UNDERSTANDING TTHM'S AND HAA5'S

By Joe Redmond

As many Water Operations Specialists know, TTHM's and HAA5's are disinfection byproducts. Drinking water professionals must monitor them according to the EPA. End of story, right? Not exactly. What are they and why are we concerned about them? How do I test for them? And most importantly, what can you do to lower these byproducts throughout your water treatment process and distribution system?

Disinfection byproducts are chemicals that are formed primarily in surface water sources by reacting naturally with Organic and Inorganic matter when chlorine and other disinfectants are introduced. In general, organic contaminants come from natural materials in the environment. Examples are from leaves, decaying plants, and other dead materials at the surface level of the water. Such organic material is usually measured as the total organic carbon (TOC). The amount of the TTHM's formed are usually related to the amount of TOC plus the used disinfectant. Some of the reactions that form TTHM's during the treatment, distribution, and storage within the drinking water systems are influenced by time, pH levels, and temperature.

TTHM's include the chemicals, Chloroform, Bromoform, Dibromochloromethane, and Bromodichloromethane.

HAA5's are the five acids that are also produced. These are Monochloroacetic acid, Dichloroacetic acid, Trichloroacetic acid, Monobromoacetic acid, and Dibromoacetic acid.

It is important to monitor and reduce or eliminate these byproducts because of the health hazards the chemicals pose to humans. After their discovery in 1974, the EPA amended regulations to include a maximum contaminant level of .10 mg/l for TTHM's. These health issues include injury to the kidneys, liver, bladder, and can cause malfunctions to the central nervous system. Currently the MCL for HAA5 is 60 parts per billion. And TTHM is set at 80 parts per billion.

Testing for DBPs (disinfection byproducts) is done by collecting treated water samples in specific bottles that are ordered from a certified laboratory. The TTHM samples are filled with no head space and HAA5 samples are filled to within one to two inches from the top. For more information on sampling collection, you can download the Quick Guide to Drinking Water Sample Collection from the EPA's website- www.epa.gov. The Department of Health dictates when and where the samples are to be collected. Based on previously tested locations, they choose the addresses where the most likely highest concentrations of DBPs will be found and set up a sample schedule, usually this monitoring will be done quarterly. I have seen quarterly sampling requirements such as February, May, August, and November. Keep in mind that the temperature plays a big roll in the formation of DBPs, so the May and August samples may be highest.

Now that you know the what and why, lets focus on the how. How do we make sure our water complies and will not violate the MCL if you are already dealing with high levels? In my experience, the best place to start would be flushing dead ends on a regular basis. By simply flowing dead end hydrants at about 50 gallons per minute for enough time to turn over the water in the main at least once a week will help lower your levels. Another area to look is your water storage tanks. If you can change the set points on the tank so that more water is used and refilled per cycle, this will help. These techniques apply to the distribution system and only help by having cooler, fresher, and overall better-quality water available at the customers tap. For systems that have the funding available, a more drastic approach may be needed to eliminate disinfection byproducts. As mentioned before, the precursors for disinfection byproducts are the organic materials that react with chlorine. One way to reduce the level of TTHM is to decrease these precursors and/or chlorination before filtration. It is best to reduce the chlorine that gets in contact with the water. If it requires oxidation before filtration this can be done by using alternative disinfectants like peroxide and potassium permanganate, however this is not the only option if pre chlorination is needed to get the desired CT values. Enhanced coagulation is a process of optimizing the process of filtration to maximize the elimination of precursors. By adding a clarifier to your treatment process, the removal is improved by reducing pH levels as low as four to five, increasing the coagulants feed rates, and using the ferric coagulants instead of alum. Another easier way of eliminating TTHM's in water is through activated carbon or charcoal. Some treatment plants have been upgraded to add clarification before filtration and granular activated carbon filters after filtration.

Another edition to the treatment plant involves ultra-violet light or a UV type disinfectant. Aeration methods are used to lower results however, trihalomethane precursors are not removed by aeration alone. Some treatment plants have added aeration to the surface water reservoirs, slow sand filters, and finished water clearwells. They also have their clearwells vented and air is blown across the water to expel any gasses. These measures as well as the upgraded clarification and carbon filtration followed by UV should correct the problem. Ideally, removing all organic and inorganic matter in the surface water supply would eliminate those precursors, but not all systems have cement bottom reservoirs that can be drained and cleaned on a regular basis. For more information on removing Disinfection byproducts, contact NYRWA, we are here to help. 💧💧💧

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