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Date: November 14, 2018

Subject: Water quality report

Water Quality Report – Haloacetic Acids (HAA5)

The pages that follow include an introduction, discussion, and conclusion that pertains to the information gathered for the report. Please contact Isaac Taylor at (816) 797-3648 or at zrt23@nau.edu if any question arise.

1.0 Introduction

Contaminants are present in nearly all water sources. The degree of regulation—or lack thereof—varies from chemical to chemical. One chemical regulated under the Safe Drinking Water Act (SDWA) is haloacetic acids (HAA5). This is not a singular chemical, but rather a grouping of five different chemicals that are considered to be by-products of disinfection within the water treatment process [1]. The five chemicals under the HAA5 acids umbrella are: monochloroacetic, dichloroacetic, trichloroacetic, bromoacetic, and dibromoacetic acids. The Environmental Protection Agency (EPA) has set standards for HAA5 and this limit will be discussed in relation to the City of Phoenix in Arizona.

2.0 Discussion

As a regulated chemical, the City of Phoenix must monitor and report back the levels within the local water in order to meet the requirements set. Water that tests outside of this range can result in dangerous health effects to both humans and animals. The Oregon Department of Health has reported that HAA5 can cause damage to the "brain, nerves, liver, kidney, and reproductive systems" in humans, and causes reproductive failure in animals [2]. The most concerning effect of HAA5 on the body is its potential carcinogenic effect in humans, and its known carcinogenic effect in animals [2].

Rather than testing for HAA5 initially, trihalomethanes (THM) are tested and a positive indicator is used to determine if HAA5 is present within the sample. The sample is reacted in a heat controlled water bath in three stages. First, a reaction with nitrogen, then acidifying the sample to 2.5 pH, and lastly, a reaction with the compound 7-amino-1,3naphthalenedisulfonic acid. This results in a value reported as chloroform, another dangerous chemical not under the HAA5 umbrella. If a positive indicator is given during the testing, it shows for the presence of HAA5 in the sample and further testing can be done to find specific levels. [3]

The Maximum Contaminant Level (MCL) is used as a limiter on the amount of HAA5 that can be present within the water source to ensure control of the hazardous effects, and the Maximum Contaminant Goal Level (MCGL) is the level the EPA would like to see the source at or under. Table 1 below compares the national MCL to the city standard range and average high.

Table 1. National maximum contaminant level and current City of Phoenix levels

Chemical	**MCL** [1]	**MCL** [2]	**Standard Range** [3]	**Average High** [3]
	mg / L	*ppb*	*ppb*	*ppb*
HAA5	0.06	60	6 - 32	22

From Table 1, it is visible that the average high concentrations of HAA5 within the sampled water stay well below the maximum levels set by the EPA. When considering the MCGL, there is no singular value identified. Rather, there are values for 2 of the 5 individually identified chemicals under the HAA5 umbrella. These values are identified in Table 2, below.

Table 2. National maximum contaminant goal level

Chemical	**MCGL** [1]
	mg / L
HAA5	
Monochloroacetic	--
Dichloroacetic	0
Trichloroacetic	0.3
Bromoacetic	--
Dibromoacetic	--

Phoenix gets their primary water from 2 different sources: Salt River Project (SRP) and Central Arizona Project (CAP) [4]. SRP pulls water from the Salt River and the Verde River, while CAP brings water down from the Colorado River [4]. In addition to this, the city also pumps up water from wells and groundwater aquifers [4]. To maintain assist aquifer levels and promote conservation of water, the city has implemented a program to reclaim and reuse fully treated effluent [4]. Within the water sources, contaminants may be present from wastewater treatment, effluent discharge, storm and urban runoff, agricultural sources, and oil/gas production [5]. Not all sources of contaminants can be controlled, however, it is important to understand where the sources may be located. By monitoring sources of contamination, potential pollution can be caught and corrected quicker and with higher accuracy for correction.

3.0 Conclusion

Haloacetic acids are a regulated water contaminant that have the potential to cause serious health effects and must be monitored closely. The City of Phoenix currently does not show issues with HAA5 in their water systems, nor do they have a recorded history of heightened concentrations of HAA5. The presence of HAA5 will be continued to be monitored to ensure that with changing water conditions, they do not begin to present themselves.

4.0 References

[1] Environmental Protection Agency, "Comprehensive Disinfectants and Disinfection Byproducts Rules (Stage 1 and Stage 2): Quick Reference GUide," Office of Water, Washington DC, 2010.

[2] Environmental Protection Agency, "EPA Web Archive," Environmental Protection Agency, 21 2 2016. [Online]. Available: https://archive.epa.gov/enviro/html/icr/web/html/gloss_dbp.html.

[3] City of Phoenix Water Services, "2017 Water Quality Report," Arizona Department of Environmental Quality, Phoenix, 2017.

[4] City of Phoenix, "Water Supply Q & A," City of Phoenix, [Online]. Available: https://www.phoenix.gov/waterservices/resourcesconservation/drought-information/climatechange/water-supply-q-a.

[5] HACH, "Trihalomethanes," HACH, Loveland, 2017.

[6] Oregon Department of Human Services, "Health Effects Information: Haloacetic Acids," Department of Human Services, Portland, 2004.