THE SPIGOT
from the NORTH DAKOTA RURAL WATER SYSTEMS ASSOCIATION

Disinfecting and The Effects of Disinfection By-Products: TRIHALOMETHANES AND HALO ACETIC ACIDS

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In the business of supplying safe drinking water to the public, there are three goals to achieve on a regular basis. These are to provide water that is potable, palatable and assuring the public has adequate pressure to their taps 24/7/365.

Palatable water is how the water, in essence, tastes. Public water systems operators do a great job of achieving this goal. Adequate pressure involves a public water system operator being able to maintain the infrastructure of their system, whether it is at the water treatment plant with pumps and motors, in the storage process or in the distribution system's mains and service lines. This goal is affected by proper planning, maintenance and the occasional mechanical failure.

The goal of potable water is the most important and sometimes the most difficult. Potable water is defined as water that is safe to drink or drinkable. There are various standards set by the state and federal regulations that direct public water supplies on what is considered safe for consumption. At times, these standards are violated and create public alarm as to how safe the water may or may not be. These concerns can come from naturally occurring and manmade contamination, water treatment plant errors or even a change in the weather.

One of the most common areas in water treatment discussed and of public concern is disinfection by-products (DBP). The most common DBP in the state is the formation of Trihalomethanes.

The water we receive from a variety of sources is treated with several types of disinfection to kill harmful organisms. Disinfectants are an essential element of potable water treatment because of the "barrier" they provide to combat waterborne disease-carrying microorganisms. These diseases include typhoid, hepatitis and cholera, which have been greatly diminished since the introduction of chemical disinfection.

DBPs are chemicals that form during drinking water treatment and distribution, when naturally occurring organics react with chlorine or other disinfecting treatments used to kill pathogens. The U.S. Environmental Protection Agency (EPA) determined pathogens pose potential health risks and must be regulated.

Chlorine residual testing results.

Of these DBPs, Total Trihalomethanes (TTHMs) are the primary violators in our state. TTHMs are comprised of multiple components and have a maximum contaminant level (MCL) of 0.08 mg/L or 80 parts per billion. TTHMs do not pose a problem for many systems across the state when taking the necessary steps to keep them in check. However, it is still important to understand how they are formed and how to address them.

TTHMs can be formed by chlorination, ozonation or chloramination of water with the formation of slightly acidic water, high organic matter and elevated water temperature. Chlorine forms when the water reacts with the organic matter to produce trihalomethanes and halo acetic acids (HAA5), not as common in the state as TTHMs. Some factors that affect the amount of DBPs are high levels of total organic carbon (TOC). The higher the TOC, the higher the DBP formation potential when the disinfectants are introduced to the water system.

Weather events can adversely affect water quality of public water systems that treat surface water throughout the state by adding additional organics into the water supply and must be continuously monitored and adjusted to the everchanging water quality conditions. Ground water systems often use the earth's layers as a natural filter to aid in the overall treatment of the raw water product.

Outside of additional treatment, there are other tips and tricks of the trade to help reduce TTHM levels and maintain proper chlorine residuals in your system.

The typical components of a chlorine residual testing kit.

- Removing extra storage tanks — Public water systems in some cases have more storage than they typically need. When possible, reduce extra storage by taking tanks offline, dropping tank levels and creating more tank turnover to keep fresh water coming into the tank.
- Adding mixers — The focus on mixers is to circulate water and create a consistent disinfection level and quality of water in the tank.
- Aeration — This can typically be done by adding air into the water, which aids in the removal of gases, such as TTHMs, entrained in the water and releases them.
- Circulation pumps — If your water storage tank has a circulation pump, it is recommended running it on a regular basis. Not only in the winter months to prevent freeze ups, but year-round to help maintain a consistent chlorine residual in the tank and to also alleviate temperature differences of the water in the tank, which can vary from 10-20 degrees from the top to bottom of the tank.
- Distribution flushing — If detention time is an issue, flushing can be very beneficial to your system. Not only does it help bring in fresh water, but it also brings in cooler water, which is less likely to react with and create TTHMs in the tank or your system's water mains.
- Maintaining proper chlorine levels — Minimum requirements for maintaining chlorine residuals are usually 0.2 mg/L of free chlorine and 0.5 mg/L for total chlorine. It is important to understand more is not always better when it comes to chlorine residuals. A system should make sure it is maintaining a residual throughout the system, but overcompensating for fear of not having enough can sometimes result in excessive disinfection, which results in unnecessary costs in use of extra chemicals for that system.

Fortunately, there is assistance available. The North Dakota Rural Water Systems Association (NDRWSA) is just a phone call away to provide hands-on assistance for not only these issues, but many more through a variety of state and federally funded programs in the areas of water treatment, distribution and wastewater collection and treatment.

NDRWSA can be reached at 701-258-9249 or 1-800-391-6951.