Disinfection of potable water supplies is a primary requirement of the United States’ Environmental Protection Agency’s (USEPA’s) Safe Drinking Water Act. The use of chlorine as a disinfectant is widely accepted by water purveyors due to its effectiveness and low cost. However, chlorine reacts with natural organic matter present in water supplies to form suspected carcinogenic disinfection by-products (DBPs). In this work, the formation of the regulated chlorinated by-products total trihalomethanes (TTHMs) and haloacetic acids (HAA5) for eleven wells has been investigated. Fluorescence, UV\(^*\)254, dissolved organic carbon (DOC), chlorine decay, and TTHM and HAA5 formation potentials (FPs) were analyzed. Fluorescence results suggested that the highest fraction of organic matter in the wells was in the form of humic acid. TTHM and HAA5 FPs were correlated to UV\(^*\)254, and to a lesser extent, DOC. TTHM FP results for each well investigated showed 85 to 250 \( \mu \)g/L TTHMs formed with <0.10 to 1.1 mg/L free chlorine residual after 96 hours of incubation. The highest TTHM-forming wells surpassed the regulatory 80 \( \mu \)g/L maximum contaminant level in less than 10 hours. Granular activated carbon (GAC) in adsorption and biological modes, nanofiltration (membrane softening), ozone oxidation, and aeration with tray, spray, or packed tower technologies were evaluated as treatment alternatives. Conceptual opinions of probable process costs suggest that of the alternative treatment technologies evaluated, recirculating tray aerators were most economical for TTHM reduction at $0.054/Kgal and $0.048/Kgal for a five million gallon per day (MGD) and 10 MGD plant, respectively, assuming a 20-year time frame and 8% interest rate. However, ozone could prove useful for HAA5 control at $0.078/Kgal and $0.059/Kgal for a 5 and 10 MGD plant, respectively, assuming a 20-year time frame and 8% interest rate.

Major: Environmental Engineering

Educational Career:
Bachelor’s of Environmental Engineering, BS, 2017, University of Central Florida

Committee in Charge:
Steven Duranceau, Chair, Civil, Environmental, and Construction Engineering
Anwar Sadmani, Professor - Department of Civil, Environmental, and Construction Engineering
Woo Hyoung Lee, Professor - Department of Civil, Environmental, and Construction Engineering

Approved for distribution by Steven Duranceau, Committee Chair, on June 14, 2019.

The public is welcome to attend.