Area Wide Optimization Program

North Carolina
Individual Program
Background Information
2019

Name of Agency:

North Carolina Department of Environmental Quality
Division of Water Resources / Public Water Supply Section

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.

NC's Program was started in late 1999. The Public Water Supply Section maintains a webpage (http://deq.nc.gov/about/divisions/water-resources/drinking-water/area-wide-optimization-program) that describes AWOP and contains links to our annual report, spreadsheet tools, and instructional videos. Microbial Turbidity Awards are presented annually to water treatment plants that meet the microbial goals.

Official Adoption of AWOP Goals

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

AWOP goals are discussed by the NC AWOP team and then further reviewed by Public Water Supply Section management staff for formal adoption. Information about adopted goals can be located on the NC AWOP webpage. The NC AWOP Team and Public Water Supply Section staff discuss AWOP goals with water systems during sanitary surveys or site visits. Staff may also periodically discuss AWOP activities at NCWOA regional section meetings. Microbial turbidity goals for raw water, individual settled, CFE, and IFE were adopted at the start of program in late 1999. Distribution system disinfection byproducts goals for individual sampling sites and long-term system goals were adopted in 2013.

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_**X**_ Individual Settled_**X**__ CFE__**X**_ IFE__**X**_
Post BW w/FTW__**X**_ Post BW wo/FTW____ Disinfection (CT) __**X**_

DBPs (TTHM/HAA5): Plant Effluent____ Enhanced Coagulation____ Disinfection____

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

Distribution Systems

Individual Site DBPs __**X**_ Long Term System DBPs__**X**_ 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.

NA

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.
Example: Nevel O. Meter, District Engineer, PBT trainer, ~ 0.3 FTE

(Note that if you submitted this information in 2017, that information is being provided and if there are no changes, simply indicate "no change" in this section.)

1. AWOP Team Leader: Eric Hudson P.E., Regional Engineer/Supervisor, ~ 0.20 FTE
2. Rebecca Sadosky PHD, Drinking Water Protection Program Coordinator, Security and Emergency Management Contact, Program Statistical Advisor, Past AWOP Team Leader, CPE Certified, ~ 0.05 FTE
3. Kimberly Barnett, Regional Engineer/Supervisor, Regional Technical Advisor, ~ 0.05 FTE
4. Mark Hahn, Environmental Senior Specialist, Regional Technical Adviser, DBP PBT Facilitator Past AWOP Team Leader, CPE Certified, ~ 0.05 FTE
5. Turner Morrison, Environmental Engineer, Disinfection Byproducts Rule Manager, ~0.05 FTE
6. Clif Whitfield P.G., Engineering Associate, Regional Technical Advisor, DBP PBT Facilitator, ~ 0.05 FTE
7. Brad Whitman, Environmental Engineer, Central Office Technical Advisor, ~0.05 FTE
8. Tommy Overby, Environmental Senior Specialist, Regional Technical Adviser, ~ 0.05 FTE
9. Lauren Plummer, Environmental Engineer, Central Office Technical Advisor, ~0.05 FTE
10. Meredith Guglielmi, Assistant Regional Engineer, Regional Technical Advisor, ~ 0.05 FTE
11. Emily Lester, Environmental Engineer, Surface Water Rule Manager, ~0.05 FTE
12. Nicole Hairston, Environmental Senior Specialist, Regional Technical Adviser, ~ 0.05 FTE

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.

(Note that if you submitted this information in 2017, that information is being provided and if there are no changes, simply indicate "no change" in this section.)

1. Fred Hill, 1999 to 2008, Retirement
2. Ray McCall, 1999 to 2010, Retirement
3. Sandy O'Daniel, 1999 to 2006, Left State Service
4. Terry Gross, 2000 to 2002, Retirement
5. Jim Adams, 2000 to 2014, Retirement
6. Bobby Whisnant, 2002 to 2004, Left State Service
7. Jeff Bryan, 2002 to 2005, Transitioned to other job duties
8. Barry Aderton, 2003 to 2004, Left State Service
9. Brad Cole, 2004 to 2006, Left State Service
10. Lisa Edwards, 2006 to 2014, Filled another state position
11. David Tawes, 2006 to 2008, Left State Service
12. Mike Hicks, 2006 to 2007, Transitioned to other job duties

13. Clinton Cook, 2009 to 2014, Transitioned to other job duties
14. Steve Proctor, 2009 to 2014, Transitioned to other job duties
15. Forina Brown, 2013 to 2015, Left State Service
16. Chandler Warner, 2014 to 2014, Filled another state position
17. Julia Cavalier, 2006 to 2016, Transitioned to other job duties
18. Shawn Guyer, 2013 to 2016, Transitioned to other job duties
19. Keri Cantrell, 2014-2015, Left State Service
20. Paul Judge, 2014-2015, Left State Service - deceased
21. Tom Boyd, 2007-2017, Retirement
22. Andrew Jarman, 2014-2018, Transition to other job duties
23. Don Price, 2014 to 2019, Retirement
24. Tiffanie Hawley, Left State Service

Inventory of State-Wide Treatment Facilities[1]	Number
Rapid rate filtration treatment plants[2,3]	145
Utilizing static settling without tubes or plates	91
Utilizing static settling with tubes or plates	33
Utilizing sludge blanket clarification (upflow, pulsator)	25
Utilizing contact adsorption clarification	3
Utilizing sludge recirculation (including ballasted clarification)	1
Utilizing DAF, or other alternative clarification process	2
Utilizing direct/in-line filtration	2
Utilizing packaged filtration (package plants)	19
Slow sand filter plants	0
Diatomaceous earth filter plants	0
Membrane treatment plants	4
Bag or cartridge filtration plants	0
Primary disinfectant	
Free chlorine	146
Chloramines	0
Ozone	3
UV	0
Secondary disinfectant	
Free chlorine	107
Chloramines	42

[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.

AWOP Vision:

Please describe the vision for your AWOP

The NC AWOP Program provides technical assistance so water systems can improve and optimize water quality. We have developed ranking tools to identify water systems that may benefit from AWOP. We recently sent technical assistance letters to water systems that have difficulty consistently maintaining compliance with the Stage 2 Disinfection Byproducts (DBP) Rule.

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):

The PWS Section's microbial and turbidity plant ranking scores were revised in 2014 to better reflect which systems are struggling with violations and higher finished water turbidities. Emphasis was placed on both violations and finished water turbidity, as these two parameters

most directly affect public health, and therefore are of greatest concern. For example, the average monthly finished water turbidity for a system is multiplied by 100, while the average settled turbidity is only multiplied by 3.16, giving the finished water turbidity more weight than the settled water turbidity in the revised ranking scores. The lower the water plant's ranking score, the better their performance on turbidity and microbial indicators.

Disinfection byproducts present a significant challenge to water systems in North Carolina. The NC AWOP bases its prioritization for DBPs on locational running annual averages (LRAA) of total trihalomethanes (TTHM) and haloacetic acids (HAA5). DBP performance data is evaluated for surface water and surface water purchase systems required to sample for DBPs.

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):

CPEs, Microbial PBT, DBP PBT, Technical Assistance, Mini CPEs

AWOP Maintenance Component Implementation:

Integrate

Please check the following areas where AWOP has been integrated into the PWSS Program:
Plan Reviews_____ Permitting_____ Capacity Development_____ Operator Training__**X**__ Technical Assistance__**X**__ DWSRF Prioritization_____ Enforcement_____ Sanitary Surveys____ Other(identify)_____

Enhance

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

_____
_____
_____
_____

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.).

In 2018, the NC AWOP had eleven staff participants from the PWS Section who worked to sustain the program by participating in varying activities such as, evaluating system capabilities and providing technical training to systems. The PWS Section issues annual certificates to facilities that meet the AWOP optimization goals for settled and finished water turbidity. The awards reflect the number of years that a plant has achieved optimized status and may also include special recognition for plants that have received the award for 10 consecutive years or more. In many communities, the achievement of the AWOP goals and certificate award has been reported by the local media. The NC Department of Environmental Quality issues a press release recognizing the water systems for winning the award and surpassing federal and state drinking water standards. AWOP Team members and Public Water Supply staff often present awards at NCWOA / NC AWWA-WEA events or local

meetings with the water systems' governing bodies. NC AWOP team members participate in EPA Region 4 AWOP meetings and activities to further our knowledge, experience and understanding of the AWOP philosophies. Funding has been made available for the purchasing of equipment and for traveling to meetings or conducting optimization activities.

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.

It is important to quantify benefits and results of AWOP activities to be able to justify staff involvement. Additionally, if plant personnel and management have not "bought in" to the AWOP, then the benefits of the AWOP may not be fully realized.

Participating in a multi-state CPE is a great way to get AWOP experience. In addition, it facilitates discussion with colleagues to share experiences on improving water treatment and water quality.

Conducting special studies (distribution mapping with hydrant sampler) provide training opportunities for staff to gain experience using AWOP tools.

Providing a professional printed and framed AWOP award instills pride and may motive surrounding water systems to seek the award. Posting pictures of award presentations on agency social media is a great way to build awareness.

Attachment I: Optimization Goals Adopted by the NOLT

Category	Goal	Applies to	Description
Microbial	Minimum Data Monitoring Goal Raw Water Turbidity	Rapid Rate Filtration Plants	— Record maximum daily raw water turbidity.
Microbial	Individual Sedimentation Basin Performance and Monitoring Goals	Rapid Rate Filtration Plants	— 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. — 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. — 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.
Microbial	Individual and Combined Filter Performance and Monitoring Goals	Rapid Rate Filtration Plants	— Combined filter effluent turbidity ≤ 0.10 NTU in 95% of readings. Optimization is based on the daily maximum values recorded from all readings. — 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. —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. —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. — Record individual and combined filter effluent turbidity readings at intervals of 1-minute or less for continuous monitoring.
Microbial	Disinfection Performance and Monitoring Goals	Rapid Rate Filtration Plants	—Meet CT requirements to achieve inactivation of *Giardia* and viruses plus a system-specific factor of safety. — Record disinfectant residual, temperature, and pH at maximum daily flow for CT calculations.
Disinfection By-Product	Plant Effluent Disinfection Byproducts (DBPs) Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—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). —Collect quarterly TTHM and HAA5 samples at the plant effluent and distribution system compliance sites.
Disinfection By-Product	Enhanced Coagulation Performance and Monitoring Goals	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—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). —Collect monthly total organic carbon samples for raw and treated water (only applies to parent systems).
Disinfection By-Product	Disinfection Performance and Monitoring Goal	Surface Water and Groundwater Under the Direct Influence of Surface Water Plants	—Meet CT requirements to achieve inactivation of *Giardia* and viruses plus a system-specific factor of safety. —Record disinfection residual, temperature, and pH at maximum daily flow for CT calculations (only applies to parent systems).

Distribution System	Disinfection Byproducts Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize any Secondary Disinfectant	—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). —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.
Free Chlorine Distribution System	Disinfection Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Free Chlorine as a Secondary Disinfectant	—Maintain ≥ 0.20 mg/L free chlorine residual at all monitoring sites in the distribution system, at all times. —Monitoring should be performed at least monthly, but more frequently at critical times (i.e., summer months). —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).
Plants that Utilize Chloramine	Disinfection: Ammonia Control Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—Maintain a detectable free ammonia residual in the plant effluent ≤ 0.10 mg/L as NH3-N. —Monitor free ammonia at <u>least</u> once per day in the plant effluent. • 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.
Plants that Utilize Chloramine	Operational Guideline Chlorine and Ammonia Dosing	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—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.
Chloramine Distribution System	Disinfection: Monochloramine and Nitrification-Related Parameters Performance and Monitoring Goals	Parent and Consecutive Water Systems that Utilize Chloramine as a Secondary Disinfectant	—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. —Monitor monochloramine, free ammonia, and nitrite in the distribution system and at the entry points (to establish a baseline). • 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 base 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).
Distribution System	Operational Guidelines Tank Operations	Parent and Consecutive Water Systems that Contain Storage Tanks (any secondary disinfectant)	—Maintain an average turnover time < 5 days; or establish and maintain a water turnover rate at each storage facility. —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).