Public Abstract

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Title:ANALYSIS AND MANAGEMENT OF DISINFECTION BY PRODUCT FORMATION IN DISTRIBUTION SYSTEMS

The newly promulgated Stage-2 Disinfectant and Disinfection By-Product (D/DBP) regulations force water utilities of all sizes to be more concerned with their finished and distributed water quality. Water quality in terms of DBPs and chlorine residual can be defined as a function of many variables including operational strategies and the pipe materials in the distribution system. Compliance for many small-scale utilities requires changes to their current operational strategy. However, these changes affect the formation of DBPs over time.

This study is performed in an effort to examine and quantify the extent of change in DBP formation and chlorine decay kinetics under different operational conditions and pipe materials found at many small-scale water utilities. As a part of this study a physical model (Pipe Loop) of a distribution system was used to evaluate the change in water quality as a function of time under different operational conditions such as having a high chlorine dosage entering the distribution system, using a chlorine booster system in the distribution system, and operation of clearwells/storage tanks. It is determined that High Chlorine run is least optimal option with approximately 64% and 30% higher production of TTHMs when compared to Normal and Chlorine Booster run, respectively. It is also determined that High Chlorine conditions minimize the wall effects and the location of Boosters should always be after the storage systems to avoid extra contact time that can produce approximately 54-104% higher concentrations of TTHMs. In case of storage systems, it is statistically proven that storage time before entering the tank, mixing conditions and fillings cycles play an important role in maintaining water quality in the tanks.

Additional resources explored in this research include a set of DBP prediction models such as Material Specific Simulated Distribution System (MS-SDS), Pipe Sector Reactor (PSR)*and the EPANET model of our Pipe Loop, which are considered for their accuracy and feasibility in small-scale utilities. PSR is built using DI pipe sections from two distributions systems. It is determined that every prediction model has its own set of merits and demerits such as computer models are known for their feasibility and accuracy but need to calibrated often using real-time data whereas field based models are straight forward to work with, but require assuming order of reaction.