

Small Water System Operator Certification Manual

Disinfection Byproducts Addendum (03/07)

(Insert after page 80)

Why the Disinfection Byproducts Trihalomethanes and Haloacetic Acids are a Problem in Drinking Water

Long-term exposure to certain concentrations of disinfection byproducts, such as haloacetic acids and trihalomethanes, has been found to be harmful to humans. Toxicological and epidemiology studies have indicated that disinfection byproducts may pose a risk of cancer and reproductive or developmental problems.

The Dilemma

To prevent waterborne disease, most systems add chlorine or other chemical disinfectants to their water to kill or inactivate the pathogens. Unfortunately, while chemical disinfectants are effective at controlling many harmful microorganisms, they can react with naturally-occurring organic materials in the water (disinfection byproduct precursors) to form disinfection byproducts. Disinfectants can also dissociate, or break down, into other chemicals. Both reactions can form unintended byproducts. This presents a dilemma for systems: they must add chemical disinfectants to reduce the risk of waterborne disease outbreaks, but at the same time carefully control their use in order to avoid producing harmful byproducts.

How Trihalomethanes and Haloacetic Acids Form

Disinfectants, such as chlorine, react with naturally occurring organic and inorganic matter in natural water to form disinfection byproducts, such as, trihalomethanes and haloacetic acids.

Sampling Locations and MCLs for Total Trihalomethanes and Haloacetic Acids

Water systems that add a chemical disinfectant, such as chlorine, to drinking water must develop and follow a monitoring plan that describes specific locations and schedules for collecting total trihalomethanes and haloacetic acids samples.

Monitoring samples for the disinfection byproducts total trihalomethanes and haloacetic acids must be taken at the location representative of the maximum residence time of water in the distribution system during the month of warmest water temperature.

The point of maximum residence time is an “active” point (currently providing water to customers) in the distribution system where the water has been in the system the longest. This active point may not necessarily be the same as the most distant point from the well.

The maximum contaminant level or MCL for total trihalomethanes is 0.080 mg/L and the MCL for haloacetic acids is 0.060 mg/L.

Control Strategies for Total Trihalomethanes and Haloacetic Acids

Public water systems have choices in how to control the disinfection byproducts total trihalomethanes and haloacetic acids. Some of the most common ways are modifying treatment processes, changing source water, and forming a partnership with another system.

Modifying Treatment

Some practical ways of reducing disinfection byproduct formation include:

Decreasing contact time and/or the concentration of disinfectant (as long as adequate microbial protection is maintained!)

Changing disinfectants or using chloramines as a secondary disinfectant in conjunction with chlorine

Adjusting the pH of your water

Changing Source Water

If high levels of disinfection byproduct precursors in source water lead to high levels of disinfection byproducts in treated water, consider blending current source water with water from a source with lower precursor levels. The lower levels of precursors in the blended water may lead to lower levels of disinfection byproducts in the finished water.

Another alternative is abandoning a source and developing a new one. Developing a new water source is expensive, but it may in some cases be the most cost-effective way to lower disinfection byproduct levels in the long run. Before changing water sources, however, consider that a new water source may have lower levels of disinfection byproduct precursors but higher levels of other contaminants. In addition, switching from a ground water source to a surface water source will subject your system to additional regulations.

Partnerships with Other Water Systems

Small water systems face many of the same technical challenges larger systems face, but often lack their resources. Working with other water systems (for example, joining with one or more communities to form a consolidated system, consolidating management, or purchasing water from another established system) may allow water systems to lower costs, simplify management, and more consistently provide customers with safe drinking water.

Maximum Residual Disinfectant Level (MRDL) Defined and MRDLs for Chlorine and Chloramines

The maximum residual disinfectant level or MRDL is the maximum permissible level of disinfectant residuals in water delivered to a consumer. MRDLs are enforceable standards. Operators must assure that a disinfectant residual is maintained throughout the distribution system to assure effective pathogen removal; however, this has to be balanced with the fact that excess amounts of disinfectants may have adverse health effects for consumers of the water.

Residual chlorine and chloramines levels are measured at the same times and at the same locations as routine coliform bacterial samples are collected.

The MRDL for chlorine and chloramines are both 4.0 mg/L, measured as Cl₂ (chlorine).