

Bacteria and Private Wells

Information Every Well Owner Should Know

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Millions of Americans get their drinking water from private wells and National Ground Water Association (NGWA) public surveys show a high level of well owner satisfaction. Importantly, the owners of household wells are responsible for their own well maintenance and water testing. And being a good water well steward means having regular—at least yearly—tests for coliform bacteria. Here are the answers to some common questions regarding bacteria in water from wells.

What are coliform bacteria?

Coliform bacteria originate as organisms in soil or vegetation and in the intestinal tract of warm-blooded animals (fecal coli). This group of bacteria has long been an indicator of water contamination and possible presence of intestinal parasites and pathogens. Coliform bacteria are relatively simple to identify, are present in much larger numbers than more dangerous pathogens, and react to the natural environment and treatment processes similarly to pathogens. By observing coliform bacteria, the increase or decrease of many pathogenic bacteria can be estimated.

Where are these bacteria found?

Sources of bacterial pollution include runoff from woodlands, pastures, and feedlots; septic tanks and sewage plants; and animals and wild fowl. Domestic animals contribute heavily to the bacterial population. Many coliform bacteria may be directly deposited into natural streams from waste in water and runoff from areas with high concentrations of animals or humans.



Photo by Keith Weller, courtesy of www.ars.usda.gov.

In a small watershed near Treynor, Iowa, hydrologist Mike Burkart (left) and farmer Bill Vorthman draw water from a 30-foot-deep sampling well to test for herbicides and nitrate.

How could coliform bacteria enter a water system?

The most likely sources come from where the water is used—the spigot, sink, or unclean containers. Another is backflow from a contaminated source such as a sink-top carbon filter, bucket of water, or puddle at the end of a hose. Also, reduced pressure or suction in long water lines can draw in bacteria-laden water or soil into pipes through joints.

However, the presence of bacteria is not always related to illness. The water could have been contaminated through improper sampling. Children may become ill because of unsanitary conditions in the home. Who sampled the water and how? How sanitary are your practices in food handling, personal hygiene, etc.? Do the children wash regularly? These are more likely routes for contamination than the water itself.

Why test for coliform bacteria?

Pathogens—the bacteria, protozoa, and viruses that make people sick—can be rare and difficult to detect even if they are present in the water. Total coliforms are indicators and are more common and easy to grow. Testing for them provides a margin of safety. Pathogens may not be present if coliforms are, but it would be wise to look for problems just in case.

Fecal coliforms are those that are usually found in the fecal material of animals. Their presence usually means that the water may be contaminated by sewage effluent. Finding the source of the problem and correcting it is very important.

Should I have my water tested?

Routine testing for bacteria, nitrates, and anything else of concern, even if you do not perceive a change in your water, is highly recommended. Annual testing can be valuable because it establishes a record of water quality. This record can be helpful in solving any future problems and in obtaining compensation if someone damages your water supply.

When should I test my water and for what should I test?

The total coliform (TC) test, which is often used as a standard of a “safe” water supply, is a place to start. Test annually for coliform bacteria, nitrate, and anything else of concern. This is best done during the spring or summer following a rainy period. These tests also should be conducted after repairing or replacing an old well, pump, or pipes, and after installing a new well or pump.

You may also want to test when:

- Family members or houseguests have recurrent incidents of gastrointestinal illness.
- An infant is living in the home.
- You are buying a home and wish to assess the safety and quality of the existing water supply.
- You want to monitor the efficiency and performance of home water treatment equipment.
- You notice a change in the taste, smell, or appearance of the water.

The TC test will not detect the large majority of bio-fouling organisms or even most bacteria in a well. It is not uncommon for wells showing no coliforms to have very large bacterial populations. Some so-called “native” bacteria will cause a positive coliform reaction in the total coliform test, but take any positive as a reason to look for possible problems.

Biological technician Sheryl Ver Wey prepares to count colonies of fecal coliform bacteria in a water sample.



Photo by Peggy Greb, courtesy of www.ars.usda.gov.

Who should test my water?

Your local health department is typically the first stop. They will either do a free or inexpensive test for the presence of bacteria, or refer you to a qualified laboratory. To test for other substances, such as metals or chemicals, a more extensive and costly sampling and testing program would have to be conducted. The services of an independent laboratory will probably be required.

The U.S. Environmental Protection Agency offers a state-by-state listing of certification officers (go to www.epa.gov/OGWDW/labs/) or call the National Ground Water Association at (800) 551-7379. The certification officer in your state can provide a list of certified labs in your area.

How should a water sample be collected?

Most testing laboratories or services supply their own sample containers. Use the containers provided and carefully follow the instructions given for collecting, preserving, and handling water samples. Samples for coliform bacteria testing must be collected using sterile containers and under sterile conditions.

Some procedures require that water runs from an inside tap for several minutes before filling the sample containers. Others instruct you to collect samples in the morning after water has been confined in the pipes overnight. Sometimes laboratories send a technician to collect and analyze the sample in your home.

Will coliform bacteria make me sick?

Most coliforms are harmless residents of soil and will not make people sick. Some strains of *E. coli*, the most common fecal coliform bacterium (usually living in animal fecal material), may be pathogens. Some found in food have been lethal. Their presence should be taken very seriously.

Your immune system also determines whether or not you will become ill. People become accustomed to the natural bacteria in their water while guests may have some discomfort or diarrhea. Immunocompromised individuals may become ill under circumstances where people with normal immune systems would not, and such individuals should be very careful of the water they drink.

Pathogenic (disease-producing) organisms occurring in water range from ultra-small viruses to microscopic bacteria to relatively large protozoa (cysts). Bacteriologic and protozoic pathogens are known to cause typhoid, dysentery, cholera, and some types of gastroenteritis. Conventional wisdom is that contamination of groundwater with protozoa indicates surface water influence. Viruses account for more than 100 human maladies including polio, infectious hepatitis, and some forms of gastroenteritis. In general, viruses are more poisonous and more resistant to disinfection than bacteria.

If my well has bacteria, what should I do about drinking water?

If you have unsafe levels of coliform bacteria, obtain an alternative source of drinking and cooking water until the problem is solved. Cleaning the well may remove the bacteria, and the water can certainly be made safe using a home treatment system.

In the meantime, you can drink bottled water, water that has been boiled for two minutes, or water obtained from a public water system that is tested to be safe for drinking. It is important that containers used to store or haul water are clean and free of coliform bacteria or chemicals.

What types of treatment devices will make the water safe for consumption?

Biological contaminants are effectively eliminated through the commonly used methods of chlorine disinfection, filtration, ultraviolet irradiation, and ozonation. All methods must be properly designed for the intended use and properly maintained. Additionally, bacterial analysis of the treated water must be made often enough to ensure adequate treatment.

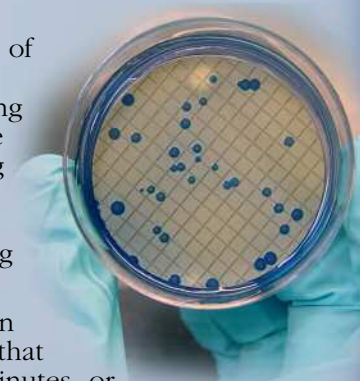


Photo by Susan Boyer, courtesy of www.ars.usda.gov.

NGWA recommends that well owners use a qualified water well system contractor to disinfect their wells. When it comes to other treatment technologies, always use a qualified water treatment system service provider. Many water well system contractors provide this service as do members of the Water Quality Association.

What steps can be taken to determine if there is a contamination problem somewhere on our property?

When investigating bacterial contamination, water well system contractors investigate several factors including the well location, the geology, and the construction of the well system.

For example, wells should not be sited in locations vulnerable to pathogens such as low-lying ground, where surface runoff pools, or too close to an animal feed lot, where there is a high concentration of fecal matter.

Geology also can impact how susceptible or protected an aquifer is from bacteria. To a large extent, the geology determines the degree of bacterial filtration or breakdown as water moves toward the aquifer.

And the quality of the well system construction can make a big difference in whether bacteria is able to enter the well. Wells should meet all applicable construction codes, and have backflow prevention devices and cross-connection controls. Well maintenance also is important to preventing system deterioration that compromises the structural integrity of the well system.

If my water is clear and smells okay, is it safe?

Not necessarily. You cannot directly smell unsafe bacteria or protozoa. They can only be detected using tests designed for that purpose, so you should check your water quality regularly.

How do ground water contractors minimize the possibility of bacterial contamination during drilling and pump service?

The most likely source of a microbial population in a well is the aquifer around it. However, it is possible to introduce bacteria into an aquifer when a well is drilled or serviced. It is therefore important for water well system contractors to follow certain practices to minimize the potential for introducing bacteria into the water supply.

Such practices include:

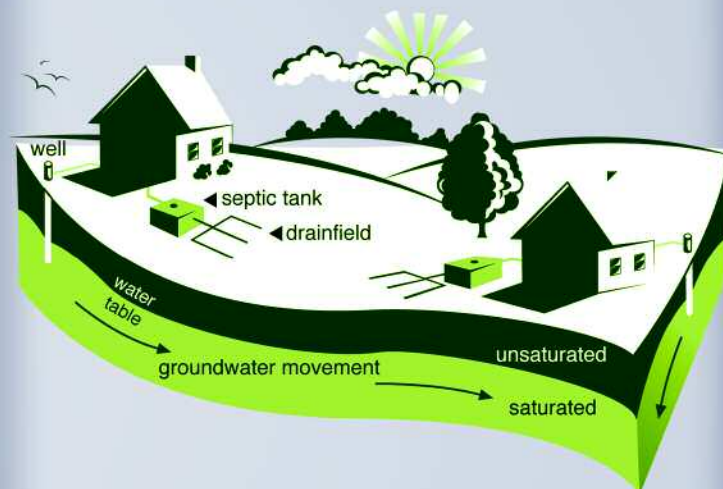
- Chlorination after completion of a well or after well servicing (usually 100 ppm or so minimizes contamination due to drilling and service activity).
- Cleaning tools thoroughly after use (to the clean steel).
- Keeping casing, riser pipe, pumps, etc. off the ground.
- Never reinstall any pipe with any encrustation, mud, or film of any kind without thorough cleaning and chlorination.

- Proper water analysis on a new well or existing well whenever it is serviced. The analysis should include total coliform bacteria and chemical parameters useful to both health and safety, and general water quality (nitrates, hardness, iron, etc.). If sulfur or iron bacteria are a problem, tests can be run to analyze these as well.

Do I need to worry about bacteria from my septic system contaminating my water?

A properly constructed and maintained septic system poses no threat to groundwater. However, an improperly constructed or failing system can be harmful as wastewater can include many types of contaminants.

Proper construction of septic systems are governed by state or local regulations, which require the septic system to be certain distances from water wells, streams, lakes, and houses. These are horizontal separation distances. Also, to remove contaminants effectively, the absorption field must be adequately separated from the groundwater. This is the vertical distance.



However, various geologic conditions such as fractured bedrock or shallow groundwater tables can allow bacteria or viruses to reach the ground water. This is why it is essential to also have the home's water well system regularly checked.

Good guidelines for septic system maintenance include having the septic system checked every one to two years and pumped every three to five years by a professional septic system contractor.

To learn more about stewardship of water wells, visit www.wellowner.org, a site developed and maintained by the National Ground Water Association. You may also call NGWA toll free at (800) 551-7379.

The National Environmental Services Center's (NESC) engineers and certified water operators can answer questions about wells, including maintenance, testing, and shock chlorination. Call NESC's technical services unit at (800) 624-8301 and select option "3" from the menu.



Cliff Treyens is the director of public awareness with the National Ground Water Association. Learn more about the NGWA by visiting their Web site at www.ngwa.org.