Master Well Owner Network

A program of the Penn State College of Agricultural Sciences and Cooperative Extension

PennState

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Coliform Bacteria

This article is available in Spanish: https://extension.psu.edu/bacterias-coliformes.

What Are Coliform Bacteria?

Coliform bacteria include a large group of many types of bacteria that occur throughout the environment. They are common in soil and surface water and may even occur on your skin. Large numbers of certain kinds of coliform bacteria can also be found in waste from humans and animals. Most types of coliform bacteria are harmless to humans, but some can cause mild illnesses, and a few can lead to serious waterborne diseases.

Coliform bacteria are often referred to as "indicator organisms" because they indicate the potential presence of disease-causing bacteria in water. The presence of coliform bacteria in water does not guarantee that drinking the water will cause an illness. Rather, their presence indicates that a contamination pathway exists between a source of bacteria (surface water, septic system, animal waste, etc.) and the water supply.

Disease-causing bacteria may use this pathway to enter the water supply. Specific types of coliform bacteria may be tested for, especially after a total coliform bacteria test is positive. These subgroups of coliform bacteria include fecal coliform and Escherichia coli or E. coli. Fecal coliform bacteria are specific to the intestinal tracts of warm-blooded animals, including humans, and thus require a more specific test for sewage or animal waste contamination. E. coli is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. A positive E. coli result is much more serious than coliform bacteria alone because it indicates that human or animal waste is entering the water supply. There are hundreds of strains of E. coli. Although most strains are harmless and live in the intestines of healthy humans and animals, a few strains can produce a powerful toxin and can cause severe illness and death.

Health Effects of Coliform Bacteria

As mentioned earlier, drinking water that is contaminated with coliform bacteria does not always cause illness. Most of these bacteria are harmless to humans. If disease-causing bacteria are present, the most common symptoms are gastrointestinal upset and general flu-like symptoms such as fever, abdominal cramps, and diarrhea. Symptoms are most likely in children or elderly household members. In some cases, household residents acquire immunity to waterborne bacteria that are common in their drinking water. In this case, visitors to the home that have not acquired immunity may become ill after drinking the water. Since the symptoms of drinking water with coliform bacteria are common to many human illnesses, knowing that water is the source of the problem is difficult without having the water tested.

Inside this Issue:

What is the Master Well Owner Network?

The Penn State Master Well Owner Network (MWON) is a program dedicated to educating PA residents about the proper construction and management of private water systems.

The goal of this program is to educate private water system owners and promote better management of private wells, springs, and cisterns throughout the state.

MWON Sponsors

This project is made possible in part by the Penn State Extension, the Pennsylvania Department of Environmental Protection and the Pennsylvania Ground Water Association.

More Information:

http://extension.psu.edu/water/mwon

Drinking Water Standards

Most bacteria in the coliform group do not cause disease, but the greater their number the greater the likelihood that disease-causing bacteria may be present. Since coliform bacteria usually persist in water longer than most disease-causing organisms, the absence of coliform bacteria leads to the assumption that the water supply is microbiologically safe to drink. Therefore, the drinking water standard requires that no coliform bacteria be present in drinking water. Fecal coliform and E. coli bacteria should also be totally absent from drinking water.

Testing Water for Coliform Bacteria

The most common water test for bacteria is for total coliform bacteria. This test is readily available to the public and is inexpensive (generally $10 to $30). Water tests for total coliform bacteria can be arranged through a local office of the Pennsylvania Department of Environmental Protection (DEP) or by a state certified commercial water-testing laboratory. A list of certified commercial labs, organized by county, can be found online from the DEP. You can also call your local DEP or Penn State Extension office to find a local certified laboratory.

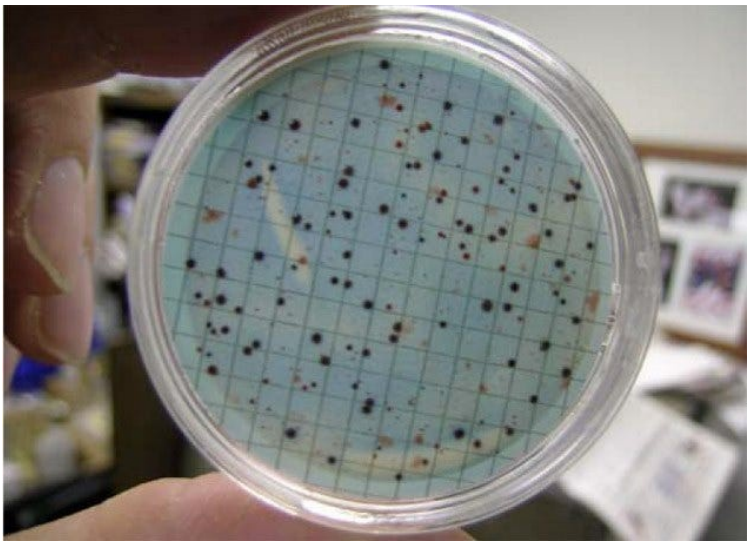


Figure 1. A petri dish showing coliform bacteria that have grown after 24 hours of incubation from filtration of 100 mL of well water.

Penn State Extension recommends that all private water supplies (wells, springs, and cisterns serving an individual house) be tested for total coliform bacteria every year. If your initial water test indicates that total coliform bacteria are present, additional tests for fecal coliform and E. coli bacteria may be warranted.

Time of year and weather conditions can affect the occurrence and amount of coliform bacteria in wells. A recent Penn State study looked at 38 wells that tested positive for coliform bacteria during a year when precipitation was near normal. These 38 wells were retested during a cold, dry weather spell a year later. Fewer than half still contained coliform bacteria, and most of these had lower numbers of bacteria than previously found. Since coliform bacteria like to live near the surface of the earth and prefer warm temperatures, it is reasonable that bacteria would be more likely to occur in groundwater wells during warmer, wetter weather conditions when surface water is recharging groundwater aquifers. Thus, the highest number of bacteria will be found by testing your well shortly after several weeks of rainy weather, while the fewest bacteria will be found when testing during dry, cold conditions in the winter. These variations in bacteria with season and weather conditions need to be considered when testing your water supply for bacteria.

Proper water testing for bacteria will require that you obtain a sterilized sample bottle from the laboratory and collect the sample strictly according to their instructions. Failure to collect the sample in a sterile container may cause bacteria to be introduced during the sampling process.

Once at the laboratory, your water may be analyzed for coliform bacteria using a variety of methods. A common method is to pass 100 milliliters (mL) of water through a membrane filter to capture the bacteria. The filter is then placed in a petri dish with agar to grow the bacteria overnight. If bacteria are present, they appear as colonies on the filter paper that can be counted (Figure 1). The bacteria results are then reported as the number of colonies per 100 mL of water. Other bacteria-testing methods look for color changes in test tubes that have been incubated with a water sample. These methods may simply express coliform bacteria results as "present" (P) or "absent" (A). In this case, "present" only indicates that at least one bacterium was present in 100 mL of water.

These presence/ absence methods have become popular because they are simple, less expensive, and quicker than enumeration methods. But, they also provide less information about the severity of the bacteria problem that can be helpful when trying to determine the causes and solutions.

There are other coliform-bacteria testing methods that rely on color changes but also provide an estimate

of the number of bacteria present. These are often referred to as "most probable number" (MPN) methods, which use a statistical relationship to estimate the number of bacteria in your sample based on color changes in multiple test tubes.

Sometimes, coliform bacteria results are reported as "TNTC" (too numerous to count) or "confluent." TNTC means that the bacteria concentration was so high that it could not be counted (generally higher than 200 colonies per 100 mL). Confluent means that numerous other noncoliform bacteria grew on the plate, making identification of coliform bacteria impossible. In either case, another sample should be submitted to the laboratory for a more accurate determination.

How Common Are Coliform Bacteria?

Coliform bacteria are one of the most common water contamination problems in private water systems in Pennsylvania and throughout the United States. A 2006 survey of 450 private wells found coliform bacteria in approximately 35 percent and E. coli bacteria in about 15 percent of private wells. Coliform bacteria are much more common in springs and shallow wells compared to deeper wells because bacteria are naturally filtered out by soil and rock as surface water Page 3 Coliform Bacteria infiltrates into the ground. Deeper wells (greater than 100 feet) can still be contaminated by coliform bacteria if they are improperly constructed by allowing surface water to flow along the well casing directly into the deep groundwater or if nearby land uses are causing contamination of deep groundwater.

For information on removing bacteria from drinking water, continue reading the above article at: https://extension.psu.edu/coliform-bacteria.

Authors: Bryan Swistock, Former Senior Extension Associate and Water Resources Coordinator; William Sharpe, Ph.D. Professor Emeritus of Forest Hydrology

NIH-Funded Private Well Study in Southeastern Pennsylvania

Researchers at Temple University are looking for families who drink water from a private well for a paid study. They are interested in keeping children safe from illnesses that can be spread by drinking water from private wells. To be part of this study, families must have a child three years old or younger. At the end of one year, families will have a fully functional whole-home UV treatment devices (value of device + installation: ~$1000).

For more information, visit their website at wettrial.org
or contact them directly at (215)204-5124 or wettrial@temple.edu.

Penn State Extension's Water Team Staff and MWON Volunteers Exhibit at Home Inspectors Conference

MWON volunteers recently joined Educators from Penn State Extension's Water Team to staff an exhibit at the Keystone American Society of Home Inspectors Conference on October 7-8 in Downtown Reading. Over 150 home inspectors and other real estate professionals were in attendance with many visiting our exhibit or attending an Extension presentation to learn about private water supply protection including the use of sanitary well caps and how to get water tested at an accredited laboratory. Home inspectors and realtors are target audiences for ~~the~~ Penn State's Drinking Water Team and MWON program because they are in a unique position to educate new homeowners about the proper management, protection, and testing of private water supplies during the home buying process.

MWON volunteer Gary Grahl helps staff the information booth at the Keystone American Society of Home Inspectors Conference in Reading, PA.

Volunteer spotlight: Gary Grahl

Master Watershed Steward, Berks/Schuylkill Program

Gary Grahl trained as a Master Watershed Steward in Berks County in 2019 and as a Master Well Owner Network volunteer in 2022. Here's what Gary has to say about participating as both a Master Watershed Steward and an MWON volunteer.

"My participation in the Master Watershed Steward program led to my interest in the Master Well Owners Network. Along with the obvious water connection, I'm a resident of an all private well neighborhood.

The MWON training enabled and inspired me to get several of my neighbors to take an active interest in the health of their families and their wells. It's not easy to get people to pay attention to something that's in the background noise of life. The MWON program helps volunteers to cut through that noise.

MWS activities like water and macroinvertebrate sampling, public/informational display booths and school education programs allow me to meet and educate a lot of people. I've done similar work at the Building Inspectors training session this past fall and I'm looking forward to more opportunities."

Gary Grahl shows Master Watershed Steward trainees the components of an in stream, real time water quality sensor station in Leesport, PA.

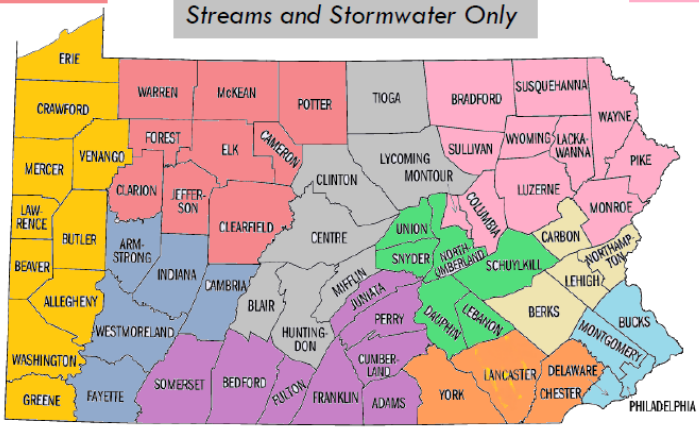
Resource Highlight: Not sure who to contact for water related questions in your county? This map will help!

Danielle Rhea – Jefferson Co.
drs5277@psu.edu
814-849-7361x504

Tyler Groh – University Park
tag5611@psu.edu
814-865-7541
Streams and Stormwater Only

Peter Wulfhorst – Pike Co.
ptw3@psu.edu
570-296-3400

Susan Boser – Beaver Co.
smw16@psu.edu
724-774-3024



Brad Kunsman – Northampton Co.
bjk21@psu.edu
610-813-6613

Justin Mansberger – Westmoreland Co.
jxm5608@psu.edu
724-858-4213

Beth Yount - Philadelphia
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215-471-2200

Andy Yencha – Cumberland Co.
azy30@psu.edu
717-240-6510

Jennifer Fetter – Dauphin Co.
jrf21@psu.edu
717-921-8803

Jodi Sulpizio – York Co.
jrb143@psu.edu
717-840-7408
or Leon Ressler – Lancaster Co.

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WATER-RELATED CALLS AND EMAILS

DRINKING WATER
STORMWATER
STREAMS
PONDS AND LAKES

Important Web Links

Master Well Owner Network
http://extension.psu.edu/water/mwon

Penn State Extension Drinking Water
http://extension.psu.edu/water/drinking-and-residential-water

PA Ground Water Association
http://www.pgwa.org/

National Ground Water Association's Information for Well Owners
http://www.wellowner.org/

Penn State Drinking Water Interpretation Tool (DWIT)
http://dwit.psiee.psu.edu/

A Complete Listing of Penn State Resources for Well and Spring Owners
https://extension.psu.edu/resources-for-water-well-spring-and-cistern-owners