Total System Optimization
Fred Hill

As new and existing regulations continue to be implemented, challenges facing the water treatment industry will also expand. One of the challenges will be integration of optimizing particle removal with other, sometimes competing, optimization goals (e.g., control of disinfection byproducts, corrosion control). Hopefully, this approach can be adapted to new drinking water regulations and associated requirements.

Future areas for optimization, such as watershed management, balancing disinfection by-product control with microbial protection, and controlling water quality in distribution systems, are believed to be suitable for development utilizing a Total System Optimization approach. The following Table presents a summary of considerations for drinking water utilities.

Total System Optimization Considerations for Drinking Water Utilities

Optimization Area	Performance Area	Optimization Activities
Watershed/Source Water Protection	Microbial Protection	• Monitor for sources of microbial contamination • Develop watershed protection program • Remove/address known sources of contamination; develop pollution prevention partnerships • Develop emergency response plans
Disinfection Byproducts	THMs/HAAs/Bromate	• Reduce current level of pre-chlorination • Relocate pre-chlorination to post sedimentation • Increase TOC removal • Change disinfectant type; change from chlorine to chloramines for maintaining residual
Lead and Copper	Lead and Copper	• Corrosion control; feed corrosion inhibitor, adjust pH to achieve stable water
Cryptosporidium Control	Microbial Protection	• Achieve optimization criteria • Limit in-plant recycle practices

In-Plant Recycle	Microbial Protection	• Limit recycle to water plant; discharge wastewater to sewer or obtain permit to discharge to receiving water • Provide treatment of recycle for particle removal
Distribution System	Microbial Protection	• Develop monitoring program: including routine, construction, and emergency coverage • Maintain minimum disinfectant in system; consider booster stations; changing from chorine to chloramines; eliminate dead-end zones • Develop unidirectional flushing program • Develop storage tank inspection program, provide vent screens, establish routine cleaning procedure • Maintain turnover rate in storage tanks based on water quality monitoring results
Distribution System	Aesthetics	• Maintain consistent pH & disinfectant residual • Reduce water age; eliminate dead-ends & low-flow areas
Groundwater Treatment	Microbial Protection	• Eliminate contaminants from entering wells (i.e.. well head protection program) • Monitor for contamination (microbial & chemical) • Provide disinfection (e.g., establish policy to achieve virus inactivation, CT)

Total System Optimization is a non-specific performance expectation that can be achieved through planning, coordination, implementation, design, construction & operation of a water system, with involvement of ALL the customers.

Goals for Total System Optimization include; (1) compliance with State & EPA drinking water regulations, (2) providing the highest quality water to the citizens of North Carolina, (3) sustaining the public's confidence in public water systems, and (4) protecting the Public Health.