
ENVIRONMENTAL Fact Sheet



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Disinfecting Public Water Systems

This fact sheet provides instruction for the disinfection of small public water systems, which are typically served by dug or drilled well sources with relatively small atmospheric and pressure water storage tanks. These steps may be used as the final corrective action following detection and resolution of bacteria contamination or after any invasive work has been performed such as system repairs or maintenance.

PRIOR TO DISINFECTION

- 1. Take Additional Bacteria Samples.** Rule out possible sampling errors such as non-sterile sample bottles, excessive holding time, improper collection procedures, and laboratory error. Sample the raw well source(s), after treatment, storage and at the entry point to the distribution system, to aid in isolating and identifying the source of contamination.
- 2. Well and Distribution Inspection.** Carefully inspect the well(s) and each of the main water system components to identify and correct potential pathways that may have allowed bacteria to enter the water system. See the NHDES fact sheets concerning Dug Well Design ([WD-DWGB-1-4](#)) or Bedrock Well Design ([WD-DWGB-1-2](#)) for information on proper well construction.
- 3. Verify Sanitary Protective Area.** Wells should be located at least 50 feet away from wetlands, brooks or other surface water, and at least 75 feet (or more, depending on the volume of water use) away from septic system components and other potential contamination sources. The top of the well casing should be at least 12 inches above ground and grading should direct all drainage away from the well.
- 4. Notify Water System Users.** Per Env-Dw 503.12, public water systems are required to advise all users at least 2 days in advance of work to be performed on the system.
- 5. Flush the System.** Chlorine cannot reach bacteria entrapped within mud, rust or other solids. Therefore, all components of the system including the well source, tanks and distribution piping should be flushed to a clean condition prior to disinfection. For dug wells, scrub the walls with a pressure washer or a long handle brush followed by a rinse, and flush to waste until water is clear. For drilled wells, pump to waste until water is clear. Flush through blow-offs and other outside taps to avoid overloading septic tanks or leach fields until the water runs clear. A temporary discharge permit from NHDES may be required. **NEVER** discharge to a surface water river or pond. Choose a dry area or a drainage swale where water can percolate naturally through the soil.

6. **Investigate Treatment Systems.** Verify with the manufacturer’s instructions **BEFORE** bleaching a treatment system of any type. Some resins, gaskets and filter membranes may be damaged by chlorine. If the well is clean, you may be able to disinfect after treatment at the holding tank.

DISINFECTION PROCEDURE

Chlorine is the standard chemical used to disinfect all components of a water system.

☠ **CAUTION:** Chlorine is a hazardous material. Read all warnings before use. Wear suitable clothing, gloves and eye protection. Do not leave in plumbing longer than overnight or maximum 24 hours.

Type of Chlorine. Chlorine is commercially available as 12.5% liquid sodium hypochlorite (industrial grade), or 8.25% (regular household bleach). In solid form, calcium hypochlorite pellets are sold in concentrations from 40 to 70% active chlorine. Liquid bleach is the more effective treatment for wells less than 200 feet deep and upper portions of deeper wells, unless the pellets are pre-dissolved in water. Pellets are recommended to treat deep sections of drilled wells because they sink to the bottom providing better chlorine contact at the bottom of the well. Crushed pellets help for intermediate depths. Disinfectant should not contain algaecides, stabilizers, conditioners or fragrances. **DO NOT** use pool bleach additives as these contain algaecides and are not certified for drinking water use. The solid calcium hypochlorite pellets are available through a water well industry retail supplier, a licensed water well contractor, or web search for “Chlorine Pellets Calcium Hypochlorite.” Pellets should be NSF-60 certified with 70% active chlorine.

Chlorine Concentration. The recommended dosage for shock disinfection is **5-10 mg/L**, though up to 50 mg/L may be used. Both [We 602.03](#) and [We 702.02](#) (under “Council & Board Rules”; click on “We 100-1000 Water Well Board rules”) require a minimum of 50 mg/L upon completion of well construction and completion of pump installation or reinstallation of an existing pump. Note that higher doses require excessive flushing to remove residual chlorine, and can reduce disinfection effectiveness due to the higher pH of the chlorinated water. The following conversion factors and tables are provided to estimate the required chlorine needed for the recommended dosage, depending on the volume of water to be disinfected.

Dosing of High-Volume System Components Depending on the water system configuration, well volume may be insufficient to adequately dose pipes and tank(s). Re-dosing the well after sending chlorinated water to the tank, and/or also dosing the tank(s) may be needed to facilitate appropriate residual in the entire system during contact time.

Volume of Water

Volume of a cylinder (in gallons) = 3.14 x R² x H x 7.48 gal/ft³

Where:

R = radius (in feet) of the well (the radius is **half** the diameter of the well)

H = water depth (in feet) from water surface to bottom of the well

Shown below are volumes for various size cylinders. Bedrock wells are typically 6 inches in diameter and dug wells are typically 36 inches in diameter.

Approximate Water Volume in Wells
(rounded to the nearest gallon)

Water Depth in Well (feet)	Diameter of Well (inches)			
	6	8	36	48
10	15	26	530	940
20	30	51	1,060	1,880
200	293	512	--	--
500	734	1,279	--	--

Approximate Water Volume in Pipes

Pipe Diameter (inches)	Gallons per Lineal Foot of Pipe	Gallons per 100 Feet of Pipe	Gallons per 150 Feet of Pipe
1	0.04	4	6
2	0.16	16	24
4	0.65	65	98
6	1.47	147	221

Volume of Chlorine

$$\text{Volume (in gallons)} = \frac{\text{gallons of water} \times \text{target concentration (mg/L or ppm)}}{\% \text{ chlorine stock} \times 1,000,000}$$

Shown below are amounts of chlorine required, as either bleach or pellets, for listed chlorine concentrations and volumes of water.

Approximate Chlorine Volume for Well Disinfection

Target Chlorine Concentration (mg/L or ppm)	Water Volume (Gallons)	Volume of 8.25% Chlorine Stock (Common Bleach)	Equivalent Weight of 70% Calcium Hypochlorite Pellets (0.79 g/pellet)
5	100	1/8 cup	3 pellets
	500	1/2 cup	16 pellets
	1,000	1 cup	31 pellets
10	100	1/4 cup	6 pellets
	500	1 cup	31 pellets
	1,000	2 cups	63 pellets
50	100	1 cup	31 pellets
	500	1 quart	157 pellets
	1,000	2 quarts	315 pellets

For wells up to 200 feet deep, use liquid bleach or crushed pellets pre-dissolved in water, as the pellets are slow to dissolve. For wells deeper than 200 feet, use a combination of bleach, crushed, and full pellets that adds up to total dosage. Bleach will treat the upper portions of the well, and the pellets will treat the deeper portions. Pellets can be crushed in a heavy bag that is struck with a hammer.

The table on the following page lists volumes of common bleach needed for tank disinfection.

Approximate Chlorine Volume for Tank Disinfection

Target Chlorine Concentration (mg/L or ppm)	Water Volume (Gallons)	Volume of 8.25% Chlorine Stock (Common Bleach)
5	1,000	1 cup
	5,000	5 cups
	10,000	10 cups
	20,000	1 ¼ gallons
10	1,000	2 cups
	5,000	10 cups
	10,000	1 ¼ gallons
	20,000	2 ½ gallons

Adding the Disinfectant. Disinfection must be carried out upstream or at the point where bacteria entered the system. If the cause of contamination has not been located, the entire system starting from the well to distribution must be disinfected. A simple procedure is as follows:

1. Run a garden hose from an outside faucet to the well and turn the water on to promote mixing in the borehole.
2. Add the prescribed chlorine amount in accordance with the tables above. Use a combination of liquid and tablets for deep wells as recommended above. Wash chlorine particles off wires and other parts of the well interior as chlorine is very corrosive and will damage wiring and fittings.
3. Continue to run water through the hose, allowing the chlorinated water to recirculate and mix evenly throughout the well depth until you smell chlorine from the hose water.
4. Run each faucet to draw disinfectant through distribution until you smell chlorine and then turn off. Measure the chlorine residual using a pool-test kit.
5. Take the hose out of the well, replace the cover and let chlorinated water sit in the system at least overnight (minimum 4 hours under We 602.03 and We 702.02) and for a maximum 24 hours.
6. After letting the chlorinated water sit in the system, flush the system by running an outside faucet. Direct discharge to a dry area *away* from plants, streams or ponds, and leach field.
7. Continue flushing until you can no longer smell any chlorine – this may take several hours, or repeated flushing over several days. Test to verify there is no residual, preferably 0 mg/L but at most equal to or lower than 0.2 mg/L.
8. Re-sample water for bacteria analysis, and note the measured chlorine residual (ideally 0 mg/L) on the laboratory sample form.
9. Repeat steps 1-8 if bacteria persist even though the source of contamination has been addressed. If the source of contamination has not been identified, re-inspect the system and/or seek professional help.

FOR MORE INFORMATION

Contact NHDES Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgbinfo@des.nh.gov. Visit www.des.nh.gov/organization/-divisions/water/dwgb/index.htm for additional fact sheets.

Note: This fact sheet is accurate as of January 2018. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.