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## **Microbiological Contaminants**

### **Where do outbreaks occur?**

There are thousands of microbial species (living organisms) in water and in human intestines. Only a few of these species present a risk to health. Harmful microorganisms that cause disease are called pathogens, and many of these come from human and animal wastes.

A 1991 study by Gunther F. Craun of the EPA, examines the number of reported waterborne disease outbreaks in the United States from 1920 to 1988.

Operators and managers of small systems should note that of the waterborne disease outbreaks documented since 1971, many have occurred in small community and non-community water systems.

### **Isn't groundwater safe?**

Operators or managers of small groundwater systems often feel that they can rely on the natural filtration of the subsoil to protect their source water from microbiological contamination. Here again, the conclusions of EPA studies might surprise small system personnel.

The statistics show that in the 1980s nearly half of all reported waterborne outbreaks occurred in groundwater systems. The Craun study should serve as a warning that, although over 90 percent of small water systems use groundwater as their source, this does not necessarily mean that they will have naturally filtered, pathogen-free water.

### **Microbial Contaminants**

Waterborne pathogens that might be found in drinking water are normally in one of three categories: bacteria, viruses, or protozoa. Each category of pathogen has unique characteristics and can present different treatment challenges.

Bacteria, for example, are a large group of single-celled organisms visible only under a microscope. The vast majority are harmless and many are beneficial to humans and the environment. In fact, life on earth could not continue without them.

However, a few of the bacterial species are the cause of disease in humans. When water containing bacteria is consumed, it generally causes gastrointestinal symptoms such as diarrhea, cramps, nausea, and vomiting.

The first approach to bacterial contamination is to install disinfectant treatment and use it on a continuing basis. If this treatment is already in place, the operator should either flush the system periodically with water or start other control measures. Additionally, water system operators or managers will need to investigate the source of the contamination and determine how they might protect their watershed in the future.

### **What about viruses?**

Viruses are even smaller microscopic particles than bacteria, and are only able to multiply inside living cells. They can also cause infection in both animals and plants. There are probably thousands of different types of viruses, and hundreds have been identified. Some of the more common diseases that airborne viruses can cause are mumps, measles, chicken pox, the common cold, and influenza. These particular viruses are not, however, carried in water.

An EPA document about drinking water microbes describes the symptoms from waterborne viruses as ranging from minor stomach flue complaints to fatal liver conditions. A waterborne virus like Hepatitis A can cause liver failure and is one of the most important microorganisms that water system personnel need to protect their community from.

Common waterborne viruses can multiply in the human intestine and be excreted in feces. As a result, sewage and polluted water sources often contain viruses in high concentrations.

Typically, viruses can be eliminated with the same sorts of disinfectants used on bacteria, unless the source water is highly polluted with sewage waste.

### **What about Cryptosporidium?**

The Cryptosporidium that contaminated Milwaukee's drinking water belongs to the third category of waterborne pathogens, one-celled animals called protozoa.

Another common protozoan is the parasite Giardia, which causes a severe intestinal ailment called giardiasis. In Craun's study, giardiasis accounted for 103 reported outbreaks, resulting in a total of 25,834 illnesses between 1971 and 1988. According to one EPA document, from

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1971 and 1985, giardiasis was the most frequently diagnosed waterborne disease.

Like cryptosporidiosis, more severe symptoms of giardiasis may include diarrhea, severe dehydration, weight loss, and fatigue. A person infected with *Giardia* may be ill with these symptoms for months, or even longer. With cryptosporidiosis, symptoms may be controlled in a much shorter time, but many experts feel that *Cryptosporidium* may be an important contributing factor in AIDS deaths.

Protozoa are also microscopic, and although they are usually single-celled organisms, they are more complex in structure and life cycle than bacteria or viruses. Both *Cryptosporidium* and *Giardia* have life cycles that produce cysts, which means that they have a protective shell around them. This cyst stage protects the protozoa when it is in the environment, and helps it to resist disinfectants like chlorine.

*Giardia* and 'Crypto' are associated primarily with surface water because soil usually acts as a filter for their removal. But, even though most small systems are groundwater systems, these systems' operators should not automatically assume they are safe from protozoa. If you do find them in groundwater, there is good reason to suspect that your water is under the direct influence of surface water. Currently, public systems are not required to test for protozoa like Crypto. ♦