

# Water Quality and Your Health

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2007

## History

Water is our most important nutrient. We can live several weeks without food but only a few days without water. The importance of having ample drinking water caused early humans to establish themselves around water sources. People collected water from rivers, streams, lakes, and wells. Due to poor sanitation practices, water from these sources was often contaminated with human sewage, animal waste and other impurities. As a result, waterborne diseases such as cholera and typhoid spread quickly by polluted water causing illness and death. It was not until the 1800s that scientists began to understand the sources of drinking water contaminants. Scientists discovered that microscopic bacteria and viruses cause infections and disease and it was the realization that bacteria and viruses could transmit disease through water that eventually led to the development of municipal water systems and water treatment advances.

With improvements in the treatment of water supplies, waterborne diseases and illnesses have largely been eliminated in areas with modern treatment facilities. Still, microbiological organisms remain as a residual problem in some water supplies. Transmissible diseases such as Hepatitis A are an important concern, as well as some micro-organisms that can cause acute and chronic gastrointestinal disorders. Congress enacted the Safe Drinking Water Act in 1974, which was

amended in 1986 and now requires public water systems to disinfect their water. As a safeguard to prevent waterborne illnesses, the South Carolina Department of Health and Environmental Control (SCDHEC) requires public water systems to maintain a chlorine residual throughout the water system. (A certain amount of chlorine must remain in water after treatment to ensure continued protection against harmful organisms. This remaining chlorine is known as a chlorine residual.)

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Chlorine is the most commonly used disinfectant for public drinking water supplies and was first used as a water disinfectant in Europe and America in the early part of the 20th century. Chlorine is considered effective, safe, and is the least expensive method of water disinfection. However, when chlorine mixes with organic compounds it will form chemical compounds called trihalomethanes (THMs). In 1974, drinking water professionals recognized the need to modify traditional chlorine treatment processes due to a better understanding about disinfection byproducts and their health impacts. Modification came in the form of

combining chlorine with a small amount of ammonia, which forms chloramines. Chloramines are seen as safe and effective and do not form trihalomethanes when mixing with organics in water. Chloramines have been used in the United States for many years and are an approved disinfectant by DHEC. The Charleston Water System disinfects treated water with trace amounts of chlorine, then adds trace amounts of ammonia to form chloramines, which protect against bacteria. Chloramination is also the disinfection process Mount Pleasant Waterworks now uses.

People with medical problems can use chloraminated water to drink, and bathe; however, it cannot be used for dialysis treatment. In the dialysis process, water comes in contact with the blood across a permeable membrane and the water must be pretreated to remove chlorine and ammonia. Medical centers that perform dialysis are responsible for purifying the water that enters the dialysis machines. Persons with home dialysis machines should check with their physician or equipment supplier. In addition, it is important to note for aquarium owners that chlorine and ammonia are toxic to all fish since water enters through the gill structure and goes directly in the bloodstream. Chloramines stay in the water for up to several weeks, so a dechlorinating agent must be added to remove it. This includes the water for both freshwater and saltwater aquariums.



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## Drinking Water Standards

Standards for many pollutants have not been developed at the state or federal levels. Many officials at water systems and wastewater treatment plants believe it is too costly to screen for them, and the science is too new to know if they are harmful. EPA has set standards for approximately 90 contaminants that may occur in drinking water and pose a risk to human health. For each of these contaminants, EPA sets a legal limit, called a maximum contaminant level (MCL), or requires a certain treatment. Water suppliers may not provide water that does not meet these standards. Water that meets these standards is safe to drink, although people with severely compromised immune systems and children may have special needs. People with cancer who are undergoing

chemotherapy, persons who have undergone organ transplants and people with HIV/AIDS or other immune system disorders as well as the elderly and infants can be more vulnerable to contaminants in drinking water than the general population. You can find more information on the EPA/Center for Disease Control guidelines on how to lessen the risk of infection by microbial contaminants from the Safe Drinking Water Hotline at (800) 426-4791.

Your local water supplier will alert you through the local media, direct mail, or other means if there is a potential acute or chronic health effect from compounds in the drinking water. Acute effects occur within hours or days of exposure and can range from making one feel a bit ill to causing serious illness or death, depending on the contaminant, its level, and the person's immune system. Chronic effects occur if a person consumes contaminated water for many years.

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If you have your own well, you are responsible for making sure that your water is safe to drink. Private wells should be tested annually for nitrate and coliform bacteria to detect contamination problems early. Test more frequently and for other contaminants, such as radon or pesticides, if you suspect a problem. Check with your local health department and local public water systems that use ground water to learn more about well water quality in your area and what contaminants you are more likely to find.

## Types of Water Contaminants

### Microbes

**Coliform bacteria** are common in the environment and are generally not harmful. However, the presence of these bacteria in drinking water is usually a result of a problem with the treatment system or the pipes that distribute water, and indicate that the water may be contaminated with germs that can cause disease.

**Fecal Coliform and E. coli** are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.

**Cryptosporidium** is a parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. However, the disease can be severe or fatal for people with severely weakened immune systems.

**Giardia lamblia** is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, cramps).

### Radionuclides / Alpha emitters

Certain minerals are radioactive and may emit a form of radiation known as alpha radiation or photons and beta radiation. Some people who drink water containing these emitters in excess of EPA's standard over many years may have an increased risk of getting cancer.

**Combined Radium 226/228.** Some people who drink water containing radium 226 or 228 in excess of EPA's stan-

dard over many years may have an increased risk of getting cancer.

**Radon gas** can dissolve and accumulate in underground water sources, such as wells, and in the air in your home. Drinking water containing radon presents a risk of developing cancer. Radon in air is more dangerous than radon in water.





## Inorganic Contaminants

Inorganic contaminants can dissolve in water from natural sources or as the result of human activity. They include Aluminum, Antimony, Arsenic, Asbestos, Barium, Beryllium Cadmium, Chromium, Copper, Cyanide Lead, Mercury, Nitrate, Nitrite, Selenium, and Thallium.

**Arsenic.** Some people who drink water containing arsenic in excess of EPA's standard over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.

**Fluoride.** Many communities add fluoride to their drinking water to promote dental health. Each community makes its own decision about whether or not to add fluoride. EPA has set an enforceable drinking water standard for fluoride of 4 mg/L (some people who drink water containing fluoride in excess of this level over many years could get bone disease, including pain and tenderness of the bones). EPA has also set a secondary fluoride standard of 2 mg/L to protect against dental fluorosis. Dental fluorosis, in its moderate or severe forms, may result in a brown staining and/or pitting of the permanent teeth. This problem occurs only in developing teeth, before they erupt from the gums. Children under nine should not drink water that has more than 2 mg/L of fluoride.

**Lead** typically leaches into water from plumbing in older buildings. Lead pipes and plumbing fittings have been banned since August 1998. Children and pregnant women are most susceptible to lead health risks.

If your home is more than five years old, chances are that any lead on the inside of the pipe has acquired a natural coating that would prevent serious leaching.

However, here are some things you can do to keep your home lead-free;

- 1) Get into the habit of flushing your pipes if the tap has not been used for three or more hours. To do this, let the water run for 15-30 seconds before using it for drinking or cooking. This removes the potential for metals that may have leached from the plumbing and brings fresh water into your home's system. You can save the flushed water for non-consumptive purposes, such as watering plants or rinsing dishes;
- 2) Never use hot water directly from your tap for cooking or making infant formula. Hot water dissolves lead more quickly than cold water. Always use cold, fresh water to heat for making hot drinks or for cooking;
- 3) Insist on lead-free materials when plumbing is done in your home.

## Synthetic Organic Contaminants, including pesticides & herbicides

Synthetic organic compounds are man-made. Numerous chemicals developed in industrial and agricultural businesses (such as herbicides, pesticides, and organic solvents) find their way into water supplies through factory discharges, and street and farm field runoff. Many of these synthesized chemicals are dangerous pollutants and can have serious health effects such as causing cancer. Furthermore, the reaction of some of these organics with the residual chlorine in drinking water can produce chlorinated hydrocarbons that are considered by some as more harmful than the original organic compound. Regulations call for very low maximum allowable levels of synthetic organic compounds in our drinking water. Synthetic organic contaminants include:

2,4-D, 2,4,5-TP (Silvex), Acrylamide, Alachlor, Atrazine, Benzoapyrene, Carbofuran Chlordane, Dalapon, Di 2-ethylhexyl adipate, Di 2-ethylhexyl phthalate, Dibromochloropropane, Dinoseb, Dioxin (2,3,7,8-TCDD), Diquat, Endothall, Endrin, Epichlorohydrin, Ethylene dibromide, Glyphosate, Heptachlor

Heptachlor epoxide Hexachlorobenzene, Hexachlorocyclopentadiene, Lindane,

Methoxychlor, Oxamyl [Vydate], PCBs [Polychlorinated biphenyls], Pentachlorophenol, Picloram, Simazine, Toxaphene

## Volatile Organic Contaminants

Volatile organic compounds (VOC's) are chemicals that evaporate, or volatilize, when exposed to air. Since they dissolve many other substances, VOC's are commonly used as cleaning and liquefying agents in fuels, degreasers, solvents, polishes, cosmetics, drugs, and dry cleaning solutions. When VOC's are spilled or dumped, a portion evaporates, but some soaks into the ground where they can be carried through the soil by rainwater or melting snow. If VOC's get into the water



table, they can persist for years due to an environment that does not promote decomposition. VOC's may have a variety of harmful health effects. Exposure at high levels can cause drowsiness or a stupor, irritation to the skin, or mucous membranes if inhaled. For each chemical, the EPA has established a maximum contaminant level (MCL). Water containing VOC's lower than the MCL is considered safe to drink. However, since little is known about the additive effects of these compounds, it is important to detect and eliminate VOC sources if two or more chemicals are found in water. Types of VOC's include:

Benzene, Carbon Tetrachloride, Chlorobenzene, o-Dichlorobenzene, p-Dichlorobenzene 1,1-Dichloroethylene, cis-1,2-Dichloroethylene trans-1,2-Dichloroethylene, Dichloromethane, 1,2-Dichloroethane, 1,2-Dichloropropane,

Ethylbenzene, Styrene, Tetrachloroethylene 1,2,4-Trichlorobenzene, 1,1,1,-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene, Toluene, Vinyl Chloride, Xylenes

## Disinfectants

Many water suppliers add a disinfectant to drinking water to kill germs such as giardia and e coli. Especially after heavy rainstorms, your water system may add more disinfectant to guarantee that these germs are killed.

**Chlorine and Chloramine.** Some people who use drinking water containing chlorine or chloramine well in excess of EPA's standard could experience irritating effects to their eyes and nose and experience stomach discomfort or anemia.

**Chlorine Dioxide.** Some infants and young children who drink water containing chlorine dioxide in excess of EPA's standard could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of EPA's standard. Some people may experience anemia.

## Disinfection Byproducts

Disinfection byproducts form when disinfectants added to drinking water react with naturally-occurring organic matter in water.

**Total Trihalomethanes.** Some people who drink water containing trihalomethanes in excess of EPA's standard over many years may experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.

**Haloacetic Acids.** Some people who drink water containing haloacetic acids in excess of EPA's standard over many years may have an increased risk of getting cancer.

**Bromate.** Some people who drink water containing bromate in excess of EPA's standard over many years may have an increased risk of getting cancer.

**Chlorite.** Some infants and young children who drink water containing chlorite in excess of EPA's standard could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorite in excess of EPA's standard. Some people may experience anemia.

## Other

**MTBE** is a fuel additive, commonly used in the United States to reduce carbon monoxide and ozone levels caused by auto emissions. Due to its widespread use, reports of MTBE detections in the nation's ground and surface water supplies are increasing. The Office of Water and other EPA offices are working with a panel of leading experts to focus on issues posed by the continued use of MTBE and other oxygenates in gasoline. EPA is currently studying the implications of setting a drinking water standard for MTBE.

**Drugs.** Additionally, researchers have been found a new category of contaminants slipping through wastewater treatment plants and finding their way to public drinking water - prescription and nonprescription drugs, including caffeine,

nicotine, anti-cholesterol medication, antibiotics, and hormones. Scientists know little about how long-term exposure may affect people, but some researchers have learned enough to call for more testing. Human health may not be the only factor to consider regarding these new found pollutants. Estrogen has been linked to male fish that have developed female organs in Europe and the U.S.

## Water Supply Emergencies

Water supply emergencies are very rare but can threaten our water supply. Several causes that could lead to a water supply emergency include natural disasters, system malfunctions, vandalism, human error, water main break, waste leakage or contamination resulting from stormwater runoff.

Today's drinking water problems are far more likely to cause nausea and diarrhea rather than any life-threatening epidemic. Gastrointestinal illnesses from polluted water have become increasingly common, according to academic and governmental studies. One such study by the Medical College of Wisconsin and the EPA found that approximately 7 million Americans suffer from nausea and/or diarrhea due to contaminated water each year.

Both the Charleston Water System and the Mount Pleasant Waterworks meet or exceed all drinking water quality standards. View their respective annual reports at their websites.

## Information Sources:

911 Water website <http://www.911water.com/>

Drinking Water Wisdom website  
<http://www.drinkingwaterwisdom.com/>

Mount Pleasant Waterworks website  
<http://www.mountpleasantwaterworks.com>

Charleston Water System website  
<http://www.charlestonwater.com>

**The Wonder of Water. An Educational Services Supplement. The Post and Courier.** Sponsored by Charleston Commissioners of Public Works. May, 2005.

U.S. Environmental Protection Agency Groundwater and Drinking Water website  
<http://www.epa.gov/safewater/dwh/>

"Water Quality and Your Health" is a community education project prepared by the Charleston Area League of Women Voters.

Funding support has been provided by Tidelands Bank.

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