Bacteria in Water Supplies Part 2: How to Disinfect Your Well

Bulletin #7115

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Introduction

Bacteria are single-celled organisms found in soil, on our bodies, on leaf material, in lakes, rivers and streams. While surface waters commonly have bacteria, most groundwater supplies do not. This is because the conditions that favor bacterial growth (food, oxygen, warm temperatures and favorable pH) are not frequently found in groundwater. Yet, many wells still have bacteria.

Bacteria may carry diseases such as typhoid, dysentery and cholera. In drinking water, these bacteria can cause serious health problems. For example, in Missouri, four people died and 243 people became ill from drinking water with a strain of *Escherichia coli* (Geldrelch et al., 1992).

The water you use for drinking and cooking must be free of pathogenic bacteria. Whether you will get sick after drinking water from contaminated sources depends on the strength of the bacterial strain, the strength and health of your body, and the number of bacteria in the water. Unlike most chemicals, one low-dose exposure to some bacteria can cause serious ill effects (Adamson et al., 1993). If you have bacterially contaminated water, you need to drink bottled water until you have properly disinfected the well.

State and federal governments require all public water supplies to be safe. However, you, as the homeowner, are responsible to ensure that your water supply is safe. Bacterial contamination is the most common water quality problem in Maine.

In Bulletin #7114, “Bacteria in Water Supplies, Part 1: Problem Bacteria and How to Test for Them,” we discussed how bacteria get into water supplies and water tests. In this fact sheet, we will discuss how to safely disinfect a well.

Disinfection Methods

If your water test results tell you that you have bacteria in your well water, you must not drink the water until it has been disinfected. One way to be sure drinking water is free from bacteria is to boil the water for five minutes. However, this does not really solve your problem. You still have a contaminated well. The bacteria in the well water, attached to the well casing, and in your plumbing also need to be killed. Treat your well, then do another water test. If bacterial problems come back after you treat the well, then you need to identify the source of the

bacteria and try again. See the The Safe H(2)OME Program Fact Sheet Series for information on keeping your well safe.

Whatever you do, you want as safe a process as possible, with as little damage to positive organisms, your plumbing or your health.

Most disinfection chemicals are toxic. Be careful when you use them.

The chemical you use for disinfection should be registered for use in Maine. As of 2004, there are 115 products registered for use in human drinking water as disinfectants (disinfectants are pesticides). Legally you are not permitted to apply a pesticide unless you have the specific label instructions. Often these label instructions are only available from the manufacturer as a supplemental label. Table 2 contains the supplemental directions for Ultra Clorox®, however each disinfectant is different and you should obtain and use the correct label directions. For more information about pesticides labeled for use for drinking water disinfection in Maine, contact the Maine Board of Pesticides Control at 207-287-7545.

Chlorination

Chlorination is probably the most common way people disinfect small public and private water supplies in Maine. It is an accepted standard method against which most other methods are compared.

Chlorine will also react with organic materials, breaking them down into simpler compounds. This is important to know because some of the chlorine you use to purify your water will get used up oxidizing material. This is called "the chlorine demand" of the water supply. It affects how much chlorine is left to attack bacteria cell walls. So, for chlorination to work, you need

1. enough chlorine free to attack enzymes; and
2. enough time for chlorine to work on the water.

If you have both, you'll be able to kill the bacteria.

Chlorination Methods

Most private wells and water systems can be disinfected with one chlorine treatment. In most cases, if the well requires a chlorination system, either it is not structurally sound, or bacteria are getting in without filtration.

Shock chlorination involves a one-time, high-level chlorination process. It's useful when you finish or repair a well or want to treat a contaminated well. See Table 1 for the steps required for shock chlorination.

Sometimes a continuous chlorination system is necessary—for instance, a continual problem with iron bacteria can be solved with a simple chlorination system. Simple chlorination systems keep a low level of chlorine in the water (0.2 to 0.5 milligrams per liter) for 30 minutes. Public water systems are required to maintain a 0.2 to 0.7 milligram-per-liter chlorine residual after a 10-minute contact time. Contact a water treatment professional for more information.

Trihalomethanes

When chlorinating water supplies, you need to be careful that trihalomethanes (THMs) don't form in the process. These chemicals form when free chlorine reacts with natural organic substances.

Methylene chloride, bromodichloromethane and chloroform are examples of THMs. These chemicals are considered carcinogens. Several studies have shown that they may increase your risk of getting pancreatic, bladder or rectal cancers (Ijsselmuiden et al., 1992; Morris et al., 1992).

However, remember that

1. there is very little organic material in groundwater;
2. the potential for human exposure to THMs from drinking water varies with the season, contact time, water temperature, pH and disinfection method; and
3. the health risks from drinking contaminated, untreated water are higher than the risk of cancer from THMs.

If you shock-chlorinate and purge your well system, the chance of having any THMs is very low. On the other hand, if you take water from a lake or pond and super chlorinate the water, there is more organic material in the water and the potential for THM formation is higher.

Other Disinfection Methods

Chlorination is the most common disinfection method. However, there are others, such as ultraviolet radiation (UV). This method uses light to kill microorganisms. You need a LJV sensor to find the dose of UV light needed to kill the bacteria. Also, water must be clear for UV to work well. UV is recommended for people who prefer not to drink chlorinated water.

Ozonation is another water treatment method. It is more powerful than chlorination and is used by many public water supply companies. The disadvantage is that ozone cannot be purchased; it must be generated. The process is more complicated than chlorination, and there are few benefits for the homeowner.

The Maine Bureau of Health's Environmental Health Unit provides advice to private well owners on well water safety. They are available to help interpret the results of well water tests (toll-free in Maine: 866-292-3474). For more information on water quality, water testing or other issues, contact your county office of the University of Maine Cooperative Extension.

References

Adamson, R.H."Waterborne Pathogens: Assessing Risk." *Health and Environment Digest* 7 (1993):1–8.

Geldreich, E.E., et al. *Water Research* 8 (1992):1127-1137.

Ijsselmuiden, C.B., et al. "Cancer of the Pancreas and Drinking Water: A Population-Based Case-Control Study in Washington County, Maryland." *American Journal of Epidemiology.* 136 (1992):836-842.

Table 1: General Steps to Shock Chlorinate a Well

1. Start with enough bottled water to meet your needs for several days.
2. Find out the depth and diameter of the well.
3. For each 10 feet of six-inch diameter well, add four ounces of bleach. For an eight-inch diameter well, add seven ounces per 10 feet. There are 128 ounces in a gallon jug of bleach.

For example: You have a 250-foot well that is six inches wide. 4 ounces of bleach x 25 (25 10-foot intervals in a 250-foot well) = 100 ounces of bleach.

4. Add the bleach to the well. Run a hose from the house to the well to start circulating water. Run water down the sides of the well casing with the hose to kill bacteria stuck to the sides of the well casing.

5. Turn on all water faucets, flush toilets and start washing machines, showers. This will bring bleach through lines and into the house. Once you smell bleach in all the faucets, turn the water off.

6. If you have a hot-water tank, add eight ounces of bleach directly to it (to flush out bacteria). Flush out as with the rest of the system.

7. Do not use the water. Let the bleach remain in the water lines for eight to 10 hours or overnight.

8. After eight to ten hours, drain the chlorinated water from the house through an outdoor spigot via a hose. If you do not have an outdoor spigot, attach the hose to the kitchen (or other) sink and run a hose out the window away from lakes, ponds and vegetation. **Do not flush the chlorinated water through the septic leach lines**. Direct the water down the driveway away from vegetation – bleach will kill grass. The chlorine will evaporate into the air.

9. Wait at least a week after you can no longer smell the bleach, **then retest for bacteria**. If you test before the chlorine is out of the system, you will have an inaccurate test. Use the water regularly for wash and other activities, but use bottled water for drinking and cooking until you know the disinfection worked.

Note: Chlorine Bleach, when used to disinfect wellwater, is a pesticide. In order to apply a pesticide in the state of Maine, it is necessary to obtain and understand the label directions pertaining to the specific product use. There are many chlorine sources licensed in Maine for well water treatment. On the following page are the supplemental label instructions for one – Ultra Clorox. The University of Maine Cooperative Extension does not endorse any specific product; this supplemental label information is provided as an example only. Contact the Maine Board of Pesticides Control at 207/287-2731 with any questions about pesticide licensing in Maine.

Table 2: Supplemental Label Instructions for Ultra Clorox® Regular Bleach

For Ultra Clorox® Regular Bleach

DRINKING WATER (POTABLE)

Individual Systems
1. DUG WELLS:
Upon completion of the casing (lining), wash the interior of the casing (lining) with a 100 ppm available chlorine solution using a stiff brush. After covering the well, pour the sanitizing solution into the well through both the pipesleeve opening and the pipeline. Wash the exterior of the pump cylinder also with the sanitizing solution.

Start pump water until strong odor of chlorine in water is noted. Stop pump and wait at least 24 hours. After 24 hours flush well until all traces of chlorine have been removed from the water. Consult your local Health Department for further details.

Individual Water Systems
1. DRILLED, DRIVEN AND BORED WELLS:
Run pump until water is as free from turbidity as possible. Pour a 100 ppm available chlorine sanitizing solution into the well. Add 5 to 10 gallons of clean, chlorinated water to the well in order to force the sanitizer into the rock formation. Wash the exterior of pump cylinder with the sanitizer. Drop pipeline into well, start pump and pump water until strong odor of chlorine in water is noted. Stop pump and wait at least 24 hours. After 24 hours flush well until all traces of chlorine have been removed from the water. Deep wells with high water levels may necessitate the use of special methods for introduction of the sanitizer into the well. Mix well (2 drops to 1 quart). Consult your local Health Department for further details.

2. FLOWING ARTESIAN WELLS:
Artesian wells generally do not require disinfection. If analysis indicates persistent contamination, the well should be disinfected. Consult your local Health Department for further details.

Emergency Disinfection
When boiling of water for 1 minute is not practical, water can be made potable by using this product. **Prior** to addition of the sanitizer, remove all suspended material by filtration or by allowing it to settle to the bottom. Decant the **clarified** contaminated water to a clean container and add 8 drops of this product to 1 gallon of water (2 drops to 1 quart). Allow the treated water to stand for 30 minutes. Properly treated water should have a slight chlorine odor. If not, repeat dosage and allow the **water** to stand an additional 15 minutes. The treated water can then be made palatable by pouring it between clean containers for several times.

For cloudy water, use 16 drops of this product per gallon of water (4 drops to 1 quart). If no chlorine odor is apparent after 30 minutes, repeat dosage and wait an additional 15 minutes.

Always read and follow precautions and usage directions before using products. Store products out of the reach of children. All uses described may not be registered in your state. Check with your state agency before proceeding with any uses listed.

For more information, contact your UMaine Extension county office.

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