Up The Creek
September 1, 2009

This month we discuss water disinfection. The technical definition is the killing, inactivation, or removal of enough pathogenic organisms to minimize the risk to public health. It does not mean sterilization, which would mean the elimination of all life forms.

In the history of human disease prevention, nothing surpasses the development of effective drinking water disinfection. Once-common deadly infections caused by parasites, protozoans, bacteria, and viruses are now rarities which, when they do happen, are often attributed to a failure of public water supply disinfection.

Disinfection is most often done by radiation and by chemical addition. Radiation exposes the water to ultraviolet light. Even when radiation is the primary disinfectant, a chemical is added to the water for continued protection throughout the distribution system. Commonly used chemicals include ozone, chlorine dioxide, chlorine, iodine, and bromine. Our treatment process does not use radiation. The USCDWUA disinfectants of choice are chlorine dioxide and chlorine. Chlorine dioxide is a quick and potent disinfectant, but does not persist in the system. That is why chlorine is used as the final step in the process.

Federal and State regulations require a concentration of at least 0.2 parts per million of chlorine in the water entering the distribution system, and maintaining a “detectible residual” of chlorine at all points in the system thereafter. In a distribution system the size of USCDWUA (105 miles of pipe), 0.2 ppm at the beginning is not nearly enough to maintain a detectable residual at the end. Chlorine is constantly lost, as it dissipates in storage tanks and reacts with pipeline walls and contaminants in the water. So we maintain a beginning concentration between 1.0 and 1.5 ppm. The maximum allowed by law is 4.0 ppm.

Why is it so important to have all that chlorine? Wasn’t the water adequately filtered and disinfected at the treatment plant? Yes, but - many miles of pipeline and your home’s plumbing are traveled before the water hits your drinking glass. It would be nice to believe that all pipes are clean, all joints are tight, nobody’s backhoe bucket is slicing through a main line, and nobody’s toilet has shifted into reverse. Experience, however, says otherwise.

There are undeniable drawbacks to the use of chlorine. Some people have esthetic or even allergic reactions. Then there are the DBPs - disinfection by products. An entire section of drinking water regulations is devoted to these compounds, which form by reaction of chlorine and natural organic matter in the water. Each new rewrite of the DBP section is more strict than the last. So on the one hand, add enough chlorine. One the other hand, don’t make too many DBPs. Then there’s the third hand.

On the third hand is fire protection. Adequate fire flow requires big pipes. Big pipes times long pipes equals old water. “Old” water means that it has taken a long time for it to get from the beginning to the end of the distribution system, losing chlorine and gaining DBPs along the way. It is desirable in a rural system to have small diameter pipes that move the water quickly and keep it fresh. This does not square well with fire protection, or planning for future growth.

To summarize the juggling act that is disinfection, we only have five dangerous things to keep in the air: (1)germs; (2)chlorine; (3) DBPs; (4) fire; (5) more people. It’s not a problem. It’s just another challenge.

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