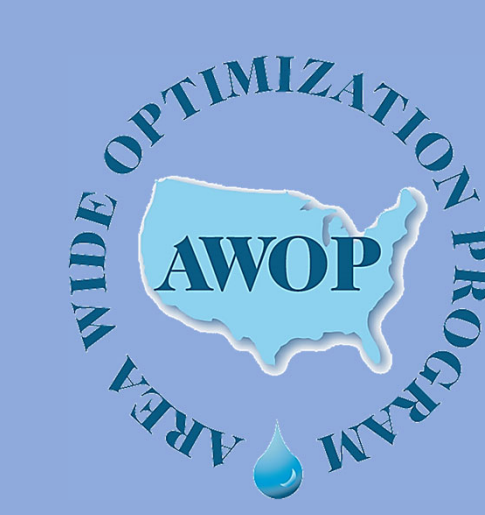


# Area-Wide Optimization Program Disinfection By-Product and Distribution System Optimization Goals and Guidelines<sup>1</sup>



## Monitoring & Operating Goals Summary

Category	Goal/Guideline	Status	Description	References
Disinfection By-Product	Plant Effluent Monitoring Goal	Adopted	<ul style="list-style-type: none"> <li>Collect quarterly total trihalomethane (TTHM) and haloacetic acid (HAA5) samples at the plant effluent with distribution system compliance sites.</li> </ul>	WRF Project #4109
Disinfection By-Product	Enhanced Coagulation Monitoring Goal <sup>2</sup>	Adopted	<ul style="list-style-type: none"> <li>Collect monthly raw and treated water total organic carbon (TOC) samples.</li> </ul>	Stage 1 D/DBP Rule
Disinfection By-Product	Disinfection Monitoring Goal	Adopted	<ul style="list-style-type: none"> <li>Record disinfectant residual, temperature, and pH at maximum daily flow in the treatment plant for CT calculations.</li> </ul>	U.S. Environmental Protection Agency, 2004
Distribution System	Disinfection By-Product Monitoring Goal	Adopted	<ul style="list-style-type: none"> <li>Collect quarterly DBP samples at all compliance locations at systems in compliance with the Stage 2 D/DBP Rule.</li> <li>Collect monthly DBP samples at all compliance locations at system <i>not</i> in compliance with the Stage 2 D/DBP Rule.</li> </ul>	Stage 2 D/DBP Rule
Distribution System	Disinfectant Residual Monitoring Goal	Adopted	<ul style="list-style-type: none"> <li>Monitor disinfectant residual at bacteriological and DBP compliance sites, all active distribution system entry points, all storage tanks (preferably while draining), and at a minimum of four critical sites (one in each quadrant of the system) identified by investigative sampling.</li> <li>Conduct monitoring at least monthly and more frequently during warmer weather.</li> </ul>	American Water Works Association, 2013 American Water Works Association, 2017
Distribution System	Chloramination Process Monitoring Goal	Adopted	<ul style="list-style-type: none"> <li>Monitor free ammonia in raw water, prior to the addition of chlorine in the treatment plant, and in the plant effluent on a routine basis. Raw water should be monitored at least weekly and other locations should be monitored at least daily. The frequency of analysis at each location should be adjusted based on variability.</li> </ul>	American Water Works Association, 2013
Distribution System	Nitrification Monitoring Goals	Adopted	<ul style="list-style-type: none"> <li>Monitor monochloramine, free ammonia, and nitrite at system entry points and in the distribution system (see <i>Disinfectant Residual Monitoring Goals</i> for locations and frequency).</li> <li>Monochloramine and free ammonia should be monitored at all locations.</li> <li>Nitrite should be monitored at samples locations where monochloramine is <math>\leq 1.50</math> mg/L; nitrate may also be monitored to further assess nitrification.</li> </ul>	American Water Works Association, 2013

## Performance Goals & Guidelines Summary

Category	Goal/Guideline	Status	Description	References
Disinfection By-Product	Plant Effluent Performance Goal	Adopted	<ul style="list-style-type: none"> <li>Adopt System Specific Targets: Discrete value or range based on a running annual average (RAA). Suggested goals may be 30% to 50% of long term locational running annual average (LRAA) goals (e.g., 20-30 ppb for TTHM, 15-20 ppb for HAA5).</li> </ul>	WRF Project #4109
Disinfection By-Product	Enhanced Coagulation Performance Goal <sup>1</sup>	Adopted	<ul style="list-style-type: none"> <li>Meet Stage 1 D/DBP Rule TOC removal requirements for enhanced coagulation, which are based on source water alkalinity and TOC levels, or an alternative compliance criterion, as a RAA of the performance ratio (PR) (actual/required removal) plus a factor of safety of 10% (or <math>PR \geq 1.1</math>).</li> </ul>	Stage 1 D/DBP Rule
Disinfection By-Product	Disinfection Performance Goal	Adopted	<ul style="list-style-type: none"> <li>Meet CT requirements to achieve inactivation of Giardia and viruses plus a system-specific factor of safety.</li> </ul>	U.S. Environmental Protection Agency, 2004
Disinfection By-Product	Disinfection By-Products Performance Goals	Adopted	<ul style="list-style-type: none"> <li>Individual Site Goal: Quarterly maximum LRAA TTHM/HAA5 values not to exceed 70/50 ppb.</li> <li>Long-Term System Goal: Average of maximum LRAA TTHM/HAA5 values not to exceed 60/40 ppb (the average of the last 8 quarters cannot exceed 60/40 ppb).</li> </ul>	<i>Under Development</i>
Distribution System	Disinfection Performance Goals	Adopted	<ul style="list-style-type: none"> <li>Maintain <math>\geq 0.20</math> mg/L free chlorine residual at all monitoring sites in the distribution system, at all times in systems that use free chlorine as a secondary disinfectant.</li> <li>Maintain <math>\geq 1.50</math> mg/L monochloramine residual at all monitoring sites in the distribution system, at all times. In systems that use chloramines as a secondary disinfectant.</li> </ul>	American Water Works Association, 2013 American Water Works Association, 2017
Distribution System	Chloramination Process Performance Goal	Adopted	<ul style="list-style-type: none"> <li>Maintain a detectable free ammonia residual in the plant effluent <math>\leq 0.10</math> mg/L as <math>NH_3-N</math>.</li> </ul>	American Water Works Association, 2013
Distribution System	Chlorine and Ammonia Dosing Operational Guideline	Adopted	<ul style="list-style-type: none"> <li>Maintain a chlorine-to-nitrogen mass ratio between 4.5:1 and 5.0:1 (or chlorine-to-ammonia mass ratio between 3.7:1 and 4.1:1), which should result in a detectable free ammonia in the plant effluent that is <math>\leq 0.10</math> mg/L as <math>NH_3-N</math>.</li> </ul>	American Water Works Association, 2013
Distribution System	Storage Tank Operational Guideline	Adopted	<ul style="list-style-type: none"> <li>Maintain an average turnover time <math>&lt; 5</math> days; or establish and maintain an acceptable water turnover rate at each storage facility to maintain water quality.</li> <li>Maintain good mixing (i.e., <math>PR^3 \geq 1</math>) at all times; for tanks where the PR cannot be calculated, adequate mixing (i.e., uniform water quality) should be confirmed by alternate means (e.g., tank profiling/water quality sampling).</li> </ul>	WRF Project #254 Grayman et al., 2000

### Footnotes:

<sup>1</sup>Applies to groundwater (GW), surface water (SW), and groundwater under the direct influence of surface water (GWUDI) treatment plants unless otherwise noted.

<sup>2</sup>Only applies to SW and GWUDI treatment plants

<sup>3</sup>Mixing performance ratio is determined using the EPA's Storage Tank Assessment Spreadsheet.

### References:

American Water Works Association. (2013). *Manual of Water Supply Practices M56: Nitrification Prevention and Control in Drinking Water* (2nd ed.). Denver, Colorado, United States of America: AWWA. doi:978-1-58321-935-5  
 American Water Works Association. (2017). *Manual of Water Supply Practices M68: Water Quality in Distribution Systems* (1st ed.). Denver, Colorado, United States of America: AWWA. doi:978-1-62576-226-9  
 Friedman, M., Kirmeyer, G., Lemieux, J., LeChevallier, M., Seidl, S., & Routt, J. (2010). *Criteria for Optimized Distribution Systems*. Denver: Water Research Foundation Project #4109. doi:978-1-60573-108-7  
 Grayman, W. M., Rossman, L. A., Arnold, C., Deininger, R. A., Smith, C., Smith, J. F., & Schnipke, R. (2000). *Water Quality Modeling of Distribution System Storage Facilities*. Denver: American Water Works Association Research Foundation.  
 Kirmeyer, G. J., Kirby, L., Murphy, B. M., Noran, P. F., Martel, K. D., Lund, T. W., . . . Medhurst, R. (1999). *Maintaining Water Quality in Finished Water Storage Facilities*. Denver: Water Research Foundation Project #254. doi:0-89867-983-4  
 Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) 63 FR 69390, December 16, 1998, Vol. 63, No. 241  
 Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) 71 FR 388, January 4, 2006, Vol. 71, No. 2