

Healthy Drinking Waters

for

M A S S A C H U S E T T S

Safe and healthy lives in safe and healthy communities

Bacteria in Private Drinking Water Wells

Private well owners are responsible for the quality of their drinking water. Private wells are not regulated by the U.S. Environmental Protection Agency (EPA). Homeowners with private wells are generally not required to test their drinking water, although local Boards of Health or mortgage lenders may require well water testing. While there is also no state requirement to have your well water tested, the Massachusetts Department of Environmental Protection (MassDEP) recommends that all homeowners with private wells do so, and use a state certified testing laboratory. Homeowners can use the public drinking water standards as guidelines to ensure drinking water quality.

The Maximum Contaminant Level (MCL) for bacteria in drinking water is zero total coliform colonies per 100 milliliters of water as established by the EPA. The total coliform test is the basic yardstick for determining the biological quality in a water supply. The test is easy to perform, inexpensive, and errs on the side of caution. The organisms in the total coliform group are called indicator organisms. The presence of coliform bacteria in drinking water indicates that a pathway for disease producing (pathogenic) organisms exists. There may or may not be pathogenic organisms in the drinking water, but you should eliminate the potential pathway to prevent them from entering the well.



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Summary

Coliform bacteria occur naturally in the environment. If a water test indicates the presence of coliform bacteria, the next step is to attempt to identify and eliminate the pathway of contamination. Boiling, chlorination, ultra-violet light, microfiltration, and distillation are treatment options for removing bacteria. Bottled water is an alternative for drinking and cooking until the problem can be corrected.

Potential Health Effects

Health symptoms may include diarrhea, cramps, nausea, possible jaundice, and associated headaches and fatigue. These symptoms, however, may be caused by a number of other factors not associated with bacteria in drinking water. Water contaminated with bacteria should not be used for drinking or cooking unless you boil it with a rolling boil for one minute or the water is disinfected by other means such as chlorination.



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Indications of Bacteria in Drinking Water

Bacterial contamination cannot be detected by sight, smell, or taste. The only way to know if a water supply contains coliform bacteria is to have it tested. In addition, there are sulfur-reducing bacteria that can be present in deep wells. The presence of these bacteria can cause the well water to have a rotten egg smell. If iron bacteria are present, they can give a musty odor to the water. Coliform bacteria concentrations in excess of one colony per 100 milliliters of water indicate contamination and the possible presence of pathogenic (disease-causing) organisms.

Sources of Bacteria in Drinking Water

Bacteria are found in the intestines of warm-blooded animals and are associated with soil decomposition. When looking for potential pathways of coliform, the following sources should be investigated:

Human Waste from malfunctioning septic systems and leaking sewer pipes has been identified as a potential bacterial contamination source for drinking water wells. Additionally a septic system located too close to a drinking water well can contaminate the supply. Massachusetts law requires a septic tank to be a minimum of 50 feet away from a well and 100 feet away from the leach field. This distance is based on research that shows that soil can physically trap bacteria as it moves, and the bacteria will die in unsaturated soil conditions at a distance of 100 feet.

Animal waste is a common source of bacteria in water. These sources of bacterial contamination include runoff from feedlots, pastures, dog runs, and other land areas containing animal wastes. Bacteria from these sources can enter wells that are open at the land surface, that lack water-tight casings or caps, that



are shallow, or do not have a grout seal in the annular space (the space between the wall of a drilled well and the outside of the well casing).

Insects, rodents or other animals entering the well are potential sources of contamination. Dug wells usually have large access openings and casings that may not be properly sealed. This makes it easy for insects, rodents, or other animals to enter the well.

Inundation or infiltration of the well by floodwaters and surface water runoff can result in high levels of bacterial contamination to the water supply. Even small depressions around the wellhead that fill with surface runoff provide an excellent breeding ground for bacteria. Bacteria can easily enter your water supply when the well is shallow and/or the well casing is not properly sealed and watertight. This is especially a risk in sandy soils.



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Older wells and water sources, especially dug wells, spring-fed systems and cistern-type systems are vulnerable to coliform bacteria and other pathogenic contaminants. Any systems with casings or caps that are not water-tight, or lack a grout seal in the annular space, are vulnerable. This is particularly true if the well is located where surface runoff can accumulate and enter the well. Well and water distribution system construction has improved during the last ten years to the point where bacterial contamination due to poor well construction is rare in newer wells.

Testing for Bacteria in Private Drinking Water Wells

The primary test to determine the presence of bacteria is the total coliform test. To determine if bacteria are present, arrange to test your drinking water at a state certified laboratory. Follow laboratory instructions carefully to avoid contamination and to obtain a good sample. Before collecting the sample, remove the faucet aerator and wipe with household chlorine bleach to disinfect. Run the water until there is no more chlorine odor and then collect your sample. Most coliforms are harmless bacteria that are found in large numbers in the intestines and feces of warm-blooded animals and occur naturally in soil and vegetation. While most coliform bacteria are not harmful, their presence indicates the possible existence of pathogens in the water supply. Coliform bacteria should not be present in a properly constructed well. In order to determine if the organisms present are pathogenic, it is recommended that the water then be tested for the presence of fecal Coliform (a pathogenic organism associated with human and animal waste).

Test your well water for bacteria under the following conditions:

- Annually.
 - When a new well is constructed.
 - When an existing well is returned to service. If the home has been unoccupied for awhile, allow the water to run for about 20 minutes with the faucet open fully before collecting the sample.
 - Any time a component of the water system is opened for repair – this includes the well, pump, pressure tank, piping, and any other components that your drinking water comes into contact with.
 - Whenever flood waters or surface runoff inundates the well.
 - Whenever you suspect bacterial contamination, as might be indicated by continuing illness in the house.
 - When a state certified laboratory test indicates nitrate concentrations above 1 milligram per liter and human or livestock waste is the suspected cause.
- Lending agencies often require a total coliform test for homes relying on private water supplies before the sale of property or approval of a new or refinanced home loan.
- If a water test indicates the presence of coliform bacteria, the next step is to attempt to identify and eliminate the source of contamination. If you are unable to locate and eliminate the bacteria source and cannot afford a new well, you may need a long-term treatment method. Overall, long-term treatment methods may result in being the most expensive alternative because of continuous operation and maintenance costs.
- As you attempt to find the source of contamination, evaluate both well location and well construction. Check the entire water distribution system for potential problem areas, including a garden hose without proper backflow prevention.*

Well location is a crucial safety factor. A well that is downhill from a source of bacterial contamination runs a greater risk of contamination than a well on the uphill side of the pollution source. Good well location requires



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minimum separation distances from sources of potential contamination and uses the natural protection provided by soil filtration. Contact a registered well driller or pump installer for all well maintenance or repairs.

Reducing Bacteria in Your Water Supply

The immediate remedy is to disinfect the well with chlorine bleach. Disinfection may only be a temporary remedy. The most important consideration is to find and eliminate the source of the contamination. Most bacterial problems are caused by improper well construction or may have been introduced during well maintenance or repair. Faulty construction can often be corrected to fix the problem. Some examples include:

- Replacing a leaky well cap or dug well cover.
- Repairing a malfunctioning septic system.
- Diverting surface water away from the well.
- Renovating the well.
- Drilling another well to obtain a safe supply from a deeper level of groundwater.
- Removing livestock or pets from the well area.

Chlorination

Chlorination can be an effective method to kill bacteria. Chlorinate when a well is new, repaired, or contaminated with bacteria. Use household chlorine bleach that does not have scents or other additives. Disinfect the well as outlined below:

New well: 1.5 quarts of unscented household chlorine bleach per 100 feet of well depth.

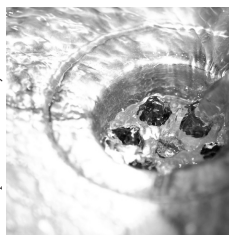
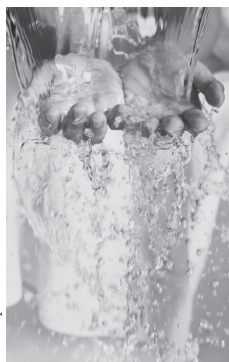
Existing well: 1 pint of unscented household chlorine bleach (all well depths).

1. Mix the appropriate amount of household chlorine bleach with 5 gallons of water and pour into the well through the top of the well casing, being sure that the casing walls are wetted completely. In order



to thoroughly distribute the disinfectant, the well should be pumped, recirculating the pumped water back into the well for at least 15 minutes.

2. Run the water at each faucet, including the outdoor faucet, until a chlorine odor is detected. If no chlorine odor is detected, repeat step 1 until a chlorine odor is detected at each tap. If you have a refrigerator with an automatic ice-maker and cold water dispenser, you should also run those until a chlorine odor is noted.
3. Close the faucets and allow the chlorinated water to remain in the well and piping system for a minimum of 2 hours, preferably overnight.
4. Run the water at each faucet until no chlorine odor is detected. If the water supply system ultimately discharges to a septic



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tank, take care to flush the distribution system slowly, keeping the faucets turned on low. This prevents the septic system from being overloaded.

5. Wait at least 24 hours after no chlorine odor is detected before collecting samples for analysis.

If bacteriological problems persist following chlorination, you have not successfully eliminated the source of contamination.

Chlorination does have its limitations. Chlorine solutions are only moderately stable, organic matter as well as iron and manganese consume chlorine, high chlorine concentrations have objectionable tastes and odors, and even low chlorine concentrations react with some organic compounds to produce strong, unpleasant tastes and odors. Chlorine use can also react with organic material to form trihalomethanes, which are likely cancer causing agents. Yet in spite of these factors, chlorination is widely used on small private water systems to ensure safe drinking water supplies.

Long-term Home Water Treatment

All efforts should be made to identify and eliminate the source of bacteria. If the problem is due to a failing septic system, improper well maintenance, or proximity of the well to animal pens, consider the costs of improving these situations over the long term versus long-term water treatment. If you cannot identify and correct the bacteria source, then there are home water treatments options available to you. These include ultraviolet radiation, distillation, ozonation, and microfiltration.

Regardless of the quality of the equipment purchased, it will not operate well unless maintained in accordance with the manufacturer's recommendations. Keep a log book to record equipment maintenance and repairs.

Equipment maintenance may include periodic cleaning and replacement of some components. Also consider any special installation requirements that may add to the equipment cost. Refer to the fact sheet *Questions to Ask When Purchasing Water Treatment Equipment* for more information.

Protection of Private Drinking Water Supplies

You can protect your private well by paying careful attention to what you do in and around your home as well as your neighbor's activities near your well. Regular testing and adopting practices to prevent contamination can help ensure that your well supplies you and your family with good quality drinking water. For more information on well protection see the fact sheet entitled *Drinking Water Wells*.



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Resources

UMass Extension

This fact sheet is one in a series on drinking water wells, testing, protection, common contaminants, and home water treatment methods available on-line at the University of Massachusetts website:

http://www.umass.edu/nrec/watershed_water_quality/watershed_online_docs.html
and Cape Cod Cooperative Extension:
508-375-6699
<http://www.capecodextension.org>

MA Department of Environmental Protection, Division of Environmental Analysis

Offers assistance, information on testing and state certified laboratories: 617-292-5770
For a listing of MassDEP certified private laboratories in Massachusetts:
<http://www.mass.gov/dep/service/compliance/wespub02.htm>

U.S. Environmental Protection Agency, New England Office

Information and education on where drinking water comes from; drinking water testing and national laws; and how to prevent contamination:
<http://www.epa.gov/ne/eco/drinkwater>

US Environmental Protection Agency

For a complete list of primary and secondary drinking water standards:
<http://www.epa.gov/safewater>

MA Department of Conservation and Recreation, Division of Water Supply Protection

Maintains listing of registered well drillers, information on well location and construction: 617-626-1409
<http://www.mass.gov/dcr/waterSupply/welldrill/index.htm>

NSF International

The NSF International has tested and certified treatment systems since 1965. For information on water treatment systems: 800-NSF-MARK (800-673-6275)
<http://www.nsf.org/consumer/>

Water Quality Association

The Water Quality Association is a not-for-profit international trade association representing the household, commercial, industrial, and small community water treatment industry. For information on water quality contaminants and treatment systems:
<http://www.wqa.org>



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