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HOW TO SHOCK CHLORINATE YOUR WATER SUPPLY

If your water sample has been found to be contaminated with coliform bacteria, and or fecal coliform bacteria, the normal procedure is to disinfect your water supply. Water containing coliform bacteria has probably been contaminated by sewage, animal fecal matter, bugs or surface water. Coliform contaminated water can contain pathogens which cause intestinal diseases or parasites dangerous to human health. Taking precautions such as boiling, chlorination, or other sterilization is advised.

To "clean up" your water, you need to disinfect the source and distribution system, and protect the system from future contamination. You should retest your system about a week after disinfection, and on a annual basis thereafter. If test results indicate that bacterial contamination is occurring, shock chlorination is the most widely suggested method for initial treatment. Shock chlorination is the one-time introduction of a strong chlorine solution into the entire water distribution system (well, pump, distribution pipeline, etc.).

When to shock chlorinate your well

Shock chlorination is recommended to ensure that bacterial contamination is controlled:
when lab results indicate a presence of bacteria, upon completion of a new well or after pump replacement or repair, when the distribution system is opened for repairs or maintenance, following contamination by flood water, and to control iron bacteria and sulfur bacteria.

How do I shock chlorinate my single house water supply?

Do not attempt this procedure on a well that serves more than one house. Accidental ingestion of high levels of chlorine can be toxic.

Before you begin the shock chlorination process, run some fresh water into a five gallon container. If concentrated chlorine accidentally comes in contact with your eyes or skin, use this fresh water to flush the affected area for 10-15 minutes. If you get some of the chlorine solution in your eyes, see your doctor after thoroughly flushing the affected eye. A second safety practice is to wear appropriate safety clothing and equipment. Wear goggles to avoid contact with the strong chlorine material and your eyes. Wear a pair of rubber gloves to protect your hands and rubber boots on your feet. To prevent discoloration of your clothing, wear a waterproof suit, coveralls or a full-length apron.

Preparations:

Do not allow anyone to drink the water until all of the chlorine has been rinsed out of the system! The highly chlorinated water is NOT safe to drink!

Before you begin:

1. be sure well construction is adequate to prevent direct entry of contaminants .
2. find and eliminate the source of the contamination.
3. disinfect the well components that could be a source of future contamination.
4. isolate portions of the system that may be degraded by the strong chlorine solution.

The best way to prevent a water supply from being contaminated by bacteria or pathogens is to eliminate the bacteria's access to the water source. Controlling access to the water supply by contaminants is difficult if the water supply is a pond, spring or other surface water. In some cases, sealing up cracks in well pits, spring houses (or spring boxes) and other potential points of entry will suffice. Be sure to remove all debris (leaves, twigs, etc.) from the spring house, well pit or storage reservoir.

Well Chlorination:

Shock chlorination of the well consists of mixing sufficient chlorine-based chemical with the well water to create a solution containing 200 milligrams per liter (mg/l), or parts per million (ppm) of chlorine throughout the entire system (well, distribution pipeline, water heater, pressure tank and other equipment).

Do not allow anyone to drink the water until all of the chlorine has been rinsed out of the system!

Remember that chlorine is very volatile so it is dangerous to work with in confined areas.

Make sure the work area is well ventilated. Prepare a mixture of one-half gallon of household bleach per 5 gallons of fresh water. Disinfect the well pit, spring house or other portions of the distribution equipment that may contribute bacteria to the water supply (pump, motor, pressure tank and exposed wiring conduits).

Drain as much water from the system as possible. For systems with pressure tanks containing a bladder, the rubber air-water separator inside the tank could be damaged by the chlorine solution. Check manufacturers' recommendations to determine if the pressure tank should be bypassed. For pressure tanks without bladders, release the air so that the tank can be filled with chlorinated water. Drain water from the water heater so that chlorinated water can be circulated through the hot water pipelines.

Backwash and clean water softeners, sand filters and iron removal filters with a strong chlorine solution. **Do not** chlorinate activated carbon filters since these filters will remove the chlorine until they become overloaded. Activated carbon filters should be removed from the distribution system until after chlorine has been flushed from the system. Estimate the water volume contained in the well casing using the table below.

Table 1 - Volume of water contained per foot of well depth.

Well casing diameter (inches)	Water volume per foot of water depth (gallons)[1]
4	0.65
6	1.47
8	2.61
10	4.08
12	5.88
18	13.22
24	23.50
30	36.72
36	52.87

[1]Volume of water calculated as the volume of a cylinder multiplied by 7.48 gallons/cubic foot.

Step 1. Determine the depth of water in the well.

The company that constructed the well should be able to provide you with the well depth and water level. For example, let's say that you have a 50 feet deep well, and the water level is at 40 feet. The well contains 10 feet of water (50-40=10 feet). If you have a deep well, we suggest adding a handful of solid calcium hypochlorite tablets as well as liquid. The solid tablets will sink to the bottom of the well, slowly dissolving and helping to sterilize the portion of the well below the pump. We suggest that the amount of solid calcium hypochlorite you add is in addition to the calculated amount of liquid sodium hypochlorite.

Step 2. Determine the volume of water in the well.

You measured the inside diameter of the well and it was 30 inches. Find the gallons per foot of depth for a 30-inch well in *Table I*. For our example we would multiply the depth of the water in the well (10 feet) by 36.7 gallons of water per foot of water depth (from *Table I*) to get 367 gallons of well water (10 x 36.7 = 367 gallons of water in the well).

Step 3. Estimate the volume of water in the distribution system.

Total up the water storage in the system, including the water heater, pressure tank, etc., and add 50 gallons for the pipeline. If you have a 50-gallon hot water heater and a 30-gallon pressure tank, you need to add 130 gallons for the distribution system.

Step 4. Determine the water contained in the entire system.

Add the water volume in the well to the water contained in the distribution system. In our example you would come up with 477 gallons (367 gallons in the well plus 110 gallons in the distribution system).

Step 5. Determine the amount of chlorine product required for a 200 ppm solution.

Table 2 lists the product amounts needed to create a 200 ppm chlorine solution using typically available sources. If you decide to purchase liquid bleach, you will need 3 pints of bleach per 100 gallons of water in the well and distribution system. For our example, you would need to purchase 14 pints or 1.75 gallons of liquid laundry bleach. You would determine this by using the worksheet at the end of this article (477 gallons divided by 100, multiplied by 3 pints per 100 gallons, and divided by 8 pints per gallon is equal to 1.75 gallons).

Table 2 - Amount of chemical required to create a chlorine concentration of about 200 ppm.

Chemical name	**Amount per 100 gallons of water**
Liquid Bleach with no additives (5.25% NaOCl)	3 pints
Commercial Strength Bleach (12-17% NaOCl)	1 pint
Chlorinated Lime (25% $CaOCl_2$)	11 ounces
Dairy Sanitizer (30% $CaOCl_2$)	9 ounces
Solid calcium hypochlorite (65-75% $Ca(OCl)_2$)	4 ounces

Well water containing iron, hydrogen sulfide, or organic substances may require more chemical to create a 200 ppm solution. Chlorine combines readily with these materials, making some of the chlorine ineffective as a disinfectant.

Step 6: Introduce the chlorine material into the well and distribution system. Remember, Do not allow anyone to drink the water until all of the chlorine has been rinsed out of the system!

The best way to introduce chlorine material into the well is to dissolve the chlorine in a 5-gallon bucket of fresh water. Be sure the bucket is plastic and has been thoroughly washed. Then pour the chlorine solution into the well. Try to splash the solution on the sidewalls of the well casing as much as possible. Attach a hose to the water hydrant or faucet nearest the well and run water through the hydrant and back into the well. This will thoroughly mix the chlorine solution and well water.

For small diameter wells (4-6 inch diameter) you can use solid chlorine tablets. Dissolve the tablets or powder in a bucket of water and introduce into the well casing as described for using liquid chlorine sources. Again, use a nearby hydrant and hose to circulate water through a portion of the distribution system to assure that the chlorine material is thoroughly mixed with well water. We have found that it is difficult to get tablets or powdered chlorine to dissolve completely. We suggest that you use liquid chlorine.

Regardless of how you introduce the chlorine material into your well, start and stop the pump several times to ensure that the chlorine is thoroughly mixed with well water. **Recirculate the water until a strong chlorine smell has been noted for at least five minutes.**

After the chlorine has been placed in the well and the casing, etc., has been washed down, move around the water distribution system and open each faucet (hot and cold), hydrant or other water outlet. Allow water to flow until a strong chlorine odor reaches that position in the system. Then close the valve at that location. **Do this with all faucets, hydrants and other outlets in the system.**

If a strong chlorine odor is not detected at each site, add more chlorine to the well. This may be an indication that your well contains iron, hydrogen sulfide or organic materials. The reason for the lack of odor is caused by the reaction between the chlorine and another ionic particles.

Step 7: Let the chlorine disinfect the system.

The most difficult step is to refrain from using water from the well so that the chlorine can disinfect the system. The system should remain idle for at least 2-3 hours, preferably overnight. **Remember, Do not allow anyone to drink the water until all of the chlorine has been rinsed out of the system!**

Step 8: Flush the system to remove the chlorine.

After the water system chlorination has been completed, the entire system must be emptied of chlorine and thoroughly flushed with fresh water by running water out of each faucet or hydrant until the chlorine odor dissipates. Distribute the waste water on gravel roads or other areas without plants or aquatic life, which it might harm. **Do not allow the highly chlorinated water to enter the septic system.** If possible, attach a hose to outlets inside the house and distribute the water to a non grassy area away from the house. The chlorine will eventually evaporate into the atmosphere.

Step 9: Retest the water supply for bacterial contamination.

The final step is to retest the water to ensure that the water source is bacteria free. Take a water sample 1-2 weeks after shock chlorinating the well, using the same procedures as before. Though most shock chlorination treatments are successful, do not drink the water until the laboratory results confirm that no bacteria are present. **Retest the well every month for 2-3 months to be sure contamination is not reoccurring.** If test results are negative, an annual water analysis program can be reinstated.

If the water supply continues to develop bacterial contamination problems after being shock chlorinated, continuous chlorination or disinfection may be an option. Other options include repairing the well, or constructing a new well. It may be necessary to abandon the water source.

Notes:

Remember Chlorine compounds are volatile so they will degrade with time. Purchase only what you'll need and use it all. Always read and follow manufacturers' recommendations. **When using chlorine bleaches, do not purchase bleaches that have scents or other additives.** Do not add other cleaning materials to the chlorine solution. Some combinations of chlorine and acids or ammonia could produce dangerous gases. Make sure all work areas are well-ventilated.

Well pits do not meet most local well construction criteria because it is difficult to preclude contamination. The best option is to construct a new well using current construction criteria and/or consider cement grouting in the pit and extending the casing.

Chlorine Solution Calculation Worksheet

Calculate volume of water in well:	**Example:**	**Your well:**
1. Depth of casing: (See *Figure 1*)	50 feet	_____feet
2. Depth to water: (See *Figure 1*)	40 feet	_____feet
3. Total depth of water: (#1 - #2)	10 feet	_____feet
4. Diameter of well: (Measure inside diameter)	30 inches	_____inches
5. Volume of water per foot: (*Table I, column 2*)	36.7 gallons	_____gallons
6. Total volume of water in casing: (#3 x #5)	367 gallons	_____gallons
7. Volume of water in the system:	110 gallons	_____gallons
8. Total volume of water:(#6 + #7)	477 gallons	_____gallons
Calculate Amount of Chlorine Product for a 200 ppm Solution:		
Chlorine product used: Liquid Bleach		
9. Product needed per 100 gallons: (*Table II* - circle the correct units)	3 (ounces/pints)	_____(ounces/pints)
10. Total product needed: (#8 x #9- circle the correct units)	14 (ounces/pints)	_____(ounces/pints)

Remember, Do not allow anyone to drink the water until all of the chlorine has been rinsed out of the system!