



Cryptosporidium and Giardia

Are They in Your Drinking Water?



pennsylvania

DEPARTMENT OF ENVIRONMENTAL
PROTECTION

Owners of private water wells need to make sure they are properly constructed and filtered because *Giardia* and *Cryptosporidium* can cause serious illness. Customers of public water supplies should also remain informed and comply with all advisories. Following is an overview of these two microbes and the diseases they cause, along with how to remove them from water supplies and what to do if you feel sick.

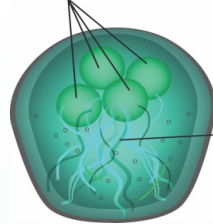
What are *Giardia* and *Cryptosporidium*?

Giardia and *Cryptosporidium* are widespread intestinal parasites that cause diarrheal illnesses in people and some wild and domesticated animals. They are not bacteria or viruses, but protozoa with complex life cycles. *Giardia* and *Cryptosporidium* exist in a cyst form, very much like a microscopic egg. When even a few cysts are consumed, they enter the small intestine, where they excyst, or "hatch," and can multiply into millions of protozoa. These organisms

Giardia cysts

No moving form

Nucleus



Flagella

complete their life cycle within the intestine after which they may again form a resistant *Giardia* cyst or *Cryptosporidium* oocyst. Sometimes, infected people or animals excrete them back into the environment, but

What illnesses do they cause?

As few as ten cysts can cause "giardiasis," a flu-like illness with symptoms involving persistent diarrhea, nausea, abdominal cramps, weight loss and sometimes dehydration. The symptoms of "cryptosporidiosis" are similar to those of giardiasis, although the number of oocysts needed to induce this illness is still uncertain. Typically, the symptoms appear within one week after the ingestion of cysts or oocysts. Both illnesses are usually acute, lasting 10 to 14 days, but they can become chronic and last up to one or two months. Individuals with weakened immune systems (e.g., those with AIDS, people receiving treatment for certain cancers, organ transplant recipients.) are especially susceptible, as well as older people, infants and malnourished children. Although cryptosporidiosis can be fatal for people with weakened immune systems, most people recover from these diseases within a short time. Not all individuals are symptomatic - that is, a number of carriers excrete cysts or oocysts for months or years without knowing they have a disease.

How are people infected?

Giardia and *Cryptosporidium* are strictly gastrointestinal organisms, meaning that they cannot be transmitted through a cut in the skin or by touching the blood of an infected individual. Cysts and oocysts are commonly transmitted from the environment to humans through inadequately or improperly treated drinking water. They may also be acquired by eating contaminated food or by personal contact with an infected person or animal. Children



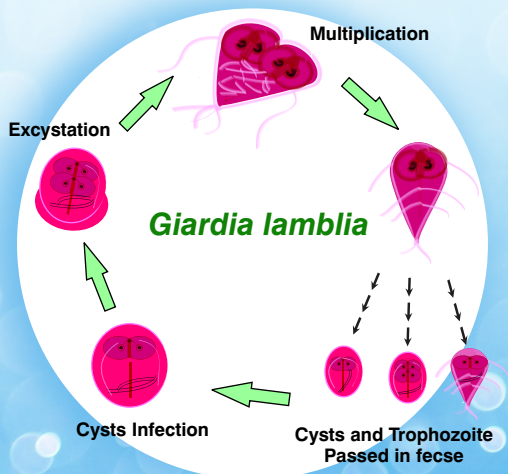
are particularly susceptible since they may ingest these protozoa through the fecal-oral route, such as playing with toys of an infected child and then putting their own hands or toys in their mouth.

How prevalent are giardiasis and cryptosporidiosis?

At one time, Pennsylvania was among the leaders nationally in the number of recorded waterborne disease outbreaks. Since 1979, eight documented giardiasis outbreaks and one cryptosporidiosis outbreak have occurred, though it is possible that many other outbreaks may have been confused with the "common flu" or misdiagnosed as some other illness. Overall, more than 600,000 people in the commonwealth have been affected by boil water advisories that were issued as a direct result of drinking water contamination or giardiasis and cryptosporidiosis outbreaks. At the national level, the most notable outbreak in Milwaukee, Wisconsin, in 1993, resulted in over 400,000 confirmed cases of cryptosporidiosis, including several deaths that occurred among immunocompromised individuals. All of these outbreaks were attributed to inadequate treatment or improperly operated water treatment facilities.

Neither *Giardia* nor *Cryptosporidium* are "new" parasites. Techniques to identify these organisms and their associated diseases have only been developed relatively recently. For example, *Cryptosporidium* was not recognized as an important cause of human diarrheal illness until 1982, while *Giardia* was first widely recognized as a source of waterborne illness in the 1970s.

Life cycle of *Giardia lamblia*





Do all water supplies contain *Giardia* and *Cryptosporidium*?

Most surface water sources either contain or are vulnerable to *Giardia* cyst and *Cryptosporidium* oocyst contamination at one time or another. Since some people are carriers, cysts and oocysts may enter the water through treated and untreated sewage discharges. Of particular concern are those animals that live in or near the water, since they are likely to deposit cysts and oocysts directly into drinking water supplies. Livestock are notorious carriers of *Cryptosporidium*, while beavers have been identified as a carrier of *Giardia*. Once in the water, both protozoan cysts remain capable of infecting a host for many months, especially in colder water where they are more resistant to natural die-off.

Since many animals are carriers of cysts and oocysts, you should never drink untreated water from even the clearest looking stream or river. Giardiasis became famous as the "backpacker's disease" because so many unsuspecting hikers and backpackers often became ill after drinking water directly from clear, mountain streams.

You should also avoid untreated spring water--no matter how clean it looks--because cysts, oocysts, bacteria and viruses may contaminate the spring supply at any time.

A properly constructed well is an unlikely source of *Giardia* and *Cryptosporidium* because the natural filtering action of the soil removes cysts and oocysts before they enter the groundwater. Some wells, though, may involve a risk if they are improperly constructed and allow direct infiltration of surface water, or if they obtain water from aquifers that do not have sufficient natural filtration.

How are cysts and oocysts removed from drinking water supplies?

Because many animals harbor these diseases, it is impossible to stop the introduction of *Giardia* and *Cryptosporidium* into a surface water supply. The only reliable long-term measure to protect consumers against waterborne diseases is a properly designed and operated filtration and disinfection treatment plant.

Because *Cryptosporidium* is smaller and more resistant to disinfection than *Giardia*, it is particularly important that Pennsylvania's Safe Drinking Water Program has taken a "multiple barrier" approach to protecting public water supplies. The first barrier is the protection of the source water quality to minimize contamination through pollution control laws and local municipal action.

The second barrier--the most effective method of protecting a drinking water system from disease-causing organisms--is a well-operated filtration plant. In themselves, the filtration plants also provide multiple barriers of public health protection, including chemical treatment, filtration and disinfection. Highly skilled operators at these plants must ensure that each process is optimized. Finally, distribution system pipes and storage facilities must be in good repair to protect the water from re-contamination.

Can water be tested for *Giardia* and *Cryptosporidium*?

Several specialized laboratories in Pennsylvania are capable of examining water samples for cysts and oocysts, but laboratory tests are very expensive for the private homeowner. *Giardia* cysts are

extremely small; they are 10 times smaller than the smallest object that can be seen with the naked eye, and *Cryptosporidium* oocysts are even smaller. Protozoan cysts may not be present at the place or time of sampling, or they may even escape detection in the sample. Therefore, testing will not prove the absence of *Giardia* or *Cryptosporidium*; it can only prove the presence of such organisms.



What if a homeowner suspects or knows that their water is contaminated?

A rapid boil of your drinking water for one full minute will destroy all *Giardia* cysts and *Cryptosporidium* oocysts. You should boil all water that you will use for drinking and cooking. A hot water heater may not kill all cysts, so as a precaution, use boiled water to wash vegetables or other food that requires washing. Also, because chlorine is ineffective against *Cryptosporidium* and must contact *Giardia* for at least 60 minutes in colder water, devices such as low temperature chemical sanitizers are not reliable for inactivating either organism.



As for washing clothing, it is unlikely that cysts or oocysts will be transferred from clothes to your mouth. Bathing is also safe in contaminated water, provided that the water is not consumed. You should take special precautions when bathing small children and infants since they commonly ingest bath water. You should be careful not to use ice or brush your teeth with contaminated water.

Several cartridge type filters, commonly called point-of-use filters, are currently available for household use, and some portable filters are available for backpackers, campers and travelers. The manufacturers' data provided with these devices must explicitly state whether they are capable of removing cysts. NSF International* approves several point-of-use devices capable of removing particles less than one micron in diameter (NSF Standard 42, Nominal Particulate Reduction, Class I), reverse osmosis filtration devices (NSF Standard 58) and cyst reduction devices (NSF Standard 53); all of these will remove *Giardia* cysts and *Cryptosporidium* oocysts from drinking water. The installation and maintenance requirements of these devices must be strictly followed to ensure proper operation. A word of caution is advised here because sales claims on point-of-use filters may not always provide the consumer with accurate information. Call your local Better Business Bureau or consumer protection agency to check for complaints against a particular product.

* For a list of certified treatment devices, call 877-867-3435 or visit NSF International's Web site at www.nsf.org .

Also, bottled water permitted by the Department of Environmental Protection (DEP) originating from protected wells or springs is less likely to contain protozoan cysts. DEP-permitted bottled water vending machines (in a supermarket, for example) approved by the National Automatic Merchandising Association and containing any of the above NSF-approved devices are considered safe; however, consumers should use clean containers to prevent contamination.

You can obtain more advice on safe drinking water in DEP's *Cryptosporidium* fact sheet by visiting DEP's Web site at www.dep.pa.gov, search term: "Crypto."

What if a homeowner suspects that they have giardiasis or cryptosporidiosis?

During the illness, a physician can sometimes confirm giardiasis by examining stool samples and accordingly prescribe medication to eliminate the *Giardia* parasite from the intestines. Some individuals will not be "cured" without the medication, although there is evidence that many people develop resistance to giardiasis or even cure themselves. In other words, symptoms may subside without treatment, but if you have contracted giardiasis at some point in your life, you may be a carrier and infect others with whom you have contact.

Although a physician can diagnose cryptosporidiosis in stool samples, a cure has not yet been found. Treatment of the symptoms is possible with antidiarrheal drugs, which may lessen the severity in most healthy people. Like those with giardiasis, individuals with cryptosporidiosis may also cure themselves. Because cryptosporidiosis can be fatal in

immunocompromised individuals, it is extremely important to prevent an infection. Therefore, those with weakened immune systems may want to take additional precautions such as regularly boiling all tap water for drinking and cooking; avoiding unpasteurized milk products; refraining from unsafe sex practices; and washing hands after using the toilet, after contact with infected people or animals and before handling food.



What is being done to protect Pennsylvania residents from waterborne diseases?

DEP regularly conducts inspections at Pennsylvania's public water systems to ensure that operators have the knowledge and equipment to optimize the performance of their facilities and protect public health. When a health risk is identified, all municipal and private water suppliers immediately take steps to protect consumers, such as issuing boil water advisories or increasing chlorine doses. The supplier is then required to seek long-term alternatives, such as a new source of water or a well-operated water treatment plant to remove the pathogens.

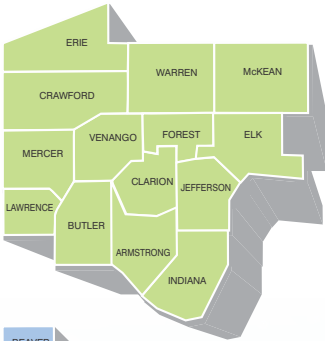
DEP regulations require strict measures to filter all surface drinking water sources and to properly operate water filtration plants. DEP also evaluates and closely monitors surface water filtration plants to ensure that *Giardia* and *Cryptosporidium* are removed from the source water. In addition, DEP has initiated special training programs for many of Pennsylvania's small water system operators so they can do a better job of providing safe drinking water.

Finally, if you receive drinking water from a surface water filtration plant, ask your water system to join the Partnership for Safe Water, a voluntary program that optimizes plant performance. You can find more details on the Partnership by visiting DEP's Web site at www.dep.pa.gov, search term: "Partnership."

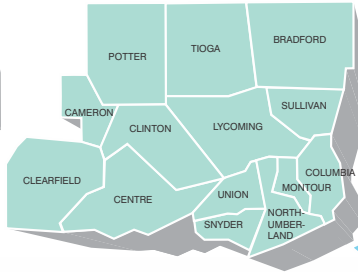


DEP Regional Offices

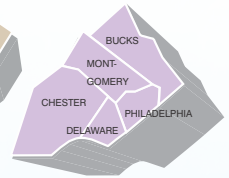
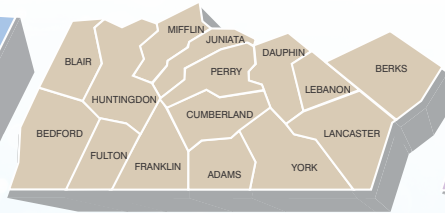
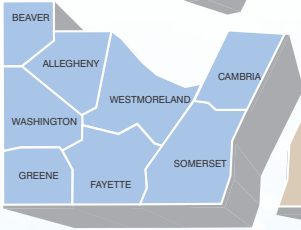
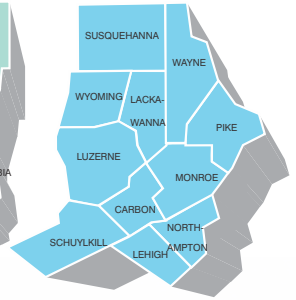
Northwest Region



Northcentral Region



Northeast Region



Southwest Region

Southcentral Region

Southeast Region

- The completed form is to be addressed to: PA DEP - Safe Drinking Water and sent to the address of the appropriate District Office or County Health Department (CHD) having jurisdiction over the water system.
- District and CHD addresses by county can be found within DEP document number 3930-FM-BSDW0560. This document can be located by searching under “forms” for document 3930-FM-BSDW0560 on eLibrary at the following link:
<http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=3195>



For more information, visit the DEP's website at www.dep.pa.gov; search term: "Safe Drinking Water."



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PROTECTION

Bureau of Safe Drinking Water

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