

Optimal locations of booster disinfection stations in Al-Khobar water distribution system

Naeem Akhtar

Civil Engineering

May 2004

Abstract

The main objective of a water distribution system is to deliver safe drinking water that is free from pathogens and microorganisms. Chlorine is typically used within drinking water distribution systems to maintain a desirable disinfectant residual to reduce biological regrowth. As chlorine flows through the pipes in a water distribution system it is lost through both the interface with natural organic matter (NOM) in raw water and with the walls of the pipes transporting finished water. In order to maintain a uniform concentration of disinfectant throughout the water distribution system there is a need to inject chlorine at different locations in the distribution system. This process is called booster disinfection and it can reduce the total amount of disinfectant applied to the distribution system while maintaining adequate disinfectant residuals. In this study a mixed integer linear programming (MILP) model is developed in conjunction with EPANET, a dynamic water quality simulation model, to determine the optimal locations and scheduling of booster disinfection stations simultaneously for the central part of the Al-Khobar water distribution system. The commercial optimization software CPLEX is used in conjunction with EPANET to optimize the water quality model of the network. The results show that a significant decrease in the amount of chlorine is achieved by adopting a booster disinfection strategy. A reduction in the amount of chlorine of approximately 50% has been observed while maintaining a uniform distribution of residual chlorine throughout the distribution system and ensuring the reduction in excessive exposure of chlorine.