 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 past these filters will not be disinfected if the filters are not removed. Replace with new filters after disinfection to avoid reintroducing bacteria into the system.

STEP 2 Determine the diameter and amount of water in the well

Measure the diameter of the well or check the driller's well construction report to determine the depth and diameter of the well and the static water level (e.g. amount of water in the well = well depth - static or resting water level). If this information is not available contact a registered well driller or pump installer for help.



STEP 3 Add chlorine solution to the well

Estimate the amount of domestic bleach (Table 1) or chlorine tablets or powder (Table 2) needed based on the diameter and amount of water in the well.

a. **For wells without a pump using domestic bleach**
Take the volume of bleach estimated and mix it with at least 45 litres (10 gallons) of water. Pour this solution into the well and let it stay in the well 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 the power to the pump. Take the volume of bleach estimated and mix it 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 (pipe that carries water from a pump in a well to the surface) or pour the solution directly into the well. Some wells have a sanitary seal with either an air vent or plug that can be removed for the addition of the chlorine mixture.

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

Well with sanitary seal – cap off

Cap with space for wiring

If possible, mix the water in the well by attaching a clean hose to the closest 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 few hours before proceeding to the next step.

c. **Disinfection with 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 & let stand for 2 hours (see instructions above).

d. **For large diameter dug wells**
Place the required weight of tablets or powder in a weighted porous sack (e.g. tightly woven burlap). Remove the well cap or lid and raise and lower the sack in the well making sure to allow the sack to touch the bottom of the well and come into contact with as much of the well water as possible. Leave the sack in the well for at least a few hours before proceeding to the next step. Alternatively calculate the volume of domestic bleach needed and mix this directly in the well.

STEP 4 Move the chlorinated water into the distribution system

Turn the pump back on and open all the water taps. Turn on all the water taps one at a time, including the outside house bibs, cold and hot water taps, toilets, washing machines, dishwashers and shower/bath fixtures. Backflush the water softener and all water filters (except carbon filters). 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. Plumbing grit and precipitated minerals may form as a result of adding chlorine and may clog faucet aerators, flush valves and equipment using filters. Faucet aerators may need to be removed if clogging occurs. If at any time the 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 let the system site idle 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 it won't matter if plants are harmed, such as a road or a gravel drive. Do not run the water into your septic system as the amount of water required to flush the system may overload and damage the septic system. Do not drain the water into a stream, ditch or storm drain that connects with any fish-bearing streams.

When there is no longer a chlorine smell present, run the hot and cold taps inside the house to flush out the hot water tank and household 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 your well! *If your 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. Overpumping may worsen the sediment problem. There may be a need to stop and start the pump if it is losing its prime.*

STEP 6 Sample the well water

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

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 what you need and use it all. Use only unscented domestic bleach.*

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