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NEW MEXICO AREA WIDE OPTIMIZATION PROGRAM

Outline

- What is AWOP
- History of AWOP
- AWOP Components
- Why Optimize
- Optimization Goals
- Optimization Benefits

What is Optimization?

- : an act, process, or methodology of making something (as a design, system, or decision) as fully perfect, functional, or effective as possible

What is the Area Wide Optimization Program (AWOP)?

- A systematic process to identify and address performance problems
- A non-regulatory approach to enhance drinking water system capacity and public health protection
- “Non-regulatory” is another way of saying AWOP is voluntary program

What is AWOP?

- Designed to optimize performance of existing particle removal and disinfection facilities of surface water treatment plants
- Facilitates water system regulatory compliance while building an awareness of the benefit of moving beyond regulatory requirements by optimizing treatment processes and thus increasing public health protection
- Effective and efficient tool to prioritize assistance resources and training

What is AWOP?

- Identifying the desired level of performance Goals
  - Identifying limiting factors
- Improving process controls
  - Any activity to help plant meet expected performance
- Monitoring
  - Demonstrate and communicate success
  - Identify limiting factors & justify changes

AWOP History

- AWOP started as a CCP based Program in 1989
- Developed CPE and CTA procedures (Handbook) with the help of participating states
- Focused on SWTR compliance 0.5 NTU
- Established optimization goals (0.1 NTU)
- Demonstrated ability to achieve optimization with existing facilities and enhanced process control

AWOP History

- Step 1: CPE
  - Comprehensive Performance Evaluation
  - Identifies factors limiting performance
- Step 2: CTA
  - Comprehensive Technical Assistance
  - Addresses factors limiting performance from CPE
  - Achieves optimized performance goals
- CCP = CPE + CTA

AWOP History

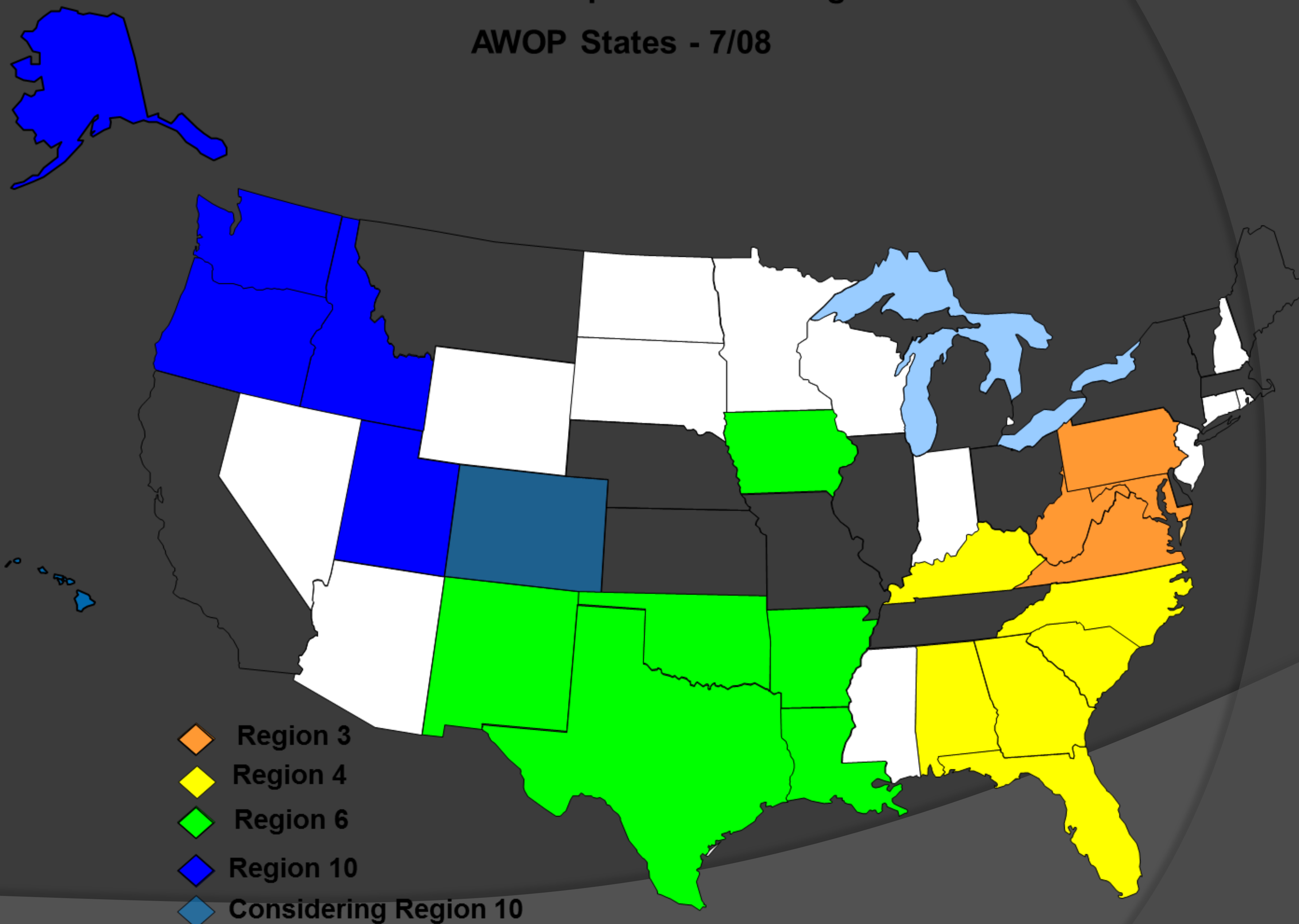
- Shift from regulation compliance to optimization of existing facilities
- Impetus for the shift:
  - Milwaukee (Cryptosporidium outbreak - 1993).
  - Research has identified that lower turbidities can significantly reduce public health risk (i.e., 0.10 NTU or lower).
- 0.10 NTU established as goal for optimized facilities

AWOP History

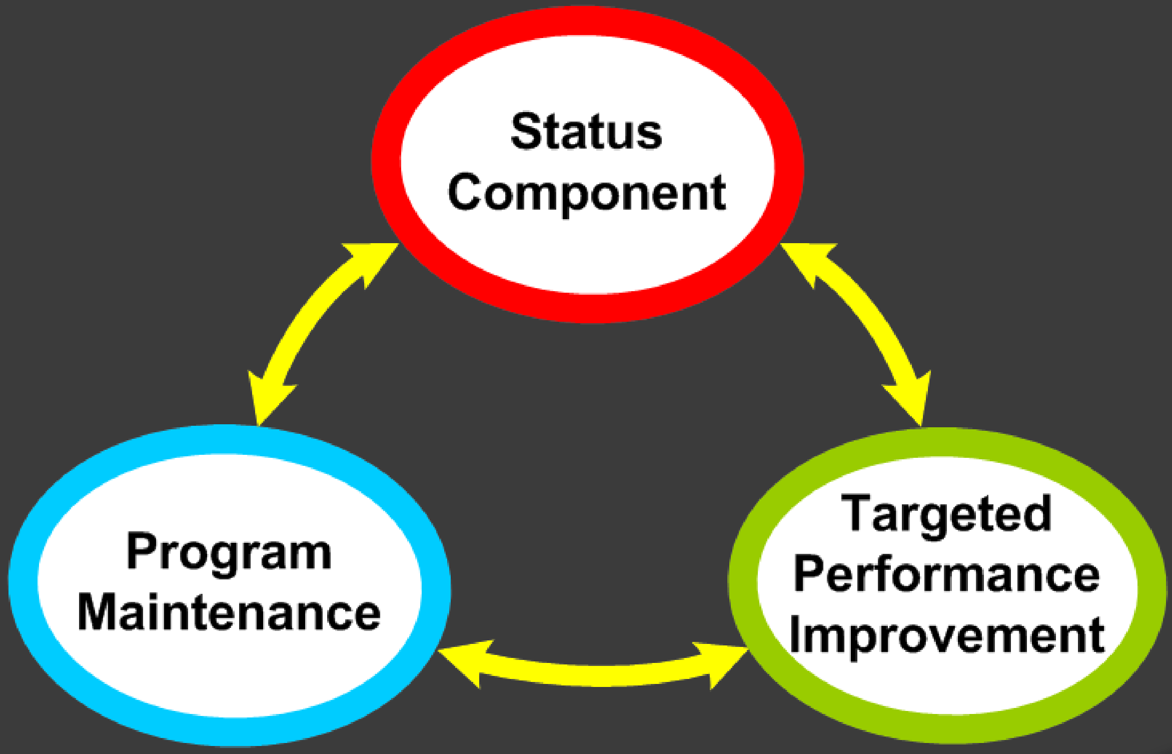
- The program is managed the Technical Support Center in Cincinnati , OH
- Has support of four EPA regions and ASDWA
- AWOP is implemented in over 20 states

Area-Wide Optimization Programs

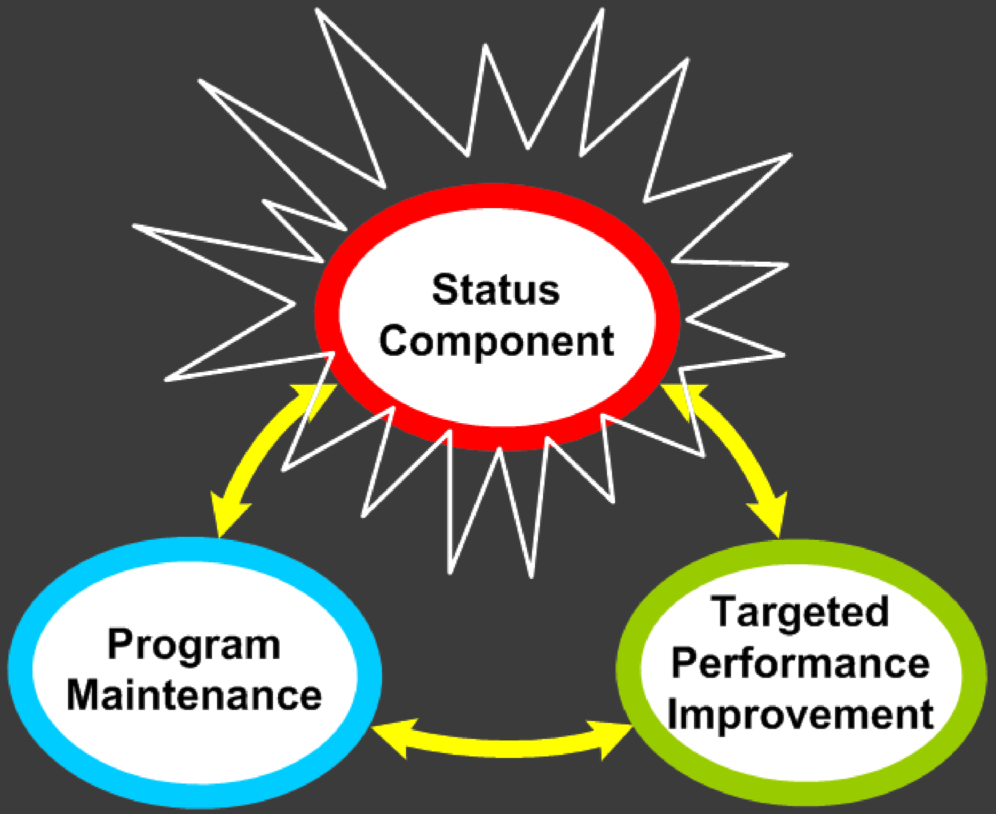
AWOP States - 7/08



AWOP Components



AWOP Components



Status Component

- The Status Component is what enables the “’strategic” application of knowledge.
- Continually monitor and assess plant performance data.
- Routinely prioritize water systems based on public health risk.
- Allocate resources based upon public health risk.

NMPrioriziationCriteria_2013 (2).pdf - Adobe Acrobat Pro

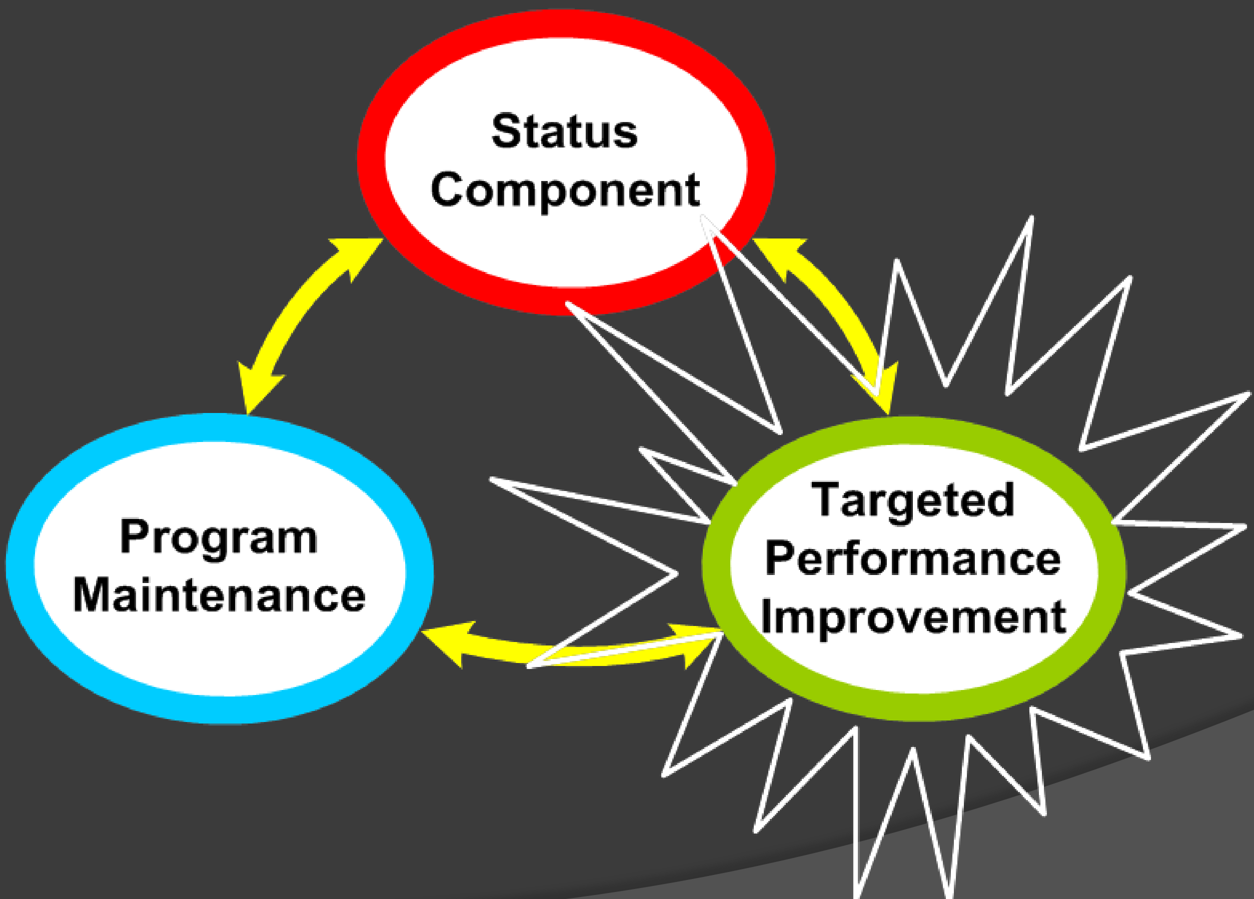
File Edit View Window Help

New Mexico Status Component Point System for 2012 Ranking
Name of Water System, NM3599999

200	**SOURCE WATER POINTS**
100	100 points when the water system has a written source water protection plan
50	50 points when the water system reviews its written source water protection plan annually
50	50 points when the water system reviews its source water assessment annually
150	**OPERATION POINTS**
50	50 points when the operator is always present while the plant is in production
50	50 points when the water system can filter-to-waste
50	50 points because jar tests are performed when water quality changes significantly (at least quarterly)
150	**MONITORING/REPORTING POINTS**
30	3 points each month that settled water is monitored (up to 10 months)
30	3 points each month that raw water is monitored (up to 10 months)
30	3 points for each month a backwash profile is developed for each filter (up to 10 months)
30	3 points for each month the water system monitors IFE turbidity online (continuous) (up to 10 months)
30	3 points for each month the system reports using an electronic MOR (up to 10 months)
400	**PERFORMANCE POINTS**
	Disinfection Byproducts Precursors
20	2 points each month the source water TOC < 4.0 mg/L (up to 10 months)
20	2 points each month the source water TOC < 2.0 mg/L (up to 10 months)
20	2 points each month the finished water TOC < 2.0 mg/L (up to 10 months)

8.95 x 11.58 in

AWOP Components



Targeted Performance Improvement Component (TPI)

- Uses appropriate resources to target the specific needs of individual water systems based on risk
- Documents performance improvements from TPI activities.
- Uses follow-up tools, CTA and PBT, to transfer problem solving skills to operators so that they can systematically address performance limiting factors
- And Special Studies

Comprehensive Performance Evaluation

- A CPE is used to determine the performance limiting factors that prevent a water system from optimizing their treatment processes
  - Operations
  - Maintenance
  - Design
  - Administration

Special Studies

- Special Studies
  - Filter Media Profile
  - Evaluate why filter-to-waste is ineffective
  - Data Integrity
  - Jar Testing

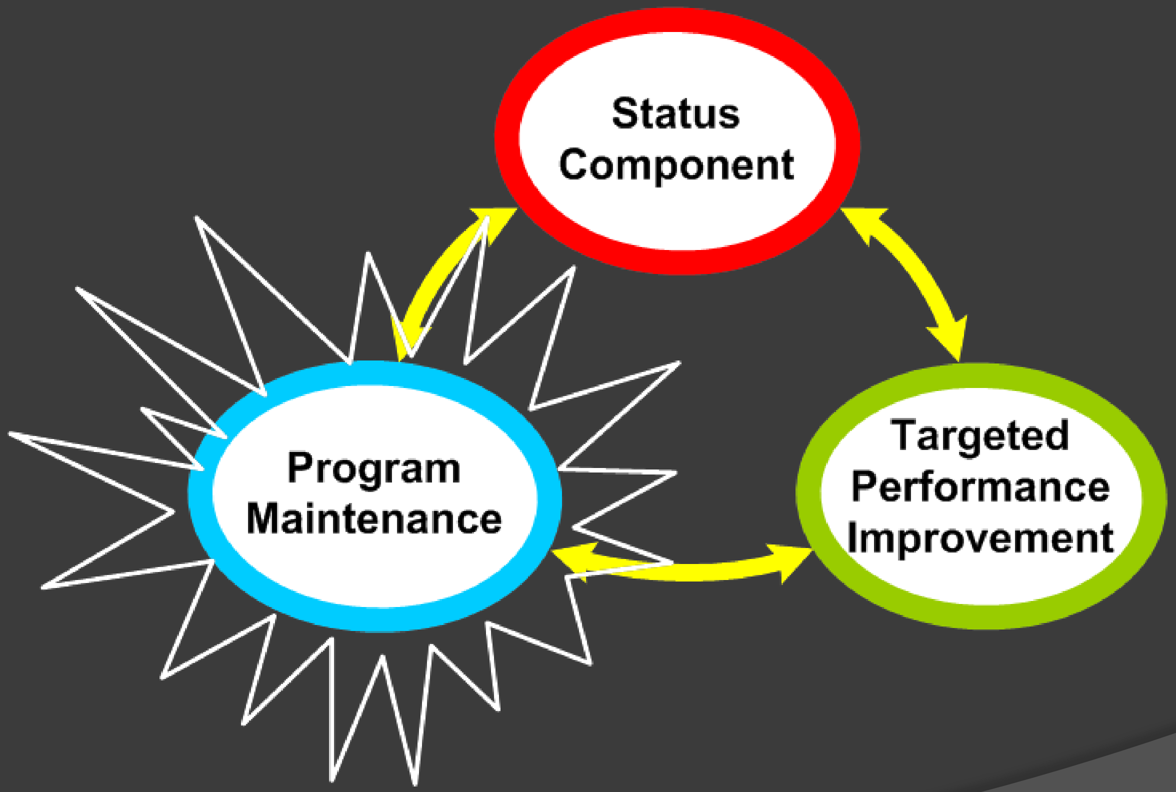
Performance-Based Training (PBT)

- PBT is the process of teaching the participants to:
  - define performance issues,
  - set up valid experiments using the scientific method, and
  - solve problems systematically.
- Multiple systems meet at a central location for five sessions over 12 – 18 months.
- It addresses common factors identified at CPEs.

Comprehensive Technical Assistance (CTA)

- CTA is site specific technical assistance
- 12-18 months, one-on-one, onsite assistance to address unique performance limiting factors

AWOP Components



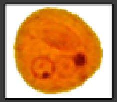
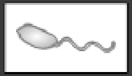
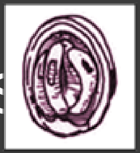
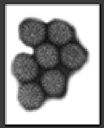
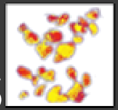
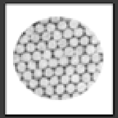
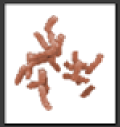
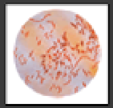
Maintenance Component

- Sustain the integrity of AWOP
- Integrate AWOP findings into other state activities

Maintenance Component Example Areas of Focus

- Ensure management awareness of AWOP success
- Ensure awareness of the Optimization Recognition Program
- Improve ties to Capacity Development
- Facilitate improvements to State Operator Training
- Ensure positive compliance improvement through mandatory CPEs
- Improve design review of new systems
- Improve regulatory agency staff training

Why Optimize?

- Amebias 
- Cholera 
- Cryptosporidiosis 
- Gastroenteritis 
- Giardiasis 
- Hepatitis A 
- Legionnaires’ 
- Shigellosis 
- Typhoid Fever 

Why Optimize?

- Waterborne disease outbreaks commonly linked with protozoan parasites
  - Giardia and Cryptosporidium routinely detected in North American water supplies
- Emerging pathogens
  - > 100 types of pathogens found in contaminated water
- Increase in vulnerable populations:
  - Immuno-compromised (e.g., cancer, AIDS patients)
  - Young children, elderly, pregnant women

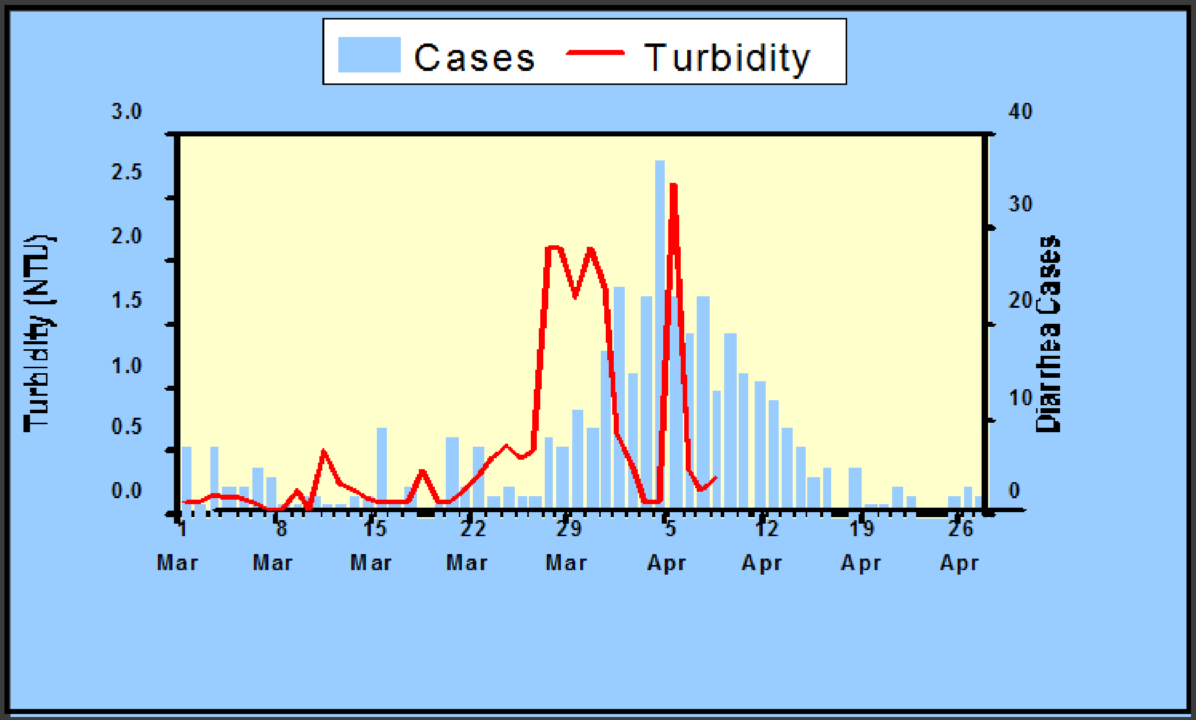
Why Optimize?

- Likely increase in the frequency, intensity, and duration of extreme weather events (droughts, storms)
- Resistance of some pathogens to conventional disinfection
  - 0.2 log or less inactivation of Cryptosporidium with free chlorine at 5 - 15 mg/L for 60 - 240 minutes
    (Finch, 1995)
- Meeting existing compliance levels not always effective in preventing disease

Why Optimize?

- Waterborne disease outbreaks linked with parasites
  - *Giardia* & *Cryptosporidium* in North American water supplies
  - Some pathogens are resistant to conventional disinfection
    - *Cryptosporidium* is 240,000 times more resistant to chlorination than *Giardia* (Jakubowski, 1995)
    - 0.2 log or less inactivation of *Cryptosporidium* with free chlorine at 5 - 15 mg/L for 60 - 240 minutes (Finch, 1995)

Milwaukee Disease Outbreak 1993

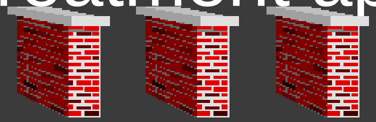


Recent Outbreaks From Cryptosporidium in Surface Water Supplies

Location	Year	Type of System	Estimated Number of Cases
Bernalillo County, New Mexico	1986	Untreated surface water supply	78
Carroll County, Georgia	1987	Treated surface water supply	13,000
Jackson County, Oregon	1992	Medford - chlorinated spring Talent - treated surface water	15,000
Milwaukee County, Wisconsin	1993	Treated surface water supply	403,000
Cook County, Minnesota	1993	Treated surface water supply	27
Clark County, Nevada	1994	Treated surface water supply	78
N. Battleford, Saskatchewan	2001	Treated surface water supply	>5,000

Why Optimize?

- Optimized performance reduces risk of exposure to pathogenic organisms
  - Reduced particles passing through filter
  - Reduced water age in distribution system

- Optimization programs are based on multiple barrier treatment approach
  - Particle removal 
    - Coagulation/flocculation + sedimentation + filtration
  - Disinfection – Just enough, but not too much

Why Optimize?

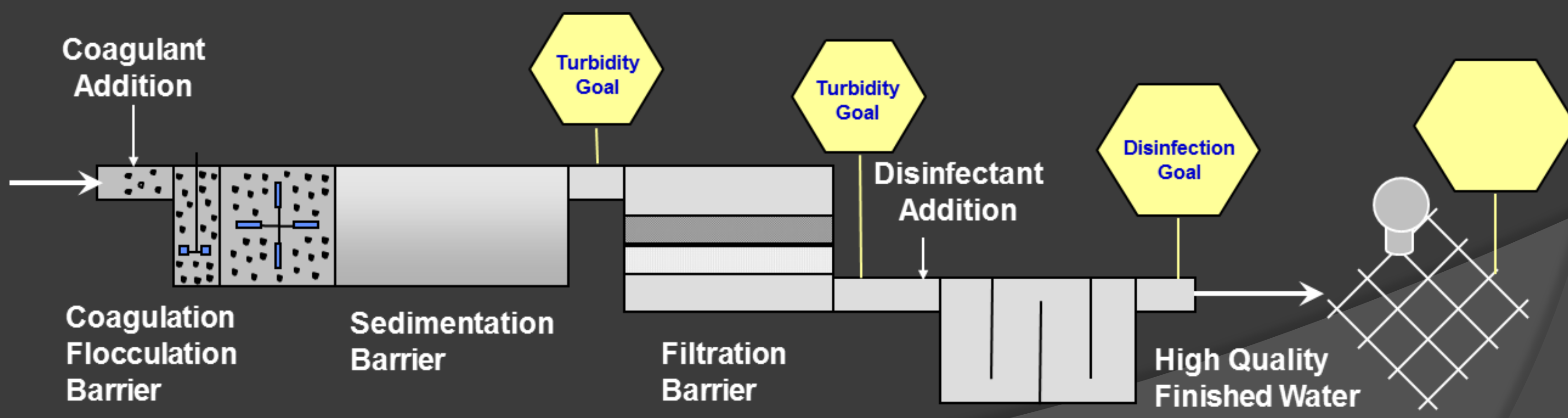
- Field work demonstrates that optimization goals are achievable at most plant without major capital expenditures
  - Economical way to maximize public health protection

Optimization Goals

- Factors exist in:
  - Operation
  - Maintenance
  - Design
  - Administration

Optimization Goals

- Optimization requires treatment beyond regulatory levels
- Focus on multiple barrier strategy to enhance plant performance
  - Particle removal (i.e., turbidity)
    - Coagulation/flocculations + sedimentation+ filtration
  - Disinfection



New Mexico Optimization Goals

- To achieve optimized performance and to provide the maximum protection to public health, the following goals are required:
  - Minimum Data Monitoring Requirements
    - Daily raw water turbidity
    - Settled water turbidity at 4-hour time increments from each sedimentation basin
    - On-line (continuous) turbidity from each filter
    - One filter backwash profile each month from each filter
  - Individual Sedimentation Basin Performance Goals
    - Settled water turbidity less than 1 NTU 95% of the time when annual average raw water turbidity is less than or equal to 10 NTU
    - Settled water turbidity less than 2 NTU 95% of the time when annual average raw water turbidity is greater than 10 NTU
    - Individual Filter Performance Goals
    - Filtered water turbidity less than 0.1 NTU 95% of the time (excluding 15-minute period following backwashes) based on the maximum values recorded during 4-hour time increments
    - Maximum filtered water measurements of 0.3 NTU
    - Initiate filter backwash immediately after turbidity breakthrough has been observed and before effluent turbidity exceeds 0.1 NTU
    - Maximum filtered water turbidity following backwash of less than 0.3 NTU, returning to 0.1 NTU within 15 minutes
  - Disinfection Performance Goals
    - CT values to achieve required log inactivation for Giardia and virus

Optimization Goals

- Why Turbidity?
  - Turbidity removal is strongly correlated with removal of pathogens
  - Turbidity data helps to identify operational trends

Optimization Goals

- Minimum data requirements
  - Daily raw water turbidity
  - Settled water turbidity at 4-hour time increments from each sedimentation basin
  - On-line (continuous) turbidity from each filter
  - One filter backwash profile each month from each filter

Optimization Goals – Sedimentation

- Turbidity: 2.0 NTU
  - 95% of the time when annual average raw water turbidity is > 10 NTU
- Turbidity: 1.0 NTU
  - 95% of the time when annual average raw water turbidity is ≤ to 10 NTU

Optimization Goals - Sedimentation

- 2001 - USEPA sponsored pilot scale work to assess Cryptosporidium removal through conventional Sedimentation unit process
  - Sedimentation processes operating under sub-optimal coagulation averaged 0.2 log removal of Cryptosporidium
  - Sedimentation processes operating under optimal coagulation averaged 1.3 log removal of Cryptosporidium
  - Cryptosporidium log removals were positively correlated with turbidity removal

Optimization Goals - Filter

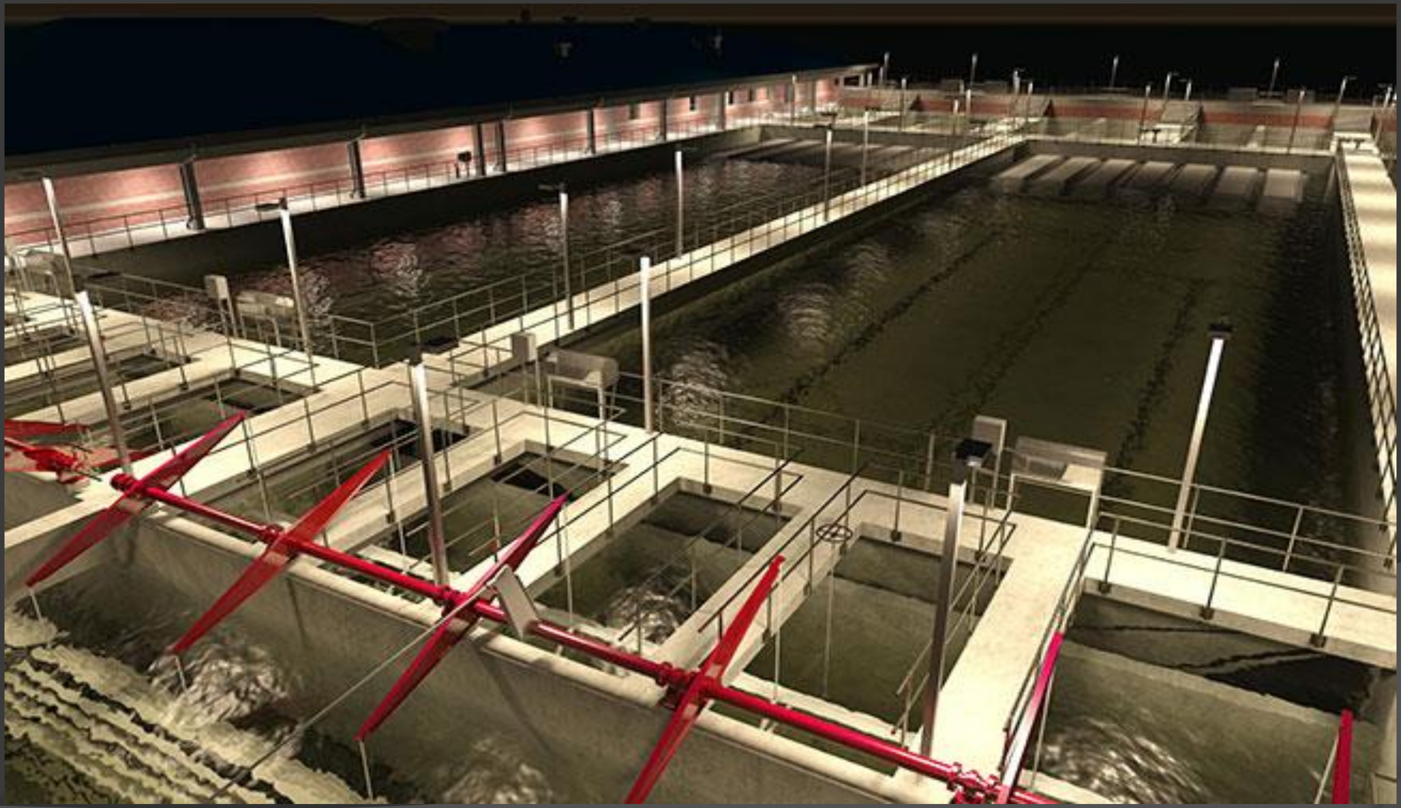
- Filtered water turbidity less than 0.10 NTU 95% of the time (excluding 15-minute period following backwashes) based on the maximum values recorded during 4-hour time increments.
- Maximum filtered water measurements of 0.3 NTU.
- Initiate filter backwash immediately after turbidity breakthrough has been observed and before effluent turbidity exceeds 0.1 NTU.
- Maximum filtered water turbidity following backwash of less than 0.3 NTU, returning to 0.1 NTU within 15 minutes.

Why Optimize? Basis for Filter Effluent Goals

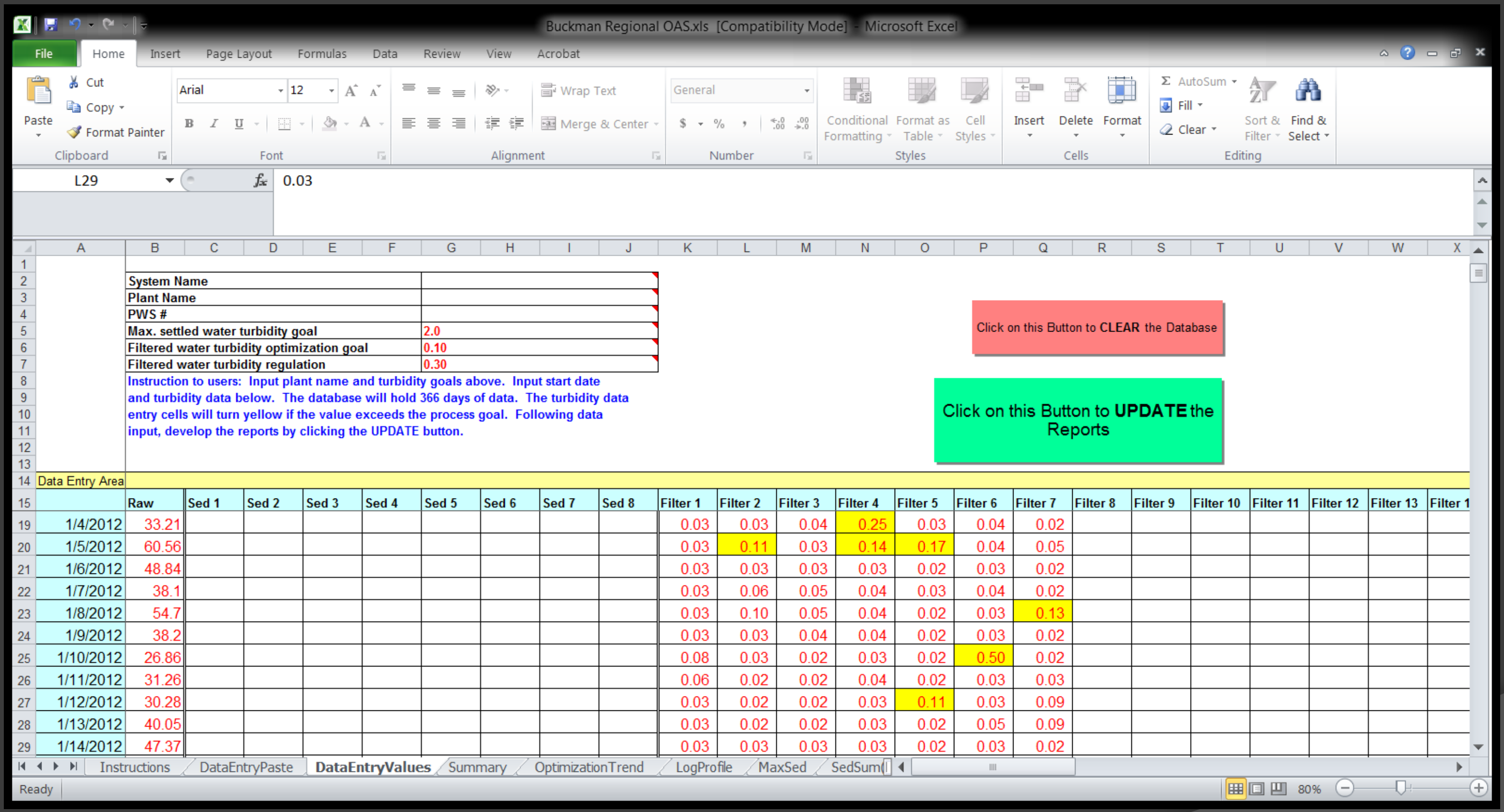
- In the year 2000 a pilot study to access Cryptosporidium removal through filtration
  - Stable operation: 5 to 6 log
    - (turbidity 0.04 NTU)
  - End-of-run: 2 to 3 log
    - (turbidity increase to 0.10 NTU)
  - Breakthrough: 1.5 to 2 log
    - (turbidity increase to 0.3 NTU)

Optimization Goals – Disinfection Goals

- CT values to achieve required log inactivation for Giardia and virus



Optimization Goals - OAS



Buckman Regional OAS.xls [Compatibility Mode] - Microsoft Excel

System Name	
Plant Name	
PWS #	
Max. settled water turbidity goal	2.0
Filtered water turbidity optimization goal	0.10
Filtered water turbidity regulation	0.30

Instruction to users: Input plant name and turbidity goals above. Input start date and turbidity data below. The database will hold 366 days of data. The turbidity data entry cells will turn yellow if the value exceeds the process goal. Following data input, develop the reports by clicking the UPDATE button.

Click on this Button to **CLEAR** the Database

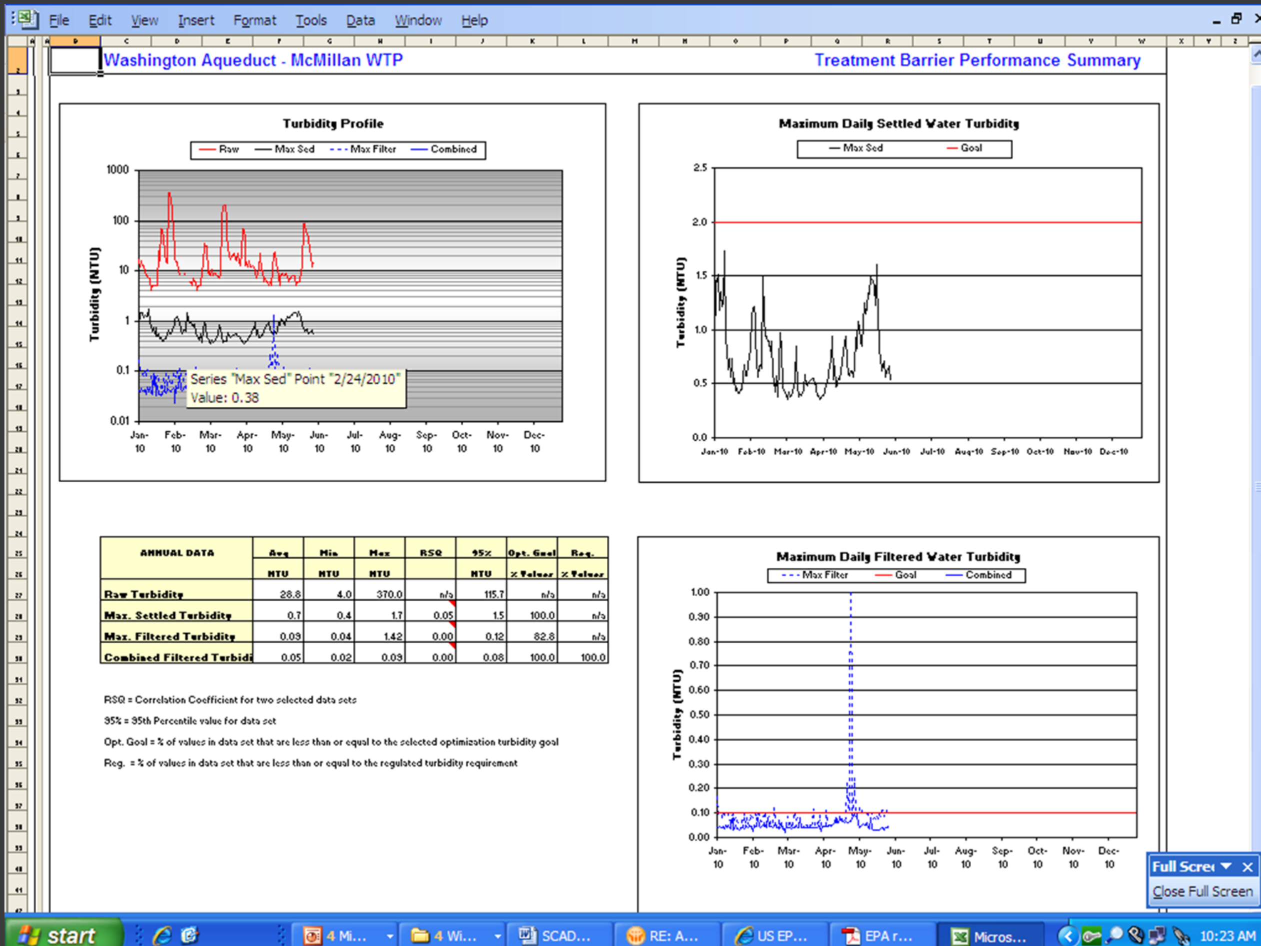
Click on this Button to **UPDATE** the Reports

Data Entry Area

	Raw	Sed 1	Sed 2	Sed 3	Sed 4	Sed 5	Sed 6	Sed 7	Sed 8	Filter 1	Filter 2	Filter 3	Filter 4	Filter 5	Filter 6	Filter 7	Filter 8	Filter 9	Filter 10	Filter 11	Filter 12	Filter 13	Filter 1
1/4/2012	33.21									0.03	0.03	0.04	0.25	0.03	0.04	0.02							
1/5/2012	60.56									0.03	0.11	0.03	0.14	0.17	0.04	0.05							
1/6/2012	48.84									0.03	0.03	0.03	0.03	0.02	0.03	0.02							
1/7/2012	38.1									0.03	0.06	0.05	0.04	0.03	0.04	0.02							
1/8/2012	54.7									0.03	0.10	0.05	0.04	0.02	0.03	0.13							
1/9/2012	38.2									0.03	0.03	0.04	0.04	0.02	0.03	0.02							
1/10/2012	26.86									0.08	0.03	0.02	0.03	0.02	0.50	0.02							
1/11/2012	31.26									0.06	0.02	0.02	0.04	0.02	0.03	0.03							
1/12/2012	30.28									0.03	0.02	0.02	0.03	0.11	0.03	0.09							
1/13/2012	40.05									0.03	0.02	0.02	0.03	0.02	0.05	0.09							
1/14/2012	47.37									0.03	0.03	0.03	0.03	0.02	0.03	0.02							

Instructions / DataEntryPaste / DataEntryValues / Summary / OptimizationTrend / LogProfile / MaxSed / SedSum

Optimization Goals - OAS



ANNUAL DATA	Avg	Min	Max	RSQ	95%	Opt. Goal	Req.
	NTU	NTU	NTU		NTU	% Values	% Values
Raw Turbidity	28.8	4.0	370.0	n/a	115.7	n/a	n/a
Max. Settled Turbidity	0.7	0.4	1.7	0.05	1.5	100.0	n/a
Max. Filtered Turbidity	0.09	0.04	1.42	0.00	0.12	82.8	n/a
Combined Filtered Turbidi	0.05	0.02	0.09	0.00	0.08	100.0	100.0

RSQ = Correlation Coefficient for two selected data sets

95% = 95th Percentile value for data set

Opt. Goal = % of values in data set that are less than or equal to the selected optimization turbidity goal

Reg. = % of values in data set that are less than or equal to the regulated turbidity requirement

Optimization Benefits

- Benefits include:
  - Improve public health protection
  - Improve consumer confidence
    - Could be a good promotional opportunity in the annual Consumer Confidence Report or other customer mailings
  - Staff professional development
    - Takes managerial and technical skills to optimize a plant
  - Improved capability to handle future challenges
    - Turbidity events, watershed changes, new rules
  - Once optimized, previously identified previously design changes may not be needed

Optimization Benefits

- Demonstrating Performance
  - Turbidity data helps to demonstrate individual plant performance

National AWOP Expansion

- DBP Control Optimization
  - Water treatment plant controls
  - Distribution system controls
- Groundwater Optimization
- Alternative Treatment Technologies
  - Slow Sand
  - Membrane
  - Others….
- Integration of AWOP into other areas of state drinking water programs