

Report of the City of Columbia DBP Analysis Project
 March 2009 through May 2009
 University of Missouri (MU) Water Resources Research Center (WRRC)

The following is a summary of the results of the last quarter of a year-long study conducted by the WRRC, in coordination with the City of Columbia's Water & Light personnel, to better understand water quality throughout the system with respect to disinfection by-products (DBPs). This study, which began in May 2008, has culminated in the consideration of treatment modification options that will help the City of Columbia maintain compliance with the Disinfection By-Products Rule.

Goals of the Fourth Quarter Sampling

During this 4th contract quarter of our study, we

- continued monitoring DBP concentration in the drinking water distribution system,
- experimented with the effects of the use of chloramine as a residual disinfectant under summer temperatures, and
- experimented with DBP formation potential in the wells and water treatment plant after observed elevated chloride levels in well waters.

Distribution System Samples:

Sample locations chosen provide some indication of the increase in DBPs as the water spends more time in the distribution system and therefore has more time for reactions to take place.

Figure 1 illustrates the trend of total trihalomethane (TTHM) production from the water treatment plant (point to the far left of graph) to the compliance location (which is then compared to other similar locations in the system to the right of that point). It should be noted that although 80 µg/L is the compliance level and several samples are above this mark, compliance by the State is determined based on a locational running annual average (LRAA). What this means is that the compliance value is the average of the last 4 quarterly samples taken

for the state. When samples are above 80 for this quarter, then to stay in compliance the water system samples for the other 3 quarters need to average below 80.

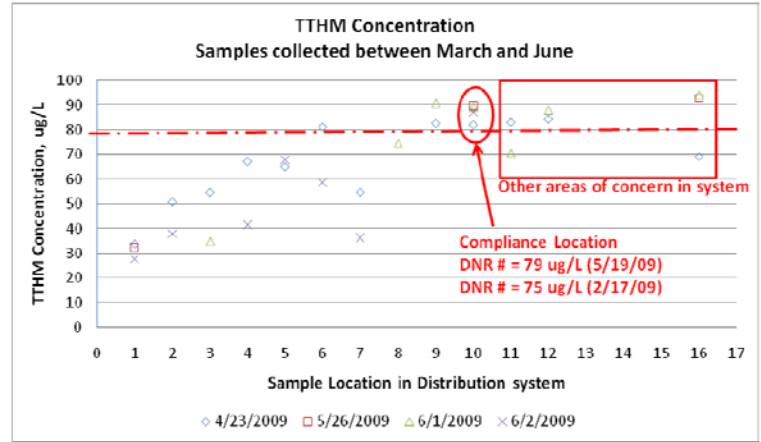


Figure 1 Trend of TTHM production at various sample points throughout the Columbia drinking water system

Effects of Chloramines on DBP formation:

Experiments conducted during the 3rd quarter (winter months) were done at the average winter temperature of 15C. During the 4th quarter researchers at WRRC reran these tests at the average summer temperature of 21C. As a recap, this experiment is designed to compare the amount of DBPs generated in chlorinated water to the amount generated in chloraminated water.

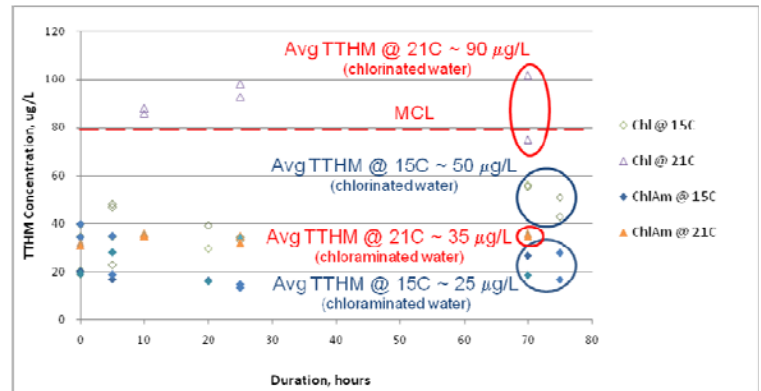


Figure 2 – Preliminary results comparing TTHM production of chlorine (top) versus chloramine (bottom) at 15C (blue) and 21C (red)

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Variability of DBP formation potential:

Each quarter the WRRC has sampled the wells and throughout the water treatment plant to determine the formation potential at various locations. During the 4th quarter, chloride levels in the wells were expected to increase. When higher chloride levels were observed in the well waters, samples were collected from select wells and from process units throughout the water treatment plant, had chlorine added to them, and then were incubated for approximately 3 days (the average time from the water treatment plant to the compliance location in the distribution system). The resulting formation potential levels of TTHM generated under these laboratory conditions are illustrated in figures 3 (wells) and 4 (water treatment plant).

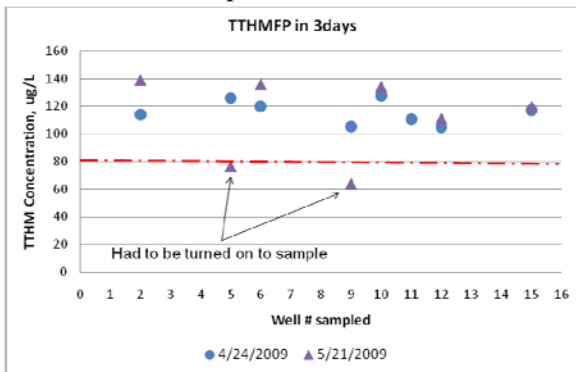


Figure 3 Well water TTHM formation potential

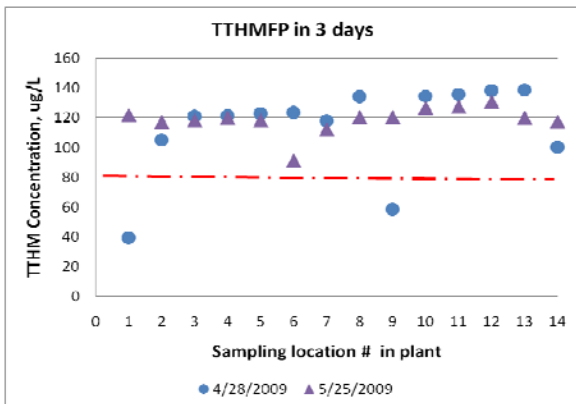


Figure 4 Treatment Process TTHM formation potential

Although there is some scatter in the well water data, both the wells and the water treatment plant sample show a consistent average formation potential of 120 µg/L. This higher number was generated under laboratory conditions which followed Standard Methods protocols and simulated a higher (more summer) temperature and a chlorine dose higher than what is used by the City. It should be noted, therefore, that even under the worst conditions, these levels of TTHM have not been seen in actual distribution system samples.

Future Efforts (Final Report for the City of Columbia)

The WRRC team is preparing a final, comprehensive report of all of their findings from this year-long study. This report will include

- data on DBP (predominantly TTHM) levels measured in the distribution system concurrent with levels reported by the Missouri Department of Natural Resources during this same time frame of May 2008-May 2009,
- data generated from laboratory experiments of the formation potential of DBPs from water samples taken from both the City wells and the process units in the water treatment plant,
- data generated from laboratory experiments comparing the production of DBPs in chlorinated Columbia drinking water versus DBPs in chloraminated Columbia drinking water, and
- suggestions of other treatment modification options which may be considered by the City for long-term compliance in addition to the addition of ammonia to form chloramines.