Chlorine Use By Municipal Water Systems

Chlorine is widely used by municipal water systems to disinfect water from bacteria, viruses and other microorganisms that cause diseases. In fact, approximately 75 percent of the municipal water systems across the United States use chlorine. Diseases such as typhoid fever and cholera that are easily spread through infected water have virtually been wiped out in the United States because of chlorine use.

What is Chlorine?

Chlorine is one of the chemical elements, noted for its great power as an oxidizing agent. When dispersed in air, it was a terrible war gas. When dissolved in water, "free chlorine" attacks everything it touches, creating chemical byproducts with every reaction. Free chlorine is also produced by adding common laundry bleach to water. Some of the by-products still retain a little oxidizing power, and these are called "combined chlorine." One of them, called monochloramine is often used by waterworks as a long-term stabilizer against bacterial growth in the mains, after primary disinfection has been completed inside the treatment plant. It takes longer to kill bacteria and viruses than to react with individual molecules, so disinfection cannot be considered complete until all of the combined chlorine has been oxidized, leaving "Free Available Chlorine" (FAC). In this Issue of Water Quality, we will be discussing only free available chlorine.

Effects of Chlorine

Despite its usefulness in disinfecting drinking water, there are problems associated with chlorine. Chlorine use can cause aesthetic water quality problems like a "swimming pool" taste and odor. Far more alarming are some studies that link chlorine by-products with bladder, colon and rectal cancer. One study shows that people who drink chlorinated water run a 21 percent greater risk of bladder cancer and a 38 percent greater risk of rectal cancer than people who drink water with little or no chlorine. One by-product is trihalomethanes (THMs). THMs are formed when chlorine reacts with naturally occurring organic matter in water, like decayed leaves. THMs (like chloroform) have been linked to a higher rate of cancer and have been classified as probable or possible human carcinogens by the U.S. Environmental Protection Agency (EPA). Research also indicates that many other volatile organic chemicals (VOCs) are also often present in water that has been treated with chlorine.

History of Chlorine and Water Treatment

Chlorine was first used to disinfect water in the United States in the early 1900s. At the time, outbreaks of cholera and typhoid fever spread by the water system were common and severe. In fact, major U.S. cities were suffering 100 or more typhoid deaths per 100,000 persons. Within 10 years after chlorine was introduced into the water system, the death rate fell dramatically. Since then, chlorine has been a primary means of chemically treating water. In the mid-1970s, research determined that VOCs, including chloroform and the other THMs, were present in drinking water that was treated with chlorine. Subsequent tests revealed that these compounds were not found in the same water prior to chlorine disinfection. Consequently, in 1979 the EPA set a Maximum Contaminant Level (MCL) of 0.1 milligrams per liter for THMs. Recognizing the need to completely eliminate THMs from drinking water, the

EPA has set a Maximum Contaminant Level Goal (MCLG) of zero for THMs. An MCLG is simply a target point, not an enforceable limit. This standard applies only to water treatment systems serving more than 10,000 people, which covers about 79 percent of the U.S. population. For further protection, the EPA is in the process of establishing a rule, which further reduces the limits on the amount of disinfectants, and disinfection by-products that can be present in municipally treated water. In the meantime, many municipal water systems are continuing to use chlorine to disinfect water.

Detecting Chlorine in Your Water

Determining whether chlorine is present in your water is sometimes as simple as smelling or tasting your water. If your water smells or tastes like a swimming pool, the cause of that smell or odor most likely is chlorine. To be certain if chlorine is used in your water system, call your local health department or water provider. Sometimes, however, chlorine is not as easily detected. To know for certain whether chlorine is present, have your water tested. Your local water supplier or state health department should be able to provide you with the name of a certified water testing laboratory in your area. Testing for chlorine alone is not expensive, but the average cost for a complete water test varies, depending upon the number of contaminants you wish to test for. However, a good general test for most common contaminants usually can be conducted for less than $150.

Reducing Chlorine In Your Water

While there is no way to prevent the addition of chlorine in your municipal water supply, there is a way to remove or reduce chlorine and chlorine by-products from your water before you drink or cook with it. This can be done simply and cost effectively with a point-of-use (POU water filtration system certified by NSF International for the reduction of chlorine, THMs and VOCs. NSF is an independent testing agency that sets product standards for manufacturers of POU systems. Typically the size of a household fire extinguisher, POU systems designed for the consumers are installed under the kitchen sink and the filtered water is served through a dedicated drinking water faucet. Commercial systems are large in size due to their increased capacity and are typically wall-mounted near the incoming water line. As water travels through the POU system, sediment, particles, bacteria and harmful chemicals are removed by the system's main ingredient (most frequently activated carbon). Activated carbon is an extremely porous material that attracts and holds harmful contaminants in the water through a process known as adsorption The result is better tasting and cleaner water with fewer contaminants. Recently a new filtration material, which also removes chlorine, very well has entered commerce. A simple copper-zinc alloy, it is readily oxidized by chlorine, but it does not have the great adsorptive surface area of activated carbon. Depending on the model, PO systems are capable of correcting most water problems, including chlorine removal; the reduction of lead, toxins, THMs, VOCs and asbestos and the removal of parasitic cysts such a Cryptosporidium and Giardia. Everpure manufactures many different filtration systems that are Class I Certified by NSF International for the removal of disinfectant chlorine from the incoming water supply.