ARIZONA COOPERATIVE EXTENSION
THE UNIVERSITY OF ARIZONA
College of Agriculture and Life Sciences
College of Agriculture and Life Sciences
AZ1486h
March, 2010

Microorganisms in Private Water Wells

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Microorganisms in drinking water are responsible for most waterborne disease outbreaks. They are the most common disease-causing contaminant in private well water. Organisms known to cause disease include bacteria, protozoa, and viruses; some algae and helminths (worms) may also be capable of producing disease. These disease-causing organisms thrive in the intestines of warm-blooded animals. They are transmitted to drinking water if the feces of an animal contaminates a water supply that does not have suitable disinfection.

Potential health effects

Health symptoms of microbiologically-contaminated water may include diarrhea, cramps, nausea, possible jaundice, and associated headaches and fatigue. It is important to note that these symptoms, however, may be caused by a number of other factors not associated with pathogens in drinking water. Water contaminated with pathogens 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 effective means.

Testing for microorganisms in private well water

Unfortunately, specific disease-producing (pathogenic) organisms present in water are not easily identified. It is very difficult, expensive, and time consuming to monitor for them. For this reason, it is necessary to select an easily measured "indicator organism," that can indicate the presence of pathogenic organisms. A group of closely related bacteria, *coliform bacteria*, has been selected as an indicator of harmful organisms in drinking water.

Coliform bacteria are living microorganisms that reside in the soil and in the intestines of mammals. These bacteria facilitate the break down of plant material in soils and food in the intestines of humans and animals. Coliform bacteria do not necessarily cause disease, but if they show up in a water test, they indicate that surface contamination has somehow gotten into the water, and disease organisms may also be present. Coliform bacteria concentrations in excess of 1 colony in 100 milliliters of water indicate contamination and the possible presence of pathogenic organisms.

How do I know if microorganisms are in my well water?

The only way to know if microorganisms are in your private well water is to have your water tested by a laboratory. It is a simple test, often costs less than $30, and results of the test can be expected within a week or two of sampling. You need to be careful when, where, and how you collect the sample to prevent contamination. Contact the laboratory that will run the bacterial analysis to find out if they have any special instructions or containers for obtaining, holding, and shipping the water sample. Use a laboratory certified by the Arizona Department of Health Services, Bureau of State Laboratory Services [contact information: 3443 N. Central Avenue, Suite 810, Phoenix, AZ 85012-2208; (602) 255-3454; (602) 255-3463 FAX; **http://azdhs.gov/lab/index.htm].**

When should I test for microorganisms?

You should test your water once a year as part of a well maintenance schedule or earlier if:

- You move into a new home
- You repair an existing well or any part of the plumbing system
- You drill a new well
- You have experienced flooding or possible well contamination

- If members of your household have recurring gastrointestinal illness, such as diarrhea
- Or if guests often have gastrointestinal illnesses while visiting your home

What should I do if my well water tests positive for microorganisms?

If the laboratory results show microorganisms are in your water, the next step is to attempt to identify and eliminate the source(s) of contamination. If you are unable to locate and eliminate the microbial source and cannot afford a new well, you may need a long-term treatment method. Overall, long-term treatment methods may be the most expensive alternative due to 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. Inspection should include the garden hose for proper backflow prevention as well as other items that may be attached to the system such as automated pool levelers or misting systems. Check the integrity of the well casing, cap, and grout seal around the borehole. Water and contaminants can seep into the well from the surface if the casing or grout seal are cracked.

Well location is a crucial safety factor. A well that is downhill from a source of microbial contamination runs a greater risk of contamination than a well on the uphill side of the pollution source. Good well location requires minimum separation distances from sources of potential contamination, using the natural protection provided by soil filtration. Contact a registered well driller or pump installer for all well maintenance or repairs.

How can I treat my well for microorganisms?

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 microbial problems are caused by improper well construction, 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

Refer to the fact sheet *Private Well Protection* (AZ1486e) for more information.

Long-term home water treatment

All efforts should be made to identify and eliminate the source of microbial pollution. If the problem is due to a failing septic system, improper well maintenance, or proximity of the well to animal pens, improving these situations may involve long-term water treatment. Home water treatment options available to you include ultraviolet radiation, distillation, ozonation, and microfiltration.

Most household water can be disinfected continuously by chlorination, distillation, ultraviolet light, or ozonation. There is no ideal disinfection method; each has its advantages and limitations.

Chlorination is widely used to disinfect water because it destroys bacteria within a reasonable contact time and provides long-term protection. Chlorine, readily available at a low cost, is easy to handle and is also effective in controlling algae. Chlorine also has its limitations. Its solutions are only moderately stable, and organic matter as well as iron and manganese can interfere with the action of chlorine. Low levels of chlorine normally used to disinfect water are not an effective treatment for the parasite *Giardia*. A relatively high chlorine level must be maintained for at least 30 minutes to kill *Giardia*. High chlorine concentrations can have objectionable tastes and odors, and even low chlorine concentrations react with some organic compounds to produce strong, unpleasant tastes and odors. Chlorinators, although simple to operate, require regular refilling with chemicals.

The heat necessary for water **distillation** is very effective in killing pathogens. One of the benefits of distillation is that it uses no chemicals. Distillation, however, takes longer to produce the processed water than some other methods, units can be expensive to operate, and the length of time distilled water is stored can affect its quality. Distilled water has a "flat" taste.

Ultraviolet (UV) light is a very effective disinfectant. This method disinfects water without adding chemicals. Therefore, ultraviolet light disinfection units do not create any new chemical complexes, do not change the taste or odor of the water, and do not remove beneficial minerals from the water. Ultraviolet light disinfection also has its disadvantages. This disinfection technique is more effective against bacteria than against viruses and parasites such as *Giardia.* There is no simple test to determine whether or not the system is providing proper disinfection. Ultraviolet light devices are most effective when water is clear and allows the light to easily pass through. Therefore, ultraviolet light devices are often combined with other treatment devices such as mechanical filters, activated carbon filters, water softeners, and reverse osmosis systems to provide complete water quality solutions. Safety features, such as detectors that activate audio and visual lamp alarms in case of lamp failure, are available to ensure that adequate disinfection conditions are maintained.

Ozonation uses ozone which is a more powerful disinfectant than chlorine. Ozone produces no tastes or odors in the water. However, as a gas, ozone is unstable and has a very short life so it must be generated at the point-of-use.

Even if tests confirm that you have a bacteriological problem, before investing in expensive equipment, have your household water supply inspected by a County Health Department official.

For more information on these treatment options, please refer to the fact sheet *Water Facts: Home Water Treatment Options* (AZ1498).

How can I know the well is free of microorganisms?

To ensure that your water is free from harmful microorganisms, test the water one or two weeks after shock chlorination. If your well is still contaminated, you must take additional measures. You may have to install a water purifying system (long-term treatment) at the well to treat all the water entering your home.

Sampling for Microorganisms

A sample is meant to represent the entire volume of water from which it is drawn. It is important to collect, store, and transport a sample properly to avoid changing the contents in a way that alters the outcome of analysis. Before collecting a sample, be sure to contact a laboratory that is certified to analyze drinking water samples and that has experience with carrying out the analysis. It is best to obtain a sample container and instructions for how to collect the sample from the laboratory prior to collecting and submitting a sample. The laboratory can offer guidance about the best place to collect the sample in your home and should give instructions about how much water is needed and how to store the sample until it can be delivered to the laboratory. Be sure to follow instructions carefully, because a sample that is collected, stored, or delivered incorrectly could lead to misinformation about the quality of your water supply.

See also *Obtaining a Water Sample for Bacterial Analysis* (AZ1486g)

For Additional Information

Arizona Well Owner's Guide to Water Supply (AZ1485)

Arizona Cooperative Extension (ACE) bulletins contain a variety of information about water, water quality, safe drinking water, and private wells. They are available through your county Extension office or from CALSmart Distribution Center, located in Tucson, at 4101 N. Campbell Avenue; (877) 763-531; (520) 795-8508 FAX; or visit **http://cals.arizona.edu/pubs/**

Sources

Healthy Drinking Waters for Rhode Islanders: Bacteria in Private Drinking Water Wells. 2003. State of Rhode Island Department of Health and the University of Rhode Island Cooperative Extension, Department of Natural Resources Science.

Parrott, Kathleen, Blake Ross, and Janice Woodard. *Bacteria and Other Microorganisms in Household Water*. Virginia Cooperative Extension. **http://www.cdc.gov/nasd/docs/d001201-d001300/d001269/d001269.html.** Accessed online, December 19, 2008.

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This information has been reviewed by University faculty.
cals.arizona.edu/pubs/water/az1486h.pdf

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