Area Wide Optimization Program

Individual Program Background Information 2019

Name of Agency: Louisiana Department of Health (LDH)

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: 1995 (state-only), 1999 (Region 6 AWOP started).
Website: http://dhh.louisiana.gov/index.cfm/page/435

Official Adoption of AWOP Goals

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

Louisiana's AWOP formally adopted its Optimized Performance Goals in January 2000. The goals that were adopted were microbial only. Optimized performance goals for DBPs were proposed under the AWOP program, but never formally adopted/transmitted to plants. Louisiana's Optimized Performance Goals are included the table below – Louisiana AWOP Optimized Performance Goals. Immediately following the goals adoption, letters were sent to all SWTPs in the state (along with the first year of their performance data for FY99). The letter outlined the state's optimized performance goals and asked that individual facilities adopt these goals. The intent was to send annual AWOP update letters to each SWTP to summarize the AWOP activities performed during the previous year and provide each system with their performance data covering the previous year in the form of the *OAS* Summary Charts. Letters were also to reinforce the Louisiana Optimized Performance Goals and asked systems to adopt the goals as their own. These letters were last sent on a yearly basis when LDH had an active program with multiple yearly field activities in the state (in FY08). Since 2008, LDH's AWOP consisted primary of attending quarterly EPA meetings and keeping yearly OAS spreadsheets updated.

With LDH hiring many new engineers, the decision was made to undergo "new state" training, and Process Applications, Inc. (PAI) was hired to assist. Session 1 (Optimization activities), Session 2 (AWOP kickoff) and Sessions 3-4 (CPEs at a SWTP) were held with 12-15 LDH staff members over the period from May 2018 – April 2019. In Session 2, held in June 2018, revisiting and reestablishing the LDH Status component was discussed. While not yet done, the plan is to review/reestablish Louisiana's status component, considering the following:

- Consider including IFE in OAS yearly plant data (add to monthly MORs),
- Revisit/reestablish optimized performance goals and retransmit to plants (letter?) asking them to adopt the goals,
- Update prioritization criteria and complete a yearly ranking using plant MOR/Eturb submissions. (NOTE: Eturb is a monthly spreadsheet developed by LDH, allowing plants to electronically submit their raw, max settled and max CFE data).

National Optimization Goals <u>adopted</u> by your PWSS Program – Check all that apply:
(refer to Attachment I for descriptions of the NOLT optimization goals.)

<u>Water Treatment Plants</u>

Microbial (Turbidity): Raw Water__X__ Individual Settled__X__ CFE__X__ IFE____
Post BW w/FTW__X__ Post BW wo/FTW__X__ Disinfection (CT) __X__

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

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

<u>Distribution Systems</u>

Individual Site DBPs ____ Long Term System DBPs____ Tank Operations____
Secondary Disinfection, Free Chlorine ____
Secondary Disinfection, Chloramines (monochloramine, Ammonia & Nitrite) ____

Louisiana AWOP Optimized Performance Goals (as adopted in 2000)

A Surface Water Treatment Plant is considered optimized if it meets the following <u>Area-Wide Optimization Program (AWOP) Optimized Performance Goals</u>:

<u>Minimum Data Monitoring Requirements:</u>

- Daily raw water turbidity
- Settled water turbidity at 4-hour increments from sedimentation basin
- Continuous on-line turbidimeter on individual filters
- A monthly filter post-backwash profile for each filter

<u>Sedimentation Performance Goals</u>:

- If the system's annual average raw water turbidity is > 10 NTU, the settled water turbidity goal is < 2 NTU 95% of the time
- If the system's annual average raw water turbidity is ≤ 10 NTU, the settled water turbidity goal is < 1 NTU 95% of the time

<u>Filtration Performance Goals (for plants with Filter-To-Waste capability)</u>:

- Maintain a turbidity of ≤ 0.10 NTU 95-percent of the time from individual filters (based on maximum values recorded during 4-hour increments), excluding backwash and filter-to-waste periods.
- Return filters to service, after filter-to-waste, at a turbidity of less than 0.10 NTU
- Initiate filter backwash when turbidity exceeds 0.10 NTU
- No individual filtered water measurements greater than 0.30 NTU

<u>Filtration Performance Goals (for plants without Filter-To-Waste capability)</u>:

- Maintain a turbidity of ≤ 0.10 NTU 95-percent of the time, excluding the 15-minute period following backwash (based on maximum values recorded during 4-hour increments)
- Maximum filtered water turbidity following backwash of 0.3 NTU, return to ≤ 0.10 NTU within 15 minutes (based on maximum values recorded during 4-hour increments)
- Initiate filter backwash when turbidity exceeds 0.10 NTU

<u>Disinfection Performance Goals</u>:

- The plant must meet the CT (disinfectant Concentration multiplied by Time) values necessary to achieve the specific log inactivation of *Giardia* cysts and Viruses required by Louisiana's SWTR

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.
None.

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

LDH Team Leaders (Facilitates AWOP Activities):
Alicia Martinez – LDH District 1 Engineer, AWOP Program Manager (LA AWOP POC)
Julie Z. LeBlanc – LDH AWOP Contractor

LDH Team Members (Participates in AWOP Activities):
Parker Allen – LDH Region 1
Daniella Manual – LDH Central Office
Clark Broussard – LDH Region 2
Sally Collins – LDH Central Office
Rory Dobbs – LDH Region 8
Jacob Haffner – LDH District 2
Spencer Hilyard, LDH Central Office
Steven Joubert – LDH District 3
Tyler Lollis, LDH Region 8
James Soileau, LDH Region 7
Dan MacDonald – LDH DWRLF Contract Lead

LDH Management (AWOP Support and Guidance):
Amanda (Laughlin) Ames – LDH Chief Engineer
John Williams – LDH Deputy Chief Engineer of Field Operations (Southeast Louisiana)
Jennifer Kihlken – LDH Deputy Chief Engineer of Field Operations (Northwest and North Louisiana)
Caryn Benjamin – LDH Deputy Chief Engineer of Compliance and Enforcement


WATERWORKS DISTRICT NO.
TERREBONNE PARISH LOUISIANA

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.

Clay Bowers - LDH, retired
Clyde Carlson - LDH, retired
Vincent Fouchi - No longer Corps-LDH team effort (S&WBNO)
Steven Hoffman - Moved to Oklahoma
Rodney Mach - No longer Corps-LDH team effort (Corps)
Effie Michalos - LDH, retired
Sean Mickal - No longer Corps-LDH team effort (Corps)
Earl Paddock - left LDH to work for another state agency
Marvin Russell - No longer Corps-LDH team effort (S&WBNO)
Kendall Smith - No longer Corps-LDH team effort (Corps)
Brandon Taylor - left Engr Section to work for Sanitarian Services
Guy Dietrich - LDH, retired
Jake Causey - Left LDH
Steven Davis - Left LDH
Chris Soileau - Left LDH
Eugene Bradley - Left LDH

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

To rekindle the AWOP program in Louisiana so that it is capable of having a profound effect on the safety (in terms of public health protection) of drinking water provided to the citizens of Louisiana.

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):

Status Component will be revisited/reestablished in the near future.

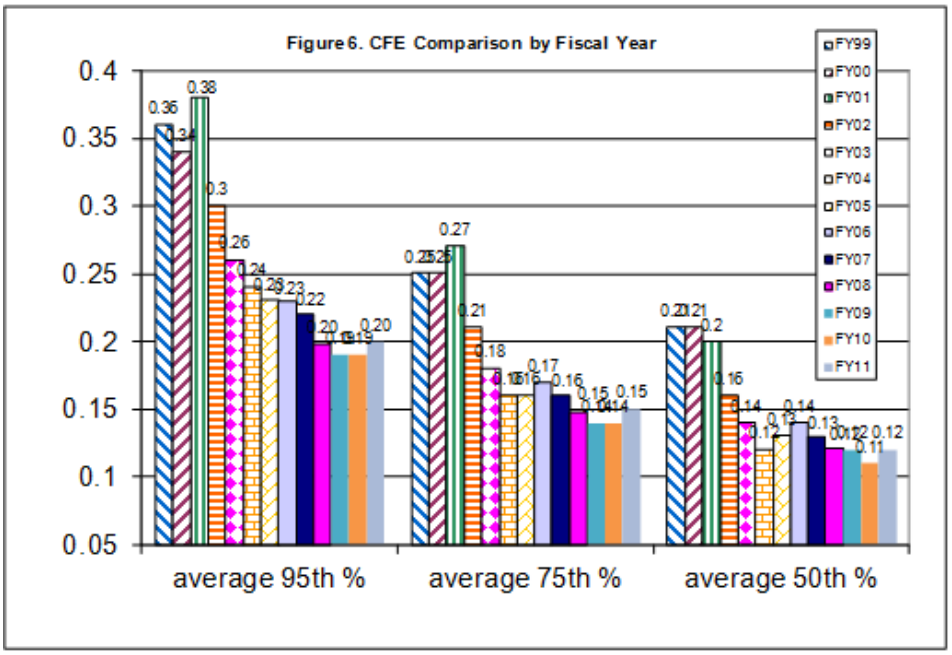
Prioritization criteria were developed by Louisiana AWOP in support of the "Status" component's SWTP Turbidity-Based Plant Ranking. The criteria are used to (annually) rank all of the state's SWTPs based upon potential risk to public health from lack of system optimization. The ranking is then used by Louisiana AWOP to assist in determining where to prioritize the appropriate "Evaluation" and "Follow Up" (now called "TPI") AWOP activities in the state of Louisiana. The Louisiana prioritization criteria are shown in the below table. While the state's program has been inactive there has not been a need for a yearly ranking to prioritize where AWOP activities should take place within the state; therefore, while data entry is completed for some years, a yearly ranking has not been developed. Most recent status of the ranking process is noted below:

- Thirteen years of individual plant performance data (raw, settled, and combined filter effluent (CFE) turbidities) have been compiled under the "Status" component. The final FY11 plant ranking has been completed (13th year of data). This latest ranking has been posted to the LDH AWOP website (http://www.dhh.state.la.us/index.cfm/page/435.
- Louisiana's 6th Summary Report (covering FY09, FY10 and FY11) has been completed.
- FY12 and FY13 data entry is completed. Draft versions of this data was submitted to EPA TSC to support the National AWOP turbidity graph.
- FY14/15/16 data entry incomplete. Once OAS spreadsheets are completed, the FY12-16 rankings to be transmitted to LDH Central Office/regional staff prior to finalizing.
- FY10-16 plant rankings & OAS will be sent to plants in the future.

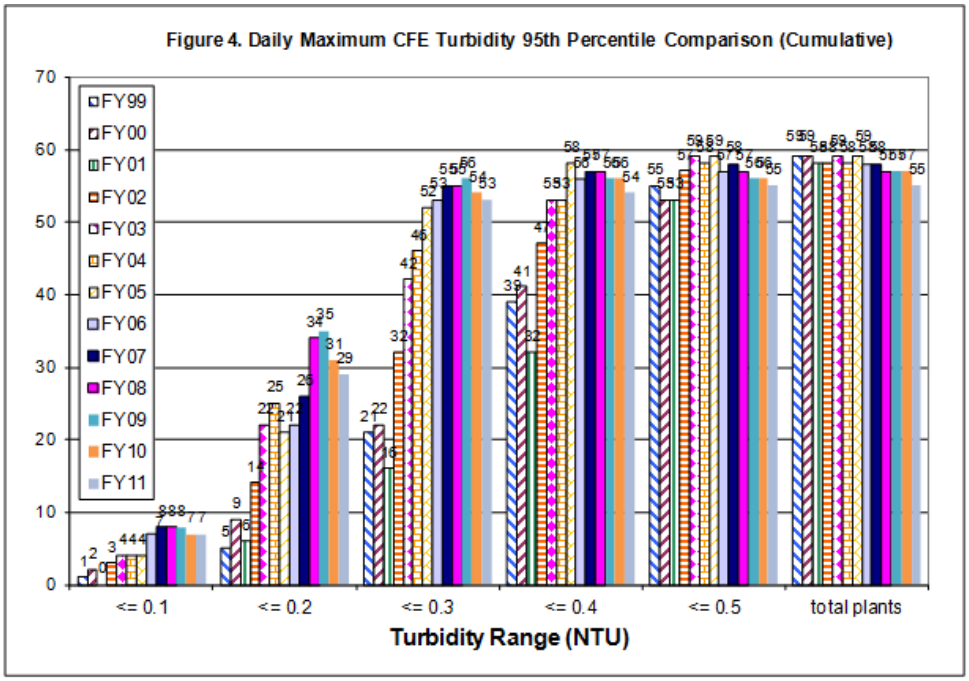
Of particular interest in the state of Louisiana is the presence of the *Naegleria fowleri* amoeba. LDH continues to respond to the presence of this amoeba in finished water within the state. The emergency rule requiring higher levels of disinfection residuals and revised TCR monitoring plans was renewed in 2015. LDH is also continuing to monitor for the amoeba in public water systems to evaluate control parameters. To date amoeba has been found in the distribution system in seven plants: St. John the Baptist Parish #1 (Lions plant), St. Bernard Parish WW (repeat), Desoto Parish WW District#1, Ascension Parish, Schriever WTP (repeat), Ebarb Water District (Aimwell), and North Monroe Water System (repeat). Testing in Summer 2016 did not reveal presence in any distribution systems tested. Routine drinking water testing by the Louisiana Department of Health in Summer 2017 has confirmed the presence of Naegleria fowleri, an ameoba that occurs naturally in freshwater, in Ouachita Parish's North Monroe Water System and Terrebonne Parish's Schriever Water System. More information can be found at: http://www.ldh.la.gov/index.cfm/page/1696.

While somewhat outdated (tracked thru FY11), the impact of AWOP to Louisiana's SWTPs over the thirteen-year period in which LDH has tracked plant performance is summarized below:

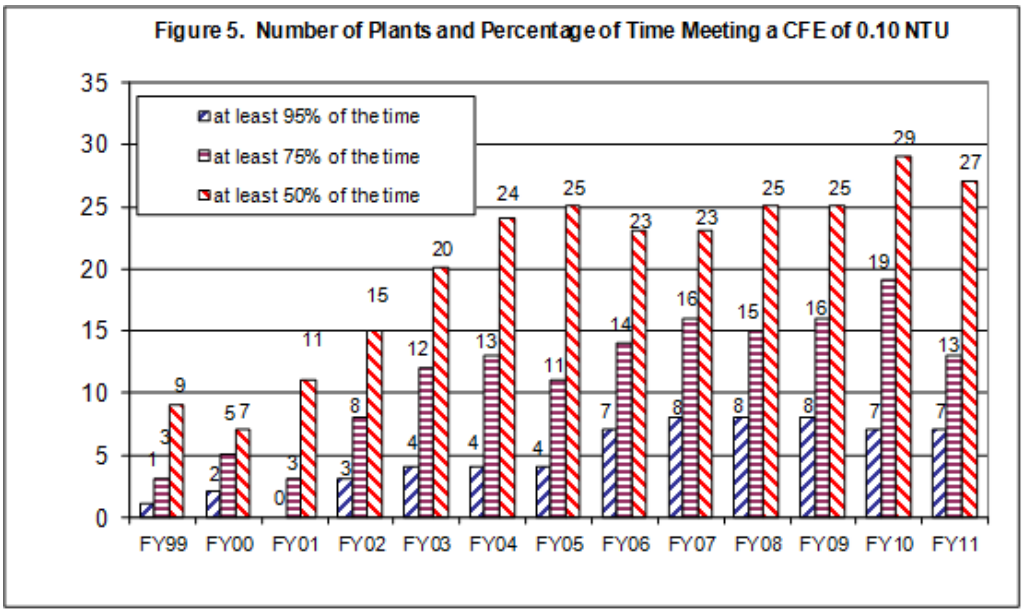
- The average 95th, 75th, and 50th CFE turbidity percentiles for the state's 59 SWTPs have declined (see figure 6 below):
  - The average 95th percentile for the state's SWTPs was 0.36 NTU in FY99 compared to 0.20 NTU in FY11
  - The average 75th percentile for the state's SWTPs was 0.25 NTU in FY99 compared to 0.15 NTU in FY11
  - The average 50th percentile for the state's SWTPs was 0.21 NTU in FY99 compared to 0.12 NTU in FY11



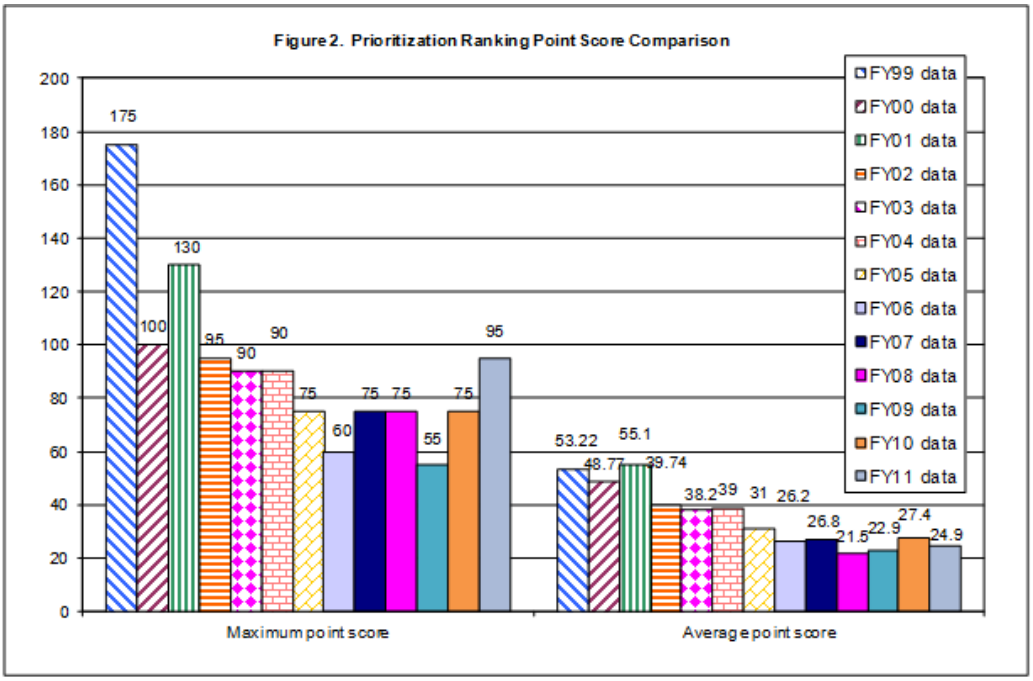
- The number of plants with a CFE of less than or equal to 0.30 NTU increased from twenty-one (21) plants in FY99 to fifty-three (53) plants in FY11 (see figure 4 below). This trend is not unexpected and is likely the result of more stringent regulations imposed during this time period requiring that all plants meet a finished water turbidity of 0.3 NTU versus 0.5 NTU.



- The number of plants meeting a CFE of 0.10 NTU (the AWOP optimized performance goal for CFE) at least 50% of the time has increased from nine (9) plants in FY99 to twenty-seven (27) plants in FY11 (see Figure 5). As this improvement trend cannot be as readily tied to a change in regulations, this trend is one of the most indicative when attempting to assess the positive impact of AWOP activities on the performance of Louisiana's SWTPs. Because the 0.10 NTU CFE performance goal is so far below the 0.3 NTU regulatory requirement, the fact that twenty-seven (27), or 49%, of Louisiana's SWTPs are meeting this goal 50% of the time in FY11 compared to nine (9), or 15%, in FY99 represents a dramatic increase in "optimized" performance levels and attitudes at Louisiana's SWTPs.



- The average prioritization point score used to rank the relative public health risk of an individual SWTP optimization-wise declined from an average of 53.22 points in FY99 to 24.9 points in FY11 (see figure 2 below).



Louisiana Prioritization Criteria
for Surface Water Treatment Plants

Performance related point scoring. The following points are considered to be "performance related" items and when summed are considered to be the performance related SUMMATION.

Criteria	Standard		Points
Finished Water Turbidity	if 95th percentile,	0 - 0.10 NTU	0
(combined effluent)		0.11 - 0.15 NTU	5
(choose one)		0.16 - 0.20 NTU	10
		0.21 - 0.25 NTU	15
		0.26 - 0.30 NTU	20
		0.31 - 0.35 NTU	25
		0.36 - 0.40 NTU	30
		0.41 - 0.45 NTU	35
		0.46 - 0.50 NTU	40
		0.51 - 0.55 NTU	45
		0.56 - 0.60 NTU	50
		0.61 - 0.70 NTU	60
		0.71 - 0.80 NTU	70
		0.81 - 0.90 NTU	80
		0.91 - 1.00 NTU	90
		> 1.01 NTU	100
If 95th percentile finished water turbidity = "blank" (this means system didn't report finished turbidity at all)			100
Settled Water Turbidity	if annual avg raw turbidity >10 NTU and		
(choose one)	settled turb ≤ 2 NTU, > 95% of time		0
		50-95% of time	5
		< 50% of time	10
	if annual avg raw turbidity ≤10 NTU and		
	settled turb ≤ 1 NTU, > 95% of time		0
		50-95% of time	5
		< 50% of time	10
If 95th percentile settled water turbidity = "blank" (this means system doesn't collect settled water turbidity at all			10
Finished Water Turbidity	maximum value during 1 year exceeds 0.5 NTU		10
(combined effluent)	maximum value during 1 year exceeds 1.0 NTU		20
Raw/settled/finished cause and effect	if a relationship is indicated		15
RSQ-Value Raw/Settled/Finished	if RSQ is "blank", meaning there is no settled water collected		15

(A Cause and Effect Relationship is determined from the RSQ Value indicated on the Optimization Assessment Software (OAS) – Treatment Barrier Performance Summary sheet. The RSQ value depicts a relationship between two data sets. Being that the RSQ value is a ratio, its maximum value is 1.0. The closer the RSQ value is to 1.0, the more definitive a relationship exists between the two data sets. This means that turbidity spikes occurring in one phase of treatment are also seen in the next treatment phase. A high RSQ value is indicative of "breakthrough" occurring through one or more treatment barriers.)

Louisiana Prioritization Criteria
for Surface Water Treatment Plants (continued)

The RSQ values for the settled and combined filtered water are treated separately. If either RSQ value (max. settled or combined filtered) is above 0.3, then there is a cause and effect relationship and 15 points should be assessed to the system.

*It should be noted that for previous years (years prior to the FY04 Ranking), the point system for this portion was as follows:
Sum of both (settled and combined filtered) RSQs < 0.15 = 0 Points (No Relationship)
Sum of both (settled and combined filtered) RSQs ≥ 0.15 and ≤ 0.5 = 10 Points (Probable Relationship)
Sum of both (settled and combined filtered) RSQs > 0.5 = 20 Points (Direct Relationship)

Non-performance related point scoring. The following prioritization criteria are considered to be "Non-Performance Related". These points are summed with the Performance Points above to obtain the TOTAL POINTS SUMMATION.

Criteria	Standard	Points
Regulatory Compliance (only compliance with turbidity, filtration, SWTR, and Bacti-related regulations are considered) (choose all that apply)	acute MCL violation within 1 year	15
	MCL violation within 1 year	5
	treatment technique viol within 1 year	5
	monitoring and reporting viol within 1 year	5
Plant operation (choose one)	if plant doesn't routinely shutdown (no regular on/off events)	0
	if plant is shutdown overnight	5
	if plant operates intermittently (frequent on/off)	10
"Filter to Waste" not available or not used?	if yes	10
Backwash recycle to head of plant?	if yes	5
Continuous on-line turbidimeters on individual filters?	if no	5
New plant? Major design change? Recent staff turnover?	if yes, to any	5

Prioritization Method:
Step 1. Sum the "performance related point scoring" = (Points assigned for finished water turbidity 95th percentile) + (Points for max > 1.0) + (Points for max > 0.5) + (Points for settled water turbidity) + (Points for probable cause and effect relationship) + (Points for direct cause and effect relationship) = SUMMATION
Step 2. Sort the entire database by SUMMATION value.
Step 3. Within each "summation" score value, re-sort that portion of the database by: (1) total points for the plant, (2) 95% finished water turbidity value, (3) 75% finished water turbidity value, and (4) 50% finished water turbidity value.

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):

- Louisiana's AWOP began with the completion of hands-on training for three Comprehensive Performance Evaluations (CPEs) in September 1995. The training CPEs were conducted by EPA Technical Support Center (TSC), Process Applications, Inc., and the University of Cincinnati.
- CPEs – 36 turbidity-based CPEs completed between 1995-2008. The 36th Louisiana CPE was in Convent, LA in Sep 2006.
- Following "new state" training sessions 1 and 2, LDH staff (12 members) participated in 3 turbidity-based CPE training events in 2018 and 2019 (CPEs 37-39 at Natchitoches, Schriever, and St. Bernard, in Oct 2018, Jan 2019 and April 2019, respectively).
- A regulatory-triggered CPE (#40) was conducted at the Almatis WTP in March/Apr 2019.
- PBTs – 4 turbidity-based PBT series completed since 2001 (total of 20 Louisiana plants, with 3 repeats). Last Louisiana PBT series ended in May 2009.
- Filter Inspections – 9 one-day filter inspections completed.
- Participation in Region 6 multi-state CPEs (most recently in TX, Nov 2012.)
- LDH and EPA Region 6 held a successful two-day distribution system sampling exercise at the Greenwood, LA plant from Nov 18-20, 2014, focusing on disinfectant residual testing at this chloraminated system.

AWOP Maintenance Component Implementation:

Integrate

Please check the following areas where AWOP has been integrated into the PWSS Program:
Plan Reviews__x___ Permitting__x___ Capacity Development__x___ Operator Training__x___ Technical Assistance__x___ DWSRF Prioritization___x__ Enforcement___x__ 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.
None.

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.).
Development of an awards program is being considered. Additionally, certificates will be awarded to plants that volunteer to participate in AWOP 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 maintain staff experience in AWOP so that the AWOP is sustainable into the future. While Louisiana completed 36 CPEs from 1995-2008, there was no working-level CPE experience within the staff. "New state" training in 3 training CPEs in 2018-2019 has provided a working-level CPE experience within the staff. In any AWOP program it is important to have a succession plan to train new staff as they come in, utilizing the experienced staff before they retire or move to other positions. This was not effectively done in Louisiana and the AWOP program has suffered as a result and in order to reestablish AWOP experience, the state had to contract with PAI to instill that information. Prior to participating in the "new state training, Louisiana had a minimal program that primarily focused on tracking status and providing awareness of the need to optimize plant performance. With completion of the 5 session "new state" training, state staff are better position to develop and implement a vibrant AWOP program. LDH staff successfully conducted its first regulatory-triggered CPE at the Almatis WTP and the plan is to perform a voluntary CPE in the near future.

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).