



## PROCEDURES FOR WATER SYSTEM DISINFECTION

**Use extreme caution when working with electricity and water. Together, water and electricity can be deadly.**

### Chemical Concerns

- Always follow the manufacturer's use and safety directions.
- Avoid eye and skin contact. Wear protective goggles or a face shield and rubber gloves when working with bleach.
- Do not mix bleach with other chemicals as they may form harmful gases.
- Do not leave bleach or the bleach solution unattended.

### Respiratory Concerns

- Disinfection can create harmful gases. The area around the well must be well ventilated.
- Harmful gases can accumulate in well pits and create a lack of oxygen.

### You will need the following to disinfect your water system:

- A garden hose that is long enough to reach from your water faucet to the well. This hose also needs to reach an area that is away from your well, septic system, landscaping, and bodies of water.
- Clean 5 gallon bucket.
- Funnel.
- Protective goggles/face shield and rubber gloves.
- Five gallons of commercially bottled water.
- Chlorine test papers.
- Unopened, unscented 6% household bleach with no additives and is less than six months old.

**STEP 1 – Isolate Critical Areas** - Turn or push the bypass valves to the “bypass” or “out of service” position for all water treatment devices (water softeners, reverse osmosis systems, etc.) and appliances that cannot tolerate bleach. These may harbor organisms and need to be disinfected separately. Follow manufacturer's instructions for disinfection procedures. Remove all filters from devices and appliances. Bait tanks and livestock watering troughs may require special attention.

**STEP 2 – Electrical Safety** - Turn OFF the electrical power to the pump. If the circuit breaker box has a lockout hasp, use it to prevent the breaker from being accidentally turned on.

**STEP 3 – Open the Well by:** Removing the well cap and moving the wires with the connector caps to the outside of the casing to avoid getting them wet when doing Step 8 or removing the vent of a well seal. Do not remove the compression bolts from a compression fit well seal Note: If the well head is different from those described, contact an Illinois Licensed Well Driller.

**STEP 4 – Inspect all well components by examining:** Wire insulation for cracking, peeling, or missing wire nuts, well casings for cracking, or a loose well cap. It is important that any plumbing or well defects are fixed so that surface water or other contaminants cannot enter the well.

**STEP 5 - Determine the diameter and depth of the well.** The health department may have records to assist you with this.

**STEP 6 - Utilizing Table I, Calculate the total gallons of water for the well.**

**TABLE I**

DIAMETER OF WELL, (INCHES)	GALLONS OF WATER/PER FOOT
3	0.37
4	0.65
5	1.0
6	1.5
8	2.6
10	4.1
12	6.0
36-(3 ft. Bored Well)	52.9 (use depth of water in well)

Example A: 5 inch well, 200 feet deep = 200 gallons in well (considering the well is full of water will be satisfactory in most cases for a drilled well, as a slight overdose does no harm).

Example B: 3 ft. bored well, 20 feet of water in well = 1058 gallons in well.

**STEP 7 - Calculate the total gallons of water in building plumbing/distribution system as follows:**

**Building plumbing/distribution System water volume** = (a) building plumbing volume + (b) pressure tank(s) volume + (c) water heater(s) volume + (d) underground water line volume.

- (a) For home plumbing volume use a default estimate of 15 gallons for each building. Disregard this for very small buildings (cottages, etc.). For large buildings (resort type structures) use 50 gallons or calculate the volume from Table II below if pipe size/lengths are known.
- (b) Total volume of Pressure/Storage Tank(s).
- (c) Total volume of water heater(s)
- (d) Calculate the volume of underground distribution lines from Table II below for systems with significant underground piping. e.g. - Campground lines with Hydrants/Hookups.

**TABLE II**

- a. one (1) foot of 3/8" (inch) pipe holds 0.006 gallon

- b. one (1) foot of ½" (inch) pipe holds 0.01 gallon
- c. one (1) foot of ¾" (inch) pipe holds 0.023 gallon
- d. one (1) foot of 1" (inch) pipe holds 0.041 gallon
- e. one (1) foot of 1-¼" (inch) pipe holds 0.064 gallons
- f. one (1) foot of 1-½" (inch) pipe holds 0.092 gallons

Example: Campground with office and shower building and 3500 feet of 1 inch campground lines.

Two buildings	>	2 x 15 = 30 gallons
One 150 gallon pressure tank	>	150 gallons
Two 50 gallon water heaters	>	100 gallons
3500 feet of 1" pipe	>	3500 x 0.041 = 144 gallons

Building plumbing/distribution water volume = 30 + 150 + 100 + 144 = 424 gallons

**STEP 8 – Calculating a bleach solution:** Add the number of gallons calculated for the well to that calculated for the plumbing. This will give you the total number of gallons in the system. Mix the chlorine solution so it contains at least **100** parts per million using ½ tablespoon of 6% household bleach per gallon of water in the system; or mix a chlorine solution containing no more than **200** parts per million by using 1 tablespoon of 6% household bleach per gallon of water in the system. A stronger solution will need less time standing in the water system. A 100 PPM solution will need to be left for 24 hours in the system, but a 200 PPM solution can be left for at least 3 hours. Do not mix a solution greater than 200 PPM, as it can reduce the disinfection effectiveness.

Example: 100 gallons of water in the well + 50 gallons in the plumbing = 150 gallons of water in the system. For a 200 parts per million solution, you would need 150 tablespoons or 9.4 cups of bleach (There are 16 tablespoons in a cup).

**STEP 9 – Mix the solution and add it to the well:** Pour water from the water system into the clean 5 gallon pail until it is about ¾ full. Add the amount of bleach which was calculated in the last step. Use a funnel to pour bleach solution into the well. Avoid getting bleach on the well cap or wires.

**STEP 10: - Recirculate the chlorinated water:**

**1.** Turn the circuit breaker to the pump ON. Be careful, the wires in the well casing are “live and hot.” **2.** Connect a garden hose to the most convenient threaded hose connection. **3.** Run the water out of the hose for about 10 minutes in an area away from the well, septic system, landscaping, and bodies of water. The water may be discolored. Continue monitoring and running the water until it runs clear. If flow significantly decreases, shut off power to the pump and contact a licensed well contractor. **4.** Turn the water OFF. **5.** Put the funnel into the well. **6.** Place the garden hose into the funnel. **7.** Turn the water ON. **8.** Recirculate water. Continue to recirculate for about 30 minutes after you first smell bleach from the garden hose. Use chlorine test papers as a visual indicator to determine if the water from the hose is at least 100 ppm of bleach. If below 100 ppm, add more bleach solution and repeat STEPS 9 and 10. **9.** Turn the circuit breaker to the pump OFF. **10.** Rinse well components with commercially bottled water. Rinsing washes off bleach solution to prevent corrosion. **11.** Replace wires and well cap. **12.** Turn the circuit breaker to the pump ON.

**STEP 11: - Bring bleach solution to faucets:**

Cold and hot water faucets. ▪ Toilets, shower, and bath fixtures. ▪ Outside faucets or yard hydrants. **1.** Select your first faucet or fixture. **2.** Remove faucet aerator, if present. This will prevent them from

getting clogged from loosened scale. **3.** Run water until chlorine test papers indicate a minimum of 100 ppm. If below 100 ppm, go to STEP 8 and add more bleach solution and repeat STEPS 9,10,11. **4.** Turn OFF the faucet and repeat for the remaining faucets and fixtures. **5.** Turn the circuit breaker to the pump OFF. **6.** Rinse well components with commercially bottled water. Rinsing washes off bleach solution to prevent corrosion. **7.** Replace well components including vents, wires, and well cap.

#### **STEP 12: - Disinfection Time**

**1.** Turn the circuit breaker to the pump OFF. **2.** Put signs or disable faucets and fixtures to prevent anyone from using the water. **3.** Let the bleach solution sit in the water system for the desired time as described in STEP 8.

#### **STEP 13: - Remove the chlorinated water**

**1.** Turn the circuit breaker to the pump ON. **2.** Attach a garden hose from an outside faucet or yard hydrant. Do not put the end of the hose in or near your septic system, landscaping, or any bodies of water, since bleach solution will harm them. **3.** Run the water to flush the bleach solution out of the well. Monitor the process, it can take 30 minutes to 24 hours or more to flush all of the bleach solution from the well. **4.** Use chlorine test papers to verify that the water coming from the outside faucet or yard hydrant is clear of any bleach solution. **5.** Flush the chlorinated water from water heaters. **6.** Run the water from all interior and exterior water faucets and fixtures to flush the bleach solution from the rest of the water system. Use a chlorine test paper that reads to 0 ppm of chlorine to verify that no bleach solution is present.

#### **STEP 14: - Reconnect appliances water softeners and other treatment devices**

Return bypass valves to ON position after following the manufacturer's directions for disinfecting appliances and water treatment devices.

#### **STEP 13 – Test the Water**

After the bleach solution is removed from the water system, it is recommended that you take a water sample to make sure that the well water tests negative for total coliform before you use it for drinking or cooking.

#### **FOLLOW-UP**

Total coliform may regrow in the water system. For this reason, it is important to retest your water between two to four weeks after disinfection. If total coliform is detected, repeat the disinfection procedure. It is not unusual to disinfect a water system multiple times to eliminate total coliform if it has been growing in the system for a period of time. If disinfection attempts are unsuccessful, the well may need to be cleaned as well as disinfected. Contact an IDPH licensed well contractor for further assistance.