



Water Issues And Concerns Fact Sheet Series

Drinking Water Supplies

by Leslie Dorworth

Drinking water supplies are becoming even more precious around the world, and various ways are being undertaken to keep them safe from contamination. The main safety concern is to keep the water free from organisms that cause disease, such as *Cryptosporidium*, *Giardia lamblia*, *Legionella*, and waterborne viruses. It is usually difficult, as well as expensive, to test for these organisms. The next best thing is to test the water for bacteria because the presence of bacteria in the water supply is usually a good indicator that there are problems with the drinking water supplies. There are many different bacteria that can cause illness, and it becomes logistically difficult to test for just one individual bacteria. Instead, indicator organisms are used and some of these indicator tests include a standard plate count, total coliform, fecal coliform or *Escheria coli* bacteria.

Many of the bacteria causing diseases that are transmitted through water are able to grow in the human intestinal tract and leave the body in the feces. This leads to the use of the coliform bacteria, inhabitants of the intestinal tract of man and animals, as indicators of pollution of water by fecal material. Coliform bacteria are used as surrogates to detect bacterial presence in a water sample. The reason for this is that it is difficult to culture and identify many specific human intestinal pathogens in a routine manner.

The coliform bacteria are not normally found in soil; in fact, soil may be considered nature's natural filter. Normally after water seeps through 20 feet of soil, it is free of coliforms and disease causing organisms. When coliform bacteria show up in a water supply system, a defective well is often the cause.

The basic test for bacterial contamination is total coliform bacteria. Total coliform is an indicator of the sanitary condition of a water supply. Total coliform includes bacteria found in soil, in water

that is on or near the surface of the ground, and in human or animal waste.

The coliform groups include all aerobic and facultatively anaerobic bacteria, such as *Escheria coli* (*E. coli*), *Citrobacter*, *Enterobacter*, and *Klebsiella* species. It is usually much easier to demonstrate the presence of these bacteria, the non-pathogenic forms, than the pathogenic types.

What are other threats to safe drinking water?

Chemicals are another concern for drinking water safety. Inorganic chemicals are naturally occurring elements, such as nitrate and phosphate that are essential nutrients for plant growth. A subgroup, heavy metals, (i.e. lead) are often associated with industrial pollution. Volatile organic compounds (VOC) are often detected near gasoline storage units and industrial sites which improperly dispose of these chemicals. Trihalomethanes or THMs are another class of volatile organic chemicals and are by-products of the chlorination or disinfection process that wastewater treatment plants use to treat the water supply. THMs are considered to be carcinogenic.

Pesticides are another threat to our potable water supplies. Pesticides are released into the environment as an inevitable consequence of their use. Acute contamination can occur via spillage or by misuse, such as spraying near water courses or careless disposal. Contamination can also result from legitimate use as pesticides may leach from treated land into surface and groundwater over a period of time. The concentrations of pesticides reaching drinking water by this route are generally low but can, in some cases, exceed federal and state recommended levels. There are only a few approved EPA tests to determine if pesticides are in the water supply. Although agriculture is the

most obvious user of pesticides, several other bodies can make significant contributions to the amounts found in the environment. Examples include cities and towns using certain pesticides to control weed growth along roadsides to homeowners using it on lawns.

Radiological contamination of water supplies is usually caused by natural sources such as groundwater flowing through certain mineral deposits in the ground, dissolving the mineral which may then become part of the drinking water supply. If a problem is suspected then the water should be tested. In most cases, it is difficult to know there is a problem since contamination does not normally result in a taste or smell problem. Human health effects are cancer, kidney problems as well as accumulation in bone tissue. Treatment for radiological contamination ranges from lime soda softening to reverse osmosis.

Finally, other chemicals are used to treat and maintain a potable water supply for human consumption. The chemicals range from the use of activated alumina which removes inorganics by adsorption to the use of zinc for corrosion control when used along with phosphates.

What are the health effects of drinking water contaminants?

People are increasingly concerned about the safety of their drinking water. Improvements in analytical methods allow detection of impurities at very low concentrations. Water supplies once considered pure are found to have contaminants. Pure water cannot be expected, but safe water is a reasonable expectation. The health effects of some contaminants in drinking water are not well understood, but the presence of contaminants does not mean that human health will be harmed. Public water supplies are tested and regulated to ensure that water remains free from unsafe levels of contamination. Small private water supplies, including wells, are not regulated by drinking water standards, and the owner must take steps to test and treat the water as needed to avoid possible health risks.

The only way to find out what is in your water is to have it tested. Drinking water can become contaminated at the original source, during treatment, or during distribution to the home. For

example, if water comes from surface water such as a lake or river, it can then be exposed to acid rain, storm water runoff, pesticide runoff, and industrial waste. The water may be cleansed somewhat by exposure to sunlight, aeration, and micro-organisms in the water. If the water comes from groundwater sources such as private wells and even some public water supplies, it generally takes longer to become contaminated. However, it also takes longer for the natural cleansing process to occur. Due to the slow movement of groundwater, it is not exposed to sunlight, aeration, or aerobic (requiring oxygen) micro-organisms. Groundwater may become contaminated by leachate from landfills and septic systems, careless disposal of hazardous household products, agricultural chemical, leaking underground storage tanks and disease producing pathogens.

The levels of contaminants in drinking water are seldom high enough to cause immediate (acute) health effects. Examples of acute health effects include nausea, lung irritation, skin rash, vomiting, and even death. Contaminants are more likely to cause chronic health effects or effects that occur long after repeated exposure to small amounts of a chemical. Examples of chronic health effects include cancer, liver and kidney damage, nervous system disorders, immune system damage, and birth defects. Evidence relating chronic health effects to specific drinking water contaminants is limited. In the absence of exact scientific information, scientists predict the likely adverse effects of chemicals in drinking water using human data from clinical reports and epidemiological studies, and laboratory animal studies.

How can water be treated?

Obviously, if there is some problem with water supplies, then some form of treatment will be necessary. This may involve the use of chemicals to remove organisms, disinfection of the unit, and or the use of various sized filters which remove organics. Assistance for drinking water problems can be obtained from local health departments or an appropriate state agency that regulates drinking water.

Recommended Resources

Citizens Guide to Groundwater Protection. 1990. EPA 440-90-004. Office of Groundwater Protection. Office of Water, U.S. Environmental Agency. Washington, D.C. 35p -emphasizes the important role of citizens in protecting the groundwater supplies

Cooke, G.D., E.B. Welch, S.A. Peterson, and P.R. Newroth. 1993. **Restoration and Management of Lakes and Reservoirs.** 2nd Edition. Lewis Publishers, 548p

EPA efforts to monitor microbial and byproduct risk. 1996. EPA. Office of Water. 811-1-96-005.

Guide for Conducting Contaminant Source Inventories for Public Drinking Water Supplies. 1991.

Technical Assistance Document. EPA 570/9-91-014. Office of Water. Washington D.C., 54p -technical assistance document focuses specifically on contaminant sources of concern within wellhead protection areas.

Water Quality Issues and Concerns is an ongoing series addressing relevant water quality issues. For water quality information, contact Leslie Dorworth, Sea Grant aquatic ecology specialist, at 219 989-2726; dorworth@calumet.purdue.edu

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