Operator Quiz Corner

**What Exactly are “THMs” and “HAAs” ?**

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Most people in the water industry have heard the acronyms “THM” and “HAA”, but not been entirely sure what they are. Both are groups of regulated compounds that typically form when chlorine is added to water that contains organic compounds. THMs and HAAS are regulated as part of EPA’s complicated “Disinfect Byproduct Rule (DBPR).

While there are hundreds of organic compounds all around us, those that react with chlorine in water are commonly referred to as “natural organic compounds”. This is a broad term used to describe compounds that form from the natural decay of plant and animal matter often found in surface water supplies.

THMs (Trihalomethanes)

There are four chemical compounds in the Trihalomethane group: Chloroform, Bromodichloromethane, Bromoform and Dibromochloromethane. The Maximum Contaminant Level (MCL) is 80 ug/L and is determined by adding up the concentrations of all four compounds. Surface waters that are chlorinated usually see chloroform as the dominant compound. Water with an elevated pH and temperature promotes the formation of THMs as long as natural organic compounds and chlorine are present. For this reason, water utilities often see the highlest levels of THMs at the locations furthest out in the distribution system.

HAAs (Haloacetic Acids)

There are five Haloacetic acid compounds: monobromoacetic acid, dibromoacetic acid, monochloroacetic acid and dichloroacetic acid. The MCL is 60 ug/L and like THMs compliance is determined by adding up the concentrations of all four compounds. HAA formation is more influenced by warmer water than pH, and formation will occur as long as organic compounds and chlorine are present. Unlike THMs, HAAs do tend to break down with water age so many utilities will see higher HAAs closer to the point of chlorine injection as opposed to the furthest points in the distribution system.

Elevated levels of THMs and HAAs have been shown to be a possible carcinogen. Pregnant women and infants are considered to be at a higher risk of developing health issues. Compliance with the MCLs noted above is more complicated than most other regulated contaminants in that it is based on EPA’s “Locational Running Annual Average” (LRAA). Samples are collected from a number of approved locations in the distribution system (systems using surface water sources collect samples quarterly) and the average value at each location is calculated and compared to the MCL. The averaging is always done using the most recent 4 quarters of results thus the term “Running” annual average. Any sample location that has a LRAA above the MCL is considered to have a Tier II Violation which requires public notification within 30 days.

If you want to learn more about disinfection byproducts you can watch an informative 6 minute video on the WaterOperator.org website: <https://wateroperator.org/blog/featured-video-disinfection-byproducts-in-tap-water-5-things-to-know>

1. Which of the following water treatment strategies would be likely to reduce the formation of THMs and HAAs?
   1. Optimize the coagulation-flocculation-clarification processes
   2. Use of granular activated carbon in the filter media
   3. Use ozone instead of chlorine for disinfection
   4. all of the above
2. Convert an HAA result of 0.058 mg/L to ug/L.
   1. 0.58 ug/L
   2. 5.8 ug/L
   3. 58.0 ug/L
   4. 580 ug/L
3. True or False? A utility that treats its well water with chlorine will likely have lower levels of THMs and HAAs than a utility that treats its reservoir water with chlorine.
   1. True
   2. False
4. Which of the following distribution system operating strategies would be considered a temporary method of reducing THM formation?
   1. Looping dead end lines.
   2. Installing mixers on storage tanks to reduce water age.
   3. Flushing dead ends lines once per week
   4. All of the above
5. Using the data in the table below determine which site exceeds the Trihalomethane LRAA MCL (all results are reported in ug/L).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Site A** | **Site B** | **Site C** | **Site D** |
| **1st Qtr** | 77.3 | 52.7 | 37.8 | 77.5 |
| **2nd Qtr** | 22.1 | 88.2 | 47.1 | 86.5 |
| **3rd Qtr** | 119.3 | 78.4 | 90.0 | 87.5 |
| **4th Qtr** | 100.8 | 73.2 | 99.7 | 88.7 |

* 1. Site A
  2. Site B
  3. Site C
  4. Site D

*Solution:*

*MCL = 80.0 ug/L*

*Averages: Site A = 79.87, Site B = 73.13, Site C = 68.65, Site D = 85.05*