

Area Wide Optimization Program



**Individual Program
Background Information
2021**

Name of Agency: Virginia Department of Health – Office of Drinking Water

Official Recognition of AWOP

Please provide the AWOP start date and describe any official recognition of AWOP in agency newsletters, web pages, awards programs, annual meetings, etc.

- Year Program Started: 2004
- Waterworks performance awards based on the AWOP goals are issued in the spring of each year, based on the previous calendar year performance data.
- A public information document describing the program is posted on the VDH ODW web site. Currently being updated and moved to Chapter 4 of the Office of Drinking Water Field Manual.

Official Adoption of AWOP Goals

Please describe when and how AWOP goals were adopted by your agency and communicated to the water systems.

Virginia adopted performance goals for clarification and filtration processes in surface water treatment plants with gravity flow, granular media filters effective January 1, 2005. Water systems were notified of the new goals and the requirement to submit data used to evaluate the goals on monthly operating reports.

National Optimization Goals adopted by your PWSS Program – Check all that apply:

(refer to Attachment I for descriptions of the NOLT optimization goals.)

Water Treatment Plants

Microbial (Turbidity): Raw Water Individual Settled CFE IFE

Post BW w/FTW Post BW wo/FTW Disinfection (CT)

DBPs (TTHM/HAA5): Plant Effluent Enhanced Coagulation Disinfection

Chloramine Application: Ammonia Control _____ *Dosing (Chlorine & Ammonia)* _____

Distribution Systems

Individual Site DBPs _____ Long Term System DBPs _____ Tank Operations _____

Secondary Disinfection, Free Chlorine _____

Secondary Disinfection, Chloramines (monochloramine, Ammonia & Nitrite) _____

Modifications to the national goals or other optimization goals utilized by your Agency:

Please describe any modified AWOP goals and/or any additional optimization goals adopted by your agency and communicated to the water systems.

Description of *Current* AWOP Team Members and Responsibilities

Please provide the name, position/title, description of AWOP duties and approximate FTE that each team member spends on AWOP. Also indicate who serves as the AWOP team lead/point of contact.

- | | |
|--------------------------|--|
| 1. Dixon Tucker, PE, | Chair VOPC - Southeast Virginia Field Office |
| 2. Robert Edelman, PE | VOPC Member – Central Office |
| 3. Aaron Moses, PE | VOPC Member - Central Office |
| 4. Susan Miner | VOPC Member – Central Office |
| 5. Nyibe Smith | VOPC Member - East Central Field Office |
| 6. Bernard Proctor, PE | VOPC Member - Danville Field Office |
| 7. Thomas Thompson, PE | VOPC Member - Lexington Field Office |
| 8. Akshay Jain, PhD, EIT | VOPC Member - Culpeper Field Office |
| 9. David Dawson, PE | VOPC Member - Abingdon Field Office |

Description of *Former* AWOP Team Members:

Please provide the name of former AWOP team members, and their reason for leaving the team. This information is for historical purposes and also to support networking as AWOP continues to expand.

- | | |
|----------------------------|--|
| 1. Adam Marque | new job outside Office of Drinking Water |
| 2. Matthew Haun | replaced due to change of committee focus |
| 3. Roy Soto, PE | new position within Office of Drinking |
| Water | |
| | new position outside the Office of Drinking |
| | Water |
| 4. Randall Morrissette, PE | replaced due to time commitments |
| 5. James Reynolds, PE | new job outside Office of Drinking Water |
| | new position within Office of Drinking Water |
| 6. Michelle Caruthers, PE | new job outside Office of Drinking Water |
| 7. James Moore, PE | promotion/retirement |
| 8. Doug Meyer, PE | new job responsibilities |
| 9. Charles Rest, PE | new job responsibilities/retirement |
| 10. Bennett Ragnauth, PE | new job responsibilities |
| 11. Mike Painter, PE | retired |

12. Susan Douglas, PE
13. James Keating, PE

new job responsibilities/retirement
new job outside Office of Drinking Water

Inventory of State-Wide Treatment Facilities^{1*}	Number
Rapid rate filtration treatment plants ^{2,3}	93
Utilizing static settling without tubes or plates	61
Utilizing static settling with tubes or plates	16
Utilizing sludge blanket clarification (upflow, pulsator)	12
Utilizing contact adsorption clarification	9
Utilizing sludge recirculation (including ballasted clarification)	
Utilizing DAF, or other alternative clarification process	2
Utilizing direct/in-line filtration	
Utilizing packaged filtration (package plants)	6
Slow sand filter plants	
Diatomaceous earth filter plants	
Membrane treatment plants	44
Bag or cartridge filtration plants	3
Primary disinfectant	
Free chlorine	138
Chloramines	
Ozone	2
UV	1
Secondary disinfectant	
Free chlorine	68
Chloramines	21
¹ Limited to surface water treatment plants (includes surface, GUDI, blended sources). ² All surface water treatment plants, except cartridge, membrane and slow sand. ³ When a plant utilizes multiple treatment processes or configurations identified below, please include them all in this inventory, e.g., a package plant that utilizes a CAC will be included as a rapid rate plant using CAC and packaged filtration. *Four of six Field Offices Reporting	

AWOP Vision:

Please describe the vision for your AWOP

Virginia envisions the following:

1. Continuing with the existing turbidity optimization goals and awards program for granular media filtration water plants.
2. Implementing PBT DBP and/or Distribution System Optimization.
3. Considering adopting optimization goals for DBPs (TTHM and HAA5).

Status Component Implementation:

Please describe status component activities that are implemented in your agency, e.g., (are water systems ranked according to public health risk and how is this information used; how is water system data integrity ensured):

Division of Technical Services (DTS) through the ETT focuses on violators with climbing ETT scores.

Prioritizing additional implantation efforts toward those systems with health base violations (primarily DBPs).

Reinforcing data integrity during our site visits

Targeted Performance Improvement (TPI) Implementation:

Please list all activities that are implemented as TPI activities in your state, e.g., CPEs, PBT, Enhanced Sanitary Surveys, technical assistance, other):

PBT for DBPs, Sanitary Surveys, Targeted Technical Assistance.

Distribution system optimization (1 to 4 systems) in the 2019/2020 period. If indicated by system grouping (primary/consecutive), a Performance Based Training at a primary facility. We also desire to bring our newer staff up to speed with special studies so that they can encourage them during the Sanitary Surveys. Pilot having plant staff explain their OAS graphs to other operators.

AWOP Maintenance Component Implementation:

Integrate

Please check the following areas where AWOP has been integrated into the PWSS Program:

Plan Reviews_____ Permitting_____ Capacity Development__X__ Operator Training_____

Technical Assistance__X__ DWSRF Prioritization_____ Enforcement_____ Sanitary Surveys__X__

Other(identify)_____

Enhance

Please describe any AWOP enhancements that have been implemented in your program. One example could include modifying status component criteria

With the closing of the last WTP in the Commonwealth without filter to waste capability, we dropped the backwash criteria that dealt with that aspect. Namely the 15 minute limit for rewash times and the 0.3 NTU limit on the rewash water. We still encourage short rewash times just as an efficiency item, but put more emphases on only diverting to production water below 0.10 NTU.

Sustain

Please describe any activities that you implement to sustain your agency’s AWOP. Some examples could include efforts to promote and incentivize AWOP (e.g., publish regular newsletter, awards program, AWOP participation = higher ranking for grant/loan funding, etc.).

Virginia implements an annual conventional water plant awards program and utilizes sanitary surveys to increase water system awareness of the program and their performance.

Lessons Learned:

Please list “lessons learned” that you feel would be helpful to other programs, e.g., how to build and maintain internal support, how to integrate AWOP into your PWSS program, etc). If you are new to AWOP, please list a question or concern you’d like to know more about.

AWOP is implemented one plant at a time, over time. It takes a personal relationship between the state staff member and the water plant representative. It takes a mixture of peer pressure, personal hand-holding, encouragement, teaching, cajoling, etc. Plants that have adopted and are

meeting optimization goals have more margin for error and are rarely have compliance problems. Plants meeting optimization goals often have staff that understand in a detailed way how and why their plant works. They often know how to complete a special study, draw the graph, interpret their own data, and can learn from their experiences and mistakes.

Attachment I: Optimization Goals Adopted by the NOLT

Category	Goal	Applies to	Description
<i>Microbial</i>	Minimum Data Monitoring Goal Raw Water Turbidity	Rapid Rate Filtration Plants	— Record maximum daily raw water turbidity.
<i>Microbial</i>	Individual Sedimentation Basin Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Settled water turbidity ≤ 2 NTU in 95% of readings when the annual average raw turbidity is > 10 NTU. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Settled water turbidity ≤ 1 NTU in 95% of readings when the annual average raw turbidity is ≤ 10 NTU. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Record individual sedimentation basin effluent turbidity readings at intervals of 4-hours or less if taking grab samples, or 15 minutes or less for continuous monitoring.</p>
<i>Microbial</i>	Individual and Combined Filter Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Combined filter effluent turbidity ≤ 0.10 NTU in 95% of readings. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Individual filter effluent turbidity ≤ 0.10 NTU in 95% of readings (excluding 15-minute period following filter backwash). Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Post backwash individual filter effluent turbidity for filters <u>without</u> filter-to-waste capability: Maximum individual filter effluent turbidity following backwash ≤ 0.30 NTU and achieve ≤ 0.10 NTU within 15 minutes.</p> <p>— Post backwash individual filter effluent turbidity for filters <u>with</u> filter-to-waste capability: Minimize individual filter effluent turbidity during filter-to-waste period and record maximum value. Return the filter to service at ≤ 0.10 NTU.</p> <p>— Record individual and combined filter effluent turbidity readings at intervals of 1-minute or less for continuous monitoring.</p>
<i>Microbial</i>	Disinfection Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Meet CT requirements to achieve inactivation of <i>Giardia</i> and viruses plus a system-specific factor of safety.</p> <p>— Record disinfectant residual, temperature, and pH at maximum daily flow for CT calculations.</p>
<i>Disinfection By-Product</i>	Plant Effluent Disinfection Byproducts (DBPs) Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	<p>— System Specific Targets: Could be a discrete value or range that is based on a running annual average. Recommended goal value/range should be 30% to 50% of long term LRAA goals (e.g., 20-30 ppb for TTHM, 15-20 ppb for HAA5).</p> <p>— Collect quarterly TTHM and HAA5 samples at the plant effluent and distribution system compliance sites.</p>

<p><i>Disinfection By-Product</i></p>	<p>Enhanced Coagulation Performance and Monitoring Goals</p>	<p>Surface Water and Groundwater Under the Direct Influence of Surface Water Plants</p>	<p>—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 running annual average (RAA) of the performance ratio (actual TOC removal/required TOC removal) plus a factor of safety of 10% (or performance ratio ≥ 1.1).</p> <p>—Collect monthly total organic carbon samples for raw and treated water (only applies to parent systems).</p>
<p><i>Disinfection By-Product</i></p>	<p>Disinfection Performance and Monitoring Goal</p>	<p>Surface Water and Groundwater Under the Direct Influence of Surface Water Plants</p>	<p>—Meet CT requirements to achieve inactivation of <i>Giardia</i> and viruses plus a system-specific factor of safety.</p> <p>—Record disinfection residual, temperature, and pH at maximum daily flow for CT calculations (only applies to parent systems).</p>
<p><i>Distribution System</i></p>	<p>Disinfection Byproducts Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize any Secondary Disinfectant</p>	<p>—Individual Site Goal: Quarterly Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 70/50 ppb. —Long-Term System Goal: Average of Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 60/40 ppb (the average of the last 8 quarters cannot exceed 60/40 ppb).</p> <p>—For systems in compliance with the TTHM and HAA5 MCLs, collect quarterly DBP samples at all compliance locations; for systems not in compliance, collect monthly samples.</p>
<p><i>Free Chlorine Distribution System</i></p>	<p>Disinfection Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Free Chlorine as a Secondary Disinfectant</p>	<p>—Maintain ≥ 0.20 mg/L free chlorine residual at all monitoring sites in the distribution system, at all times.</p> <p>—Monitoring should be performed at least monthly, but more frequently at critical times (i.e., summer months).</p> <p>—Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites base on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total).</p>
<p><i>Plants that Utilize Chloramine</i></p>	<p>Disinfection: Ammonia Control Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>—Maintain a detectable free ammonia residual in the plant effluent ≤ 0.10 mg/L as NH₃-N.</p> <p>—Monitor free ammonia at <u>least</u> once per day in the plant effluent.</p> <ul style="list-style-type: none"> • The monitoring frequency may be adjusted based on the variability observed over an extended period of time. • Free ammonia may be monitored in the source water periodically (e.g., once per week) to assess variability.

<p><i>Plants that Utilize Chloramine</i></p>	<p>Operational Guideline Chlorine and Ammonia Dosing</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>— 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 ≤ 0.10 mg/L as $\text{NH}_3\text{-N}$.</p>
<p><i>Chloramine Distribution System</i></p>	<p>Disinfection: Monochloramine and Nitrification-Related Parameters Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>— Maintain ≥ 1.50 mg/L monochloramine residual at all monitoring sites in the distribution system, at all times, to provide a disinfection barrier against both microbial contamination and nitrification prevention.</p> <p>— Monitor monochloramine, free ammonia, and nitrite in the distribution system and at the entry points (to establish a baseline).</p> <ul style="list-style-type: none"> • Monochloramine and free ammonia should be monitored at <u>all sample locations</u>. • Nitrite should be monitored at sample locations where monochloramine is ≤ 1.50 mg/L; nitrate may also be monitored, to further assess nitrification. • Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites based on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total). • Monitoring should be done at least monthly, but more frequently at critical times (e.g., summer months).
<p><i>Distribution System</i></p>	<p>Operational Guidelines Tank Operations</p>	<p>Parent and Consecutive Water Systems that Contain Storage Tanks (any secondary disinfectant)</p>	<p>— Maintain an average turnover time < 5 days; or establish and maintain a water turnover rate at each storage facility.</p> <p>— Maintain good mixing (i.e., Performance Ratio ≥ 1) 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).</p>

Area Wide Optimization Program



**Individual Program
Background Information
2021**

WV-DHHR, Bureau for Public Health, Office of Environmental Health Services

Official Recognition of AWOP

WV Start Date: 2004 along with Region 3. Program exposure in WV Rural Water Assn magazine, multiple seminars, Awards Program, and integration w/Operator Certification Program courses/classes

Official Adoption of AWOP Goals

WV Goals adopted in 2004 for settled water and CFE only. Communication of goals is accomplished in annual WTP site visit reports, and on Turb-OPT summary chart shared with PWSs. Achieving goals, SNSV deficiencies, past violations are reviewed for the awards program.

National Optimization Goals adopted by your PWSS Program – Check all that apply:

Water Treatment Plants

Microbial (Turbidity): Raw Water ____ Individual Settled CFE IFE ____

Post BW w/FTW ____ Post BW wo/FTW ____ Disinfection (CT) ____

DBPs (TTHM/HAA5): Plant Effluent ____ Enhanced Coagulation ____ Disinfection ____

Chloramine Application: Ammonia Control ____ Dosing (Chlorine & Ammonia) ____

Distribution Systems*

Individual Site DBPs ____ Long Term System DBPs ____ Tank Operations ____

Secondary Disinfection, Free Chlorine ____

Secondary Disinfection, Chloramines (monochloramine, Ammonia & Nitrite) ____

*West Va encourages PWS to establish site specific and circulate NOLT goals

Modifications to the national goals or other optimization goals utilized by your Agency:

85% water accountability target is a sister agency goal is promoted in reports.

Post BW return-to-service goals discussed with individual PWS on-site

Description of *Current* AWOP Team Members and Responsibilities

1. Initial Contact: AWOP Team Co-Leader: Mike Hawranick, P. E., District Engineer, PBT Trainer/Facilitator, 0.1 FTE (located in Fairmont District Office)
2. AWOP Team Co-Leader: JD Douglas, P. E., District Office Coordinator, PBT Trainer/Facilitator, < 0.1 FTE (located in St Albans District Office)
3. Alan Marchun, District Engineer, E.I.T, PBT Facilitator, < 0.1 FTE (role limited/staff reduction Kearneysville District Office)
4. Seth Myers, Ph. D., Environmental Resource Specialist 2, PBT Facilitator, < 0.1 FTE (limited role located in Fairmont District Office)

Others:

Bertis McCarty, WV Rural Water Assn. Circuit Rider, DSO facilitator, Mary Hutson, WV RCAP Executive Director, co-presenter, Meredith Vance, WV BPH-OEHS-EED acting director 2019

Description of *Former (since 219)* AWOP Team Members:

2. Brad Reed, Richard Snider, Craig Cobb, district office engineers retired
3. 2 other District Office engineers performing > 1 job position.

Inventory of State-Wide Treatment Facilities¹	Number
Rapid rate filtration treatment plants ^{2,3}	113
Utilizing static settling without tubes or plates	33
Utilizing static settling with tubes or plates	67
Utilizing sludge blanket clarification (upflow, pulsator)	2
Utilizing contact adsorption clarification	5
Utilizing sludge recirculation (including ballasted clarification)	0
Utilizing DAF, or other alternative clarification process	1
Utilizing direct/in-line filtration	5

Utilizing packaged filtration (package plants)	12
Slow sand filter plants	1
Diatomaceous earth filter plants	0
Membrane treatment plants	8
Bag or cartridge filtration plants	0
Primary disinfectant	
Free chlorine	113
Chloramines	0
Ozone	
UV	
Secondary disinfectant	
Free chlorine	
Chloramines	
¹ Limited to surface water treatment plants (includes surface, GUDI, blended sources). ² All surface water treatment plants, except cartridge, membrane and slow sand. ³ When plant utilizes multiple treatment processes or configurations identified below, include all in inventory, e.g., a package plant that utilizes a CAC will be included as a rapid rate plant using CAC and packaged filtration.	

AWOP Vision:

Continue as a platform to promote “Public Health Protection” to PWSs & agency personnel. W. Va. AWOP vision includes: (1) Using tools provided to prioritize our agency’s efforts/assets, (2) Encourage use of the tools/concepts by PWSs, (3) Review new trends/tools and include in program functions as appropriate, & (4) Continue dialogue with the AWOP network.

Status Component Implementation:

Data is transferred by DW staff from MORs to OAS (turbOPT), compiled along w/ recent violations (including new understanding of the 14 TT HB violations) & un-resolved SNSV significant deficiencies. Individual scorecards are generated, and a master list is compiled and shared in-house, with tech assistance providers, and individual water systems.

Targeted Performance Improvement (TPI) Implementation:

PBTs: (on a 1 on 1 basis, previously: microbial & DBP), enhanced Sanitary Surveys, Site Visits, & technical assistance. Technical Assistance: Currently promote “Special Studies” for lead and disinfectant residual improvement.

AWOP Maintenance Component Implementation:

Integrate

AWOP has been “partially” integrated into the PWSS Program:

Plan Reviews_X___ Permitting_X___ Capacity Development____ Operator Training__X___

Technical Assistance __X__ DWSRF Prioritization __X__ Enforcement _X___ Sanitary Surveys __X___

Other(identify)_____

Enhance

AWOP enhancements implemented.

New focus on tracking quarterly HB violations & QA for potential violations. Set a HB vio goal in 1 district. Previously added settled water to our MORs. Envision adding IFE and trend charts to surface water MOR's.

Sustain

Implementation activities to sustain AWOP.

Promote DSO best practices, continue awards program, seminar presentations, & continue to share microbial status component.

Lessons Learned:

1. Share success stories/award winners/high public health risk PWSs with DW staff
2. Gains (and losses) are made 1 PWS & one DW employee at a time.

3. Data based decision = good.

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<i>Microbial</i>	Individual Sedimentation Basin Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Settled water turbidity ≤ 2 NTU in 95% of readings when the annual average raw turbidity is > 10 NTU. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Settled water turbidity ≤ 1 NTU in 95% of readings when the annual average raw turbidity is ≤ 10 NTU. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Record individual sedimentation basin effluent turbidity readings at intervals of 4-hours or less if taking grab samples, or 15 minutes or less for continuous monitoring.</p>
<i>Microbial</i>	Individual and Combined Filter Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Combined filter effluent turbidity ≤ 0.10 NTU in 95% of readings. Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Individual filter effluent turbidity ≤ 0.10 NTU in 95% of readings (excluding 15-minute period following filter backwash). Optimization is based on the daily maximum values recorded from all readings.</p> <p>— Post backwash individual filter effluent turbidity for filters <u>without</u> filter-to-waste capability: Maximum individual filter effluent turbidity following backwash ≤ 0.30 NTU and achieve ≤ 0.10 NTU within 15 minutes.</p> <p>— Post backwash individual filter effluent turbidity for filters <u>with</u> filter-to-waste capability: Minimize individual filter effluent turbidity during filter-to-waste period and record maximum value. Return the filter to service at ≤ 0.10 NTU.</p> <p>— Record individual and combined filter effluent turbidity readings at intervals of 1-minute or less for continuous monitoring.</p>
<i>Microbial</i>	Disinfection Performance and Monitoring Goals	Rapid Rate Filtration Plants	<p>— Meet CT requirements to achieve inactivation of <i>Giardia</i> and viruses plus a system-specific factor of safety.</p> <p>— Record disinfectant residual, temperature, and pH at maximum daily flow for CT calculations.</p>
<i>Disinfection By-Product</i>	Plant Effluent Disinfection Byproducts (DBPs) Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	<p>— System Specific Targets: Could be a discrete value or range that is based on a running annual average. Recommended goal value/range should be 30% to 50% of long term LRAA goals (e.g., 20-30 ppb for TTHM, 15-20 ppb for HAA5).</p> <p>— Collect quarterly TTHM and HAA5 samples at the plant effluent and distribution system compliance sites.</p>

<p><i>Disinfection By-Product</i></p>	<p>Enhanced Coagulation Performance and Monitoring Goals</p>	<p>Surface Water and Groundwater Under the Direct Influence of Surface Water Plants</p>	<p>—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 running annual average (RAA) of the performance ratio (actual TOC removal/required TOC removal) plus a factor of safety of 10% (or performance ratio ≥ 1.1).</p> <p>—Collect monthly total organic carbon samples for raw and treated water (only applies to parent systems).</p>
<p><i>Disinfection By-Product</i></p>	<p>Disinfection Performance and Monitoring Goal</p>	<p>Surface Water and Groundwater Under the Direct Influence of Surface Water Plants</p>	<p>—Meet CT requirements to achieve inactivation of <i>Giardia</i> and viruses plus a system-specific factor of safety.</p> <p>—Record disinfection residual, temperature, and pH at maximum daily flow for CT calculations (only applies to parent systems).</p>
<p><i>Distribution System</i></p>	<p>Disinfection Byproducts Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize any Secondary Disinfectant</p>	<p>—Individual Site Goal: Quarterly Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 70/50 ppb. —Long-Term System Goal: Average of Maximum Locational Running Annual Average TTHM/HAA5 values not to exceed 60/40 ppb (the average of the last 8 quarters cannot exceed 60/40 ppb).</p> <p>—For systems in compliance with the TTHM and HAA5 MCLs, collect quarterly DBP samples at all compliance locations; for systems not in compliance, collect monthly samples.</p>
<p><i>Free Chlorine Distribution System</i></p>	<p>Disinfection Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Free Chlorine as a Secondary Disinfectant</p>	<p>—Maintain ≥ 0.20 mg/L free chlorine residual at all monitoring sites in the distribution system, at all times.</p> <p>—Monitoring should be performed at least monthly, but more frequently at critical times (i.e., summer months).</p> <p>—Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites base on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total).</p>
<p><i>Plants that Utilize Chloramine</i></p>	<p>Disinfection: Ammonia Control Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>—Maintain a detectable free ammonia residual in the plant effluent ≤ 0.10 mg/L as NH₃-N.</p> <p>—Monitor free ammonia at <u>least</u> once per day in the plant effluent.</p> <ul style="list-style-type: none"> • The monitoring frequency may be adjusted based on the variability observed over an extended period of time. • Free ammonia may be monitored in the source water periodically (e.g., once per week) to assess variability.

<p><i>Plants that Utilize Chloramine</i></p>	<p>Operational Guideline Chlorine and Ammonia Dosing</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>—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 ≤ 0.10 mg/L as NH₃-N.</p>
<p><i>Chloramine Distribution System</i></p>	<p>Disinfection: Monochloramine and Nitrification-Related Parameters Performance and Monitoring Goals</p>	<p>Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant</p>	<p>—Maintain ≥ 1.50 mg/L monochloramine residual at all monitoring sites in the distribution system, at all times, to provide a disinfection barrier against both microbial contamination and nitrification prevention.</p> <p>—Monitor monochloramine, free ammonia, and nitrite in the distribution system and at the entry points (to establish a baseline).</p> <ul style="list-style-type: none"> • Monochloramine and free ammonia should be monitored at <u>all sample locations</u>. • Nitrite should be monitored at sample locations where monochloramine is ≤ 1.50 mg/L; nitrate may also be monitored, to further assess nitrification. • Sample locations should include bacteriological and DBP compliance sites, all distribution system entry points (e.g., plant effluent, consecutive system connections), all tanks (preferably while draining), and identified critical sites based on investigative sampling (minimum of one critical site in each quadrant of the system, four sites total). • Monitoring should be done at least monthly, but more frequently at critical times (e.g., summer months).
<p><i>Distribution System</i></p>	<p>Operational Guidelines Tank Operations</p>	<p>Parent and Consecutive Water Systems that Contain Storage Tanks (any secondary disinfectant)</p>	<p>—Maintain an average turnover time < 5 days; or establish and maintain a water turnover rate at each storage facility.</p> <p>—Maintain good mixing (i.e., Performance Ratio ≥ 1) 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).</p>