2019 Overview of Connecticut’s AWOP

State of Connecticut
Department of Public Health – Drinking Water Section
Drinking Water Section (DWS) Background

- Responsible for ensuring quality and adequacy of public drinking water in Connecticut
- Primacy agency responsible for implementation and enforcement of SDWA in Connecticut
- Oversees various state statutes and regulations
- Regulates approximately 2,500 Public Water Systems (PWSs) in CT serving a total population of approximately 2.9 million people
Connecticut’s SWTPs

- 36 surface water systems comprising 49 SWTPs
  - Small package plants to full scale conventional plants
  - Slow sand filter plant (optional tour on 5/1)
  - Dissolved Air Flotation (DAF)
  - Ozone and deep bed GAC
  - 1 Membrane plant
  - <1 MGD to 80 MGD capacity
  - Various ages and different degrees of automation and technology
  - Several new DAF projects; new SWTPs and plant upgrades
  - DAF current technology of choice in CT
Connecticut’s SWTPs

- Serve a significant portion of the State’s population
- *Approximately 64% (2.2 million) people in CT are served by surface water

*From SDWIS
2009 – Year of the Copepods

• Early that year DWS notified by a surface water system that organisms were observed by a customer to be “swimming” in customer’s residential whole-house water filter
• System lab confirmed organisms were copepods and rotifers
• Copepods and rotifers - invertebrates that are traditionally viewed as an aesthetic/nuisance concern, found in unfiltered surface water systems
2009 – cont.

- Copepods (most ~0.5 - 1 mm), Rotifers (~50 um – 2 mm)
- Giardia (~6 - 10 um), Crypto (~4 - 7 um)
- Copepods/rotifers have high degree of motility, can penetrate filters
- Required Cl\(_2\) residuals for inactivation ~ 1.5 mg/L (AWWA M7 – Problem Organisms in Water: Identification and Treatment)
- Was this a limitation of rapid sand filtration? What else could be passing through (i.e. copepods ~125 times larger than crypto)?
2009 - cont.

- As a result of what we did not know at that time, DWS recommended that a precautionary boil water advisory be issued to all customers of the system; concurrence by CDC

- Intensive water quality and public health monitoring
  - DPH: epidemiological review of hospital admittance data for increase in GI cases
  - System: Source to tap monitoring for giardia and crypto as well as invertebrates
    - No giardia or crypto found, however, live copepods found from source to distribution system. Copepod numbers in source appeared to be normal based on limnological evaluation.
2009 - cont.

- Only after data indicated there was no apparent public health threat, boil water advisory was lifted after 5 days
- DWS conducted exhaustive literature research
- DWS spoke to various experts all over the country
- DWS conducted national survey of other states
- In CT, anecdotally heard that other systems were also detecting copepods in their source waters
  - Reluctance to share data with DWS
  - Not sure if other SWTPs were passing invertebrates through their plants as well
Plant Evaluation

• DWS conducted intensive investigation of SWTP (39 yr-old 21 MGD conventional plant with 6 mono-media rapid sand filters) yielded no regulatory violations, however, raised some DWS and EPA concerns about plant performance issues:
  – Plant was operating in start-stop mode each day
  – No filter-to-waste
  – Concerns over filter loading rates especially during peaks
  – Concerns about backwashing practices including condition of surface wash equipment and filter bed expansion

• **Plant never had TT violation and was in regulatory compliance**

• DWS analyzed/trended several months of past turbidity data and developed filter profiles for all 6 filters
  – Appeared that one of the filters was underperforming on paper although still in regulatory compliance
That same year two other SWTPs incurred TT violations
System A: Algal bloom & raw water quality changes
  • Increased raw water turbidity & alkalinity decrease
  • Monitoring equipment constraints > 1.00 NTU
  • Lack of knowledge of NTU standard for direct filtration
  • Back to back Tier 2 TT violations
  • Ordered to perform CPE
System B: Algal bloom & filter breakthrough
  • Increased loading on filters
  • Monitoring & alarm interpretation issues
  • Tier 2 TT violation
Optimization

• During our research all roads appeared to lead to plant optimization as key to optimal plant performance
• Shifted our focus from invertebrates to plant performance issues and optimization
• Enhanced sanitary surveys of SWTPs with added element on optimization and plant performance
  – Operator knowledge/complacency, focus on backwash techniques/performance, turbidity trending, source water monitoring, etc.
• In 2009 DPH issued Circular Letter DWS #2009-01 to all SWTPs recommending to assess performance against nationally established optimization goals
Why Optimize?

• If I’m meeting the regulations isn’t that good enough? Not necessarily so. In fact, a lot of the performance issues encountered were at plants which were in regulatory compliance.

• Optimization can be a compliance assistance tool for SWTP operators.

• Gives operators some breathing room to identify problems and trends before they lead to regulatory non-compliance.

• Drinking water research demonstrates increased public health protection by achieving optimized performance goals.
CFE < 0.3 NTU

Acceptable?
IFE & CFE < 0.10 NTU

Acceptable!
Why Optimize?

- Extreme weather events may alter source water characteristics (i.e. increased algae blooms, higher raw water turbidities, changes in alkalinity, etc.)
- Reinforces multiple barrier strategy to enhance plant performance via performance goals for treatment unit processes.
- Field work demonstrates that optimization goals are achievable at most plants without major capital expenditures – economical way to maximize public health protection.
**Optimization**

- **Voluntary, non-regulatory**
- However does require optimization of treatment beyond current regulatory requirements
- Requires a change in mindset (i.e. what do those turbidity blips/spikes really mean?)
  - “Every turbidity spike is guilty until proven innocent”
- No room for complacency!
- “That’s how we’ve always done it” – not good enough
Optimization Goals

• Again, these are voluntary goals
• National goals
• As with SWTR compliance, optimization goals are primarily based on turbidity
  • Current regulatory turbidity limit = 0.30 NTU
  • Optimization goal = 0.10 NTU
• Based on actual field experience at over 100 SWTPs in the country
• Provide an increased level of public health protection to consumers
Sedimentation Performance Goals

- Turbidity: \( \leq 2 \) NTU 95% time when source turbidity >10 NTU
- Turbidity: \( \leq 1 \) NTU 95% time when source turbidity \( \leq 10 \) NTU
- Measure settled turbidity at 4-hour time intervals from each basin
Filtration Performance Goals

- **Turbidity:** \( \leq 0.10 \) NTU 95% time

- **Post backwash turbidity**
  - With filter-to-waste:
    Return to service
    \( \leq 0.10 \) NTU
  - Without filter-to-waste:
    \( \leq 0.30 \) NTU and return to
    \( \leq 0.10 \) NTU in 15 minutes
Post Backwash Performance Goals

- Studies have shown that up to 90% of the particles that pass through a well operated filter do so during the filter ripening period following filter backwash.
- Tools to reduce this impact include filter-to-waste (FTW), resting filters, and Extended Terminal Sub-fluidization Wash (ETSW).
- Minimizing this impact plays a critical role in optimization.
Next Frontier

• Distribution system optimization
• DBP optimization (technical topic for this meeting)
**AWOP**

- **AWOP = Area Wide Optimization Program**
- **What is AWOP?**
  - A program that provides a framework for states to incorporate optimization efforts into day-to-day operation of their drinking water programs.
- **Supported by EPA on a national and regional level**
- **Primary goal of AWOP is to promote optimization of existing SWTPs to maximize protection of public health**
- **Recent expanded focus on distribution systems**
- **CT joined EPA Region 3 AWOP in 2012 (EPA Region 1 currently does not have an AWOP program)**
EPA Region 3 AWOP

- The regional program is a cooperative effort with:
  - Member States: CT, MD, PA, VA, WV, NJ, MI – new attendees
  - EPA Region 3 Representatives
  - National Optimization Leadership Team
    - ASDWA
    - EPA Technical Support Center
    - A small business contractor- Process Applications, Inc.
    - EPA OGWDW
AWOP Components

- **Status**
- **Maintenance**
- **Targeted Performance Improvement**
AWOP Components

• **Status Component**
  – Develop state specific prioritization criteria to assess relative risk
  – Communicate with PWSs on need to optimize
  – Prioritize PWSs annually based on criteria
  – Assesses impacts of activities

• **Targeted Performance Improvement (TPI)**
  – Target high priority PWSs based on status component
  – Take appropriate action to improve performance (CPE, CTA, PBT, or FPPE)

• **Maintenance Component**
  – Findings from status and TPI used to enhance program
  – Integrate with other state activities to enhance state program
  – Quarterly AWOP meetings and multi-state events
Ultimate Goal!

Filtered Water Turbidity

Turbidity (NTU)

Benefits to CT DPH

• Access to Technical Training modules on optimization concepts straight from EPA

• Networking with State and EPA counterparts

• Learning and sharing information about a wider variety of topics during the technical topics portion of each meeting

• These benefits enable a small state with limited staffing resources to expand their technical knowledge base and become not only a regulator but a resource for PWSs increasing public health protection.
CT DPH AWOP Activities

- Incorporated AWOP into existing sanitary survey process
- Incorporated Optimization Goals and Questions into SWTP Sanitary Survey Checklists
- Staff training, recent survey group SWTP sanitary survey training event
- Continue to find and correct SCADA turbidimeter data capping issues at SWTPs (i.e. capped at 1.0)
- Continue to find inconsistencies and lack of knowledge in completing routine SWTP MORs, operator training during surveys
CT DPH AWOP Activities

• Created CEU program for operators to get credits for conducting special studies within their plant
• Worked with CT Section AWWA on a SCADA, Controls and Data Integrity Seminar
• Bridge the gap with Rule Implementation Unit - Receives and Reviews all WQ data, MORs – Working to roll out new online MORs through CMDP (portal) that will require SWTPs to submit 4-hour CFE turbidities. Hope to begin using this data second half of 2020 to start populating OAS!
• Revisit Disinfection CT Evaluations for SWTPs and DBP workshop – upcoming projects for 2019
Practical Application of AWOP in CT

- Worked with a SWTP to address the following issues:
  - Turbidities capped at 1.0 in SCADA, changed to 5.0
  - Moved CFE turbidimeter from post clearwell to combined filter effluent, more representative CFE turbidity readings
  - Observed filter cracking during sanitary survey, system completed filter rehabilitation including adding air scour and replacing original filter media, develop new backwash SOP
  - Trained operators on how to use OAS on a daily basis and they still are using it!
  - Trained operators on how to correctly complete MORs
  - ETSW pilot study as a result of observed backwashing issues
Emerging Issues

• Overall increase in DBPs statewide, significant drought in 2016 followed by consecutive wet years resulting in increased organics loading, increase awareness of treatment plant and distribution system optimization

• OCCT submittals and reviews continue to be challenging

• Legionella

• PFAS