Turbidity Data Integrity Considerations and Real World Implications

Alison G. Dugan, P.E.

United States Environmental Protection Agency; Office of Groundwater and Drinking Water

Standards and Risk Management Division: Technical Support Center

Bill Davis, P.E.

Process Applications, Inc.

Presentation Outline

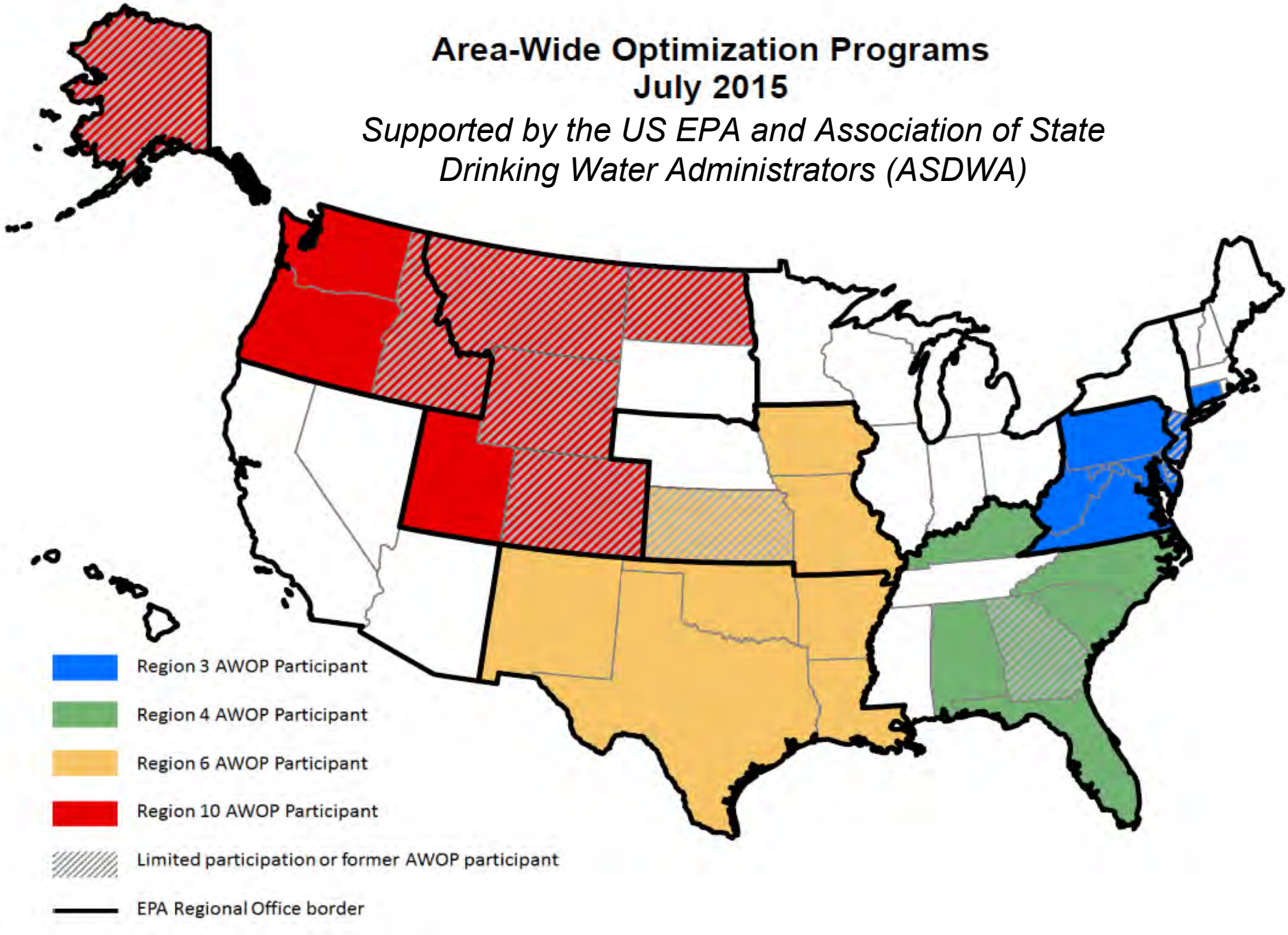
- Area-Wide Optimization Program (AWOP) Background
- Evolution of Data Integrity Efforts
- Current Status of Data Integrity Activities
- Summary

Area Wide Optimization Program (AWOP)

- (Facilitated) program, which encourages drinking water quality beyond compliance levels, to increase public health protection through:
  - Enhanced process monitoring and control
  - Using existing staff and facilities
  - Measuring performance relative to optimization goals
  - Technical tools and implementation approaches focus on improving and/or maintaining good water quality – using the multiple barrier approach
- The program began in 1989 with microbial (turbidity) optimization at surface water treatment plants and has expanded to other areas
- Program is primarily implemented with State Drinking Water Program staff

Area-Wide Optimization Programs
July 2015

Supported by the US EPA and Association of State Drinking Water Administrators (ASDWA)



What does “good data” or “data integrity” mean to you?

- Data shows system is in compliance & meeting optimization goals
- Data that is real (not false)
- Can you use your data to accurately evaluate performance?
- Can your data be used to make operational decisions?

- Water systems utilize data all the time – but these efforts are only as good as the data!
- Data integrity ⇒ understanding & addressing the challenges that may result in inaccurate data!

Evolution of the AWOP Data Integrity Effort

- State implementation of AWOP activities uncovered some concerns in the late 1990s
  - Plant turbidimeters were not consistent
  - Subsequent (annual) Comprehensive Performance Evaluations indicated a mix of turbidimeter performance (within spec, reading low, reading high)
  - The state initiated a program to verify the performance of PWS turbidimeters, pH meters and chlorine analyzers.
- Inaccurate data were the basis for plant operational decisions!

Evolution of the AWOP Data Integrity Effort

- Concerns related to achieving adequate CT/disinfection also surfaced
  - Changing disinfection practices impacted CT
  - Water didn't always flow the way it was intended
  - MAJOR potential impact on public health
- Data Integrity concepts were included in distribution system optimization program development (mid 2000s)
  - Sampling approach to ensure distribution system water quality is captured
  - Optimization training includes review of field monitoring methods and equipment/instruments
- Currently incorporating concepts into all aspects of AWOP

Turbidity Data Integrity
AWOP Evaluation Approach

- Topic/Evaluation Areas include:
  - O&M and calibration procedures for
    - Online turbidimeters
    - Portable and bench turbidimeters
  - Impact of online turbidimeter configuration (settings) on data output
  - Tracing turbidity data from source to reporting (data life cycle)
  - Interpreting and reporting turbidity data from online turbidimeters
  - Turbidity data validation/invalidation procedures
- Could be applied at WTPs as a self-assessment

Draft Turbidity Data Integrity White Paper

Draft White Paper
Electronic Turbidity Data Handling in Water Treatment Plants to Support Optimization and Regulatory Monitoring

developed by
Process Applications, Inc.
and
EPA Technical Support Center

*"A **white paper** is an authoritative report or guide informing readers in a concise manner about a complex issue and presenting the issuing body's philosophy on the matter. It is meant to help readers understand an issue, solve a problem, or make a decision." (Wikipedia)*

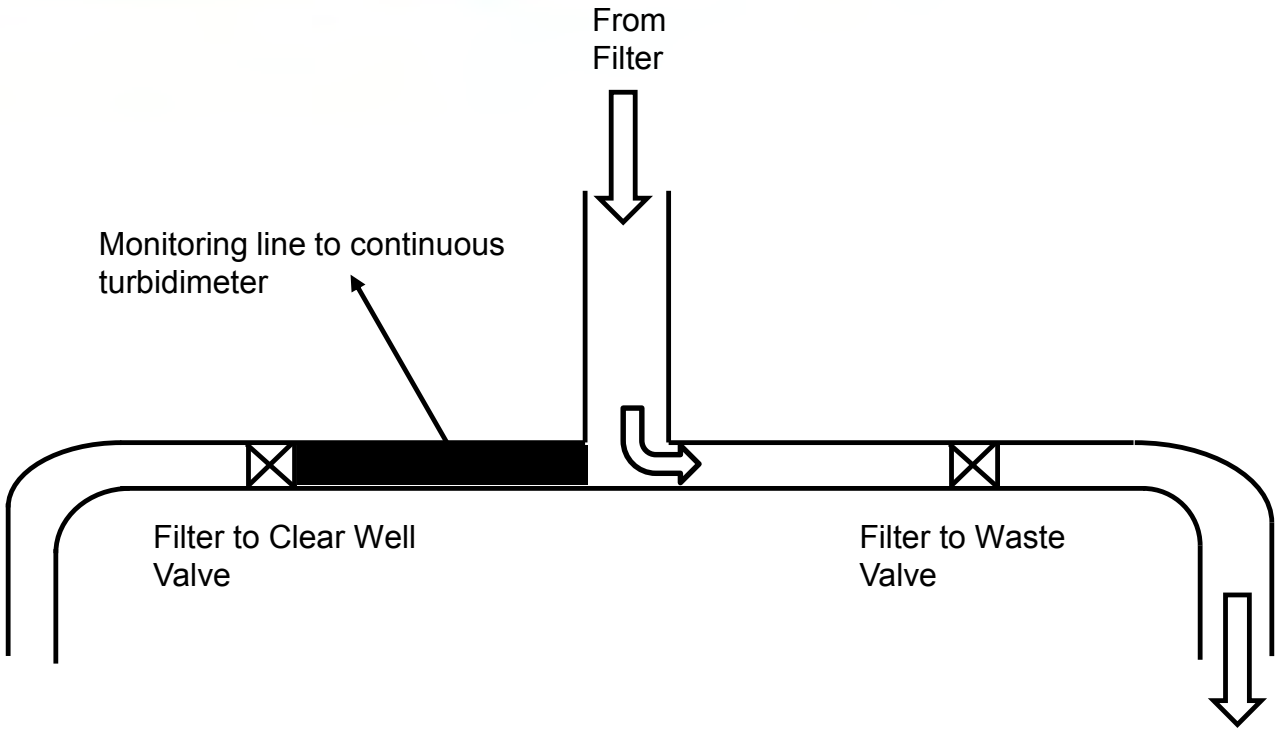
Draft White Paper: Background

- **Electronic Turbidity Data Handling in Water Treatment Plants to Support Optimization and Regulatory Monitoring**
  - Initiated due to AWOP experiences
  - Implications for optimization and regulatory monitoring
    - White paper addresses both
  - Identifies four areas of electronic data handling errors and how the AWOP community might address them
    - Could also be addressed by individual WTPs in a self-assessment-type manner

Draft White Paper: Content

- Turbidimeter and Sample Tap Locations and Considerations
  - Instruments should be as close as possible to the sample tap (≤ 1 minute sample detention time suggested)
  - Sample tap should be representative of filtered water

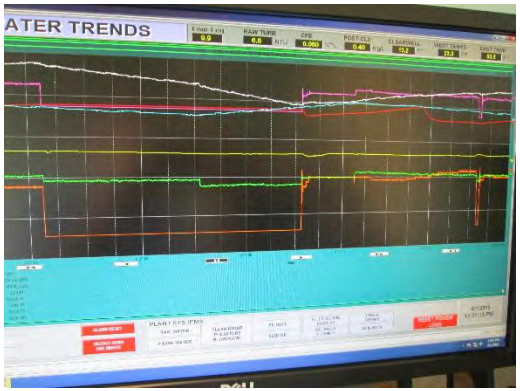
Monitoring Point	Detention Time (min)
Raw Water	2.0
Clarifier No. 1	5.0
Clarifier No. 2	5.2
Filter No. 1 Effluent	9.0
Filter No. 2 Effluent	7.8
Filter No. 3 Effluent	6.8
Filter No. 4 Effluent	4.1
Combined Filter Effluent	4.6



During filter-to-waste: What will be measured here?

Draft White Paper: Content

- The best data to capture for:
  - Optimization purposes
  - Regulatory purposes
    - Maximum daily turbidity data **excluding**
      - FTW
      - Backwashes
      - Idle time periods



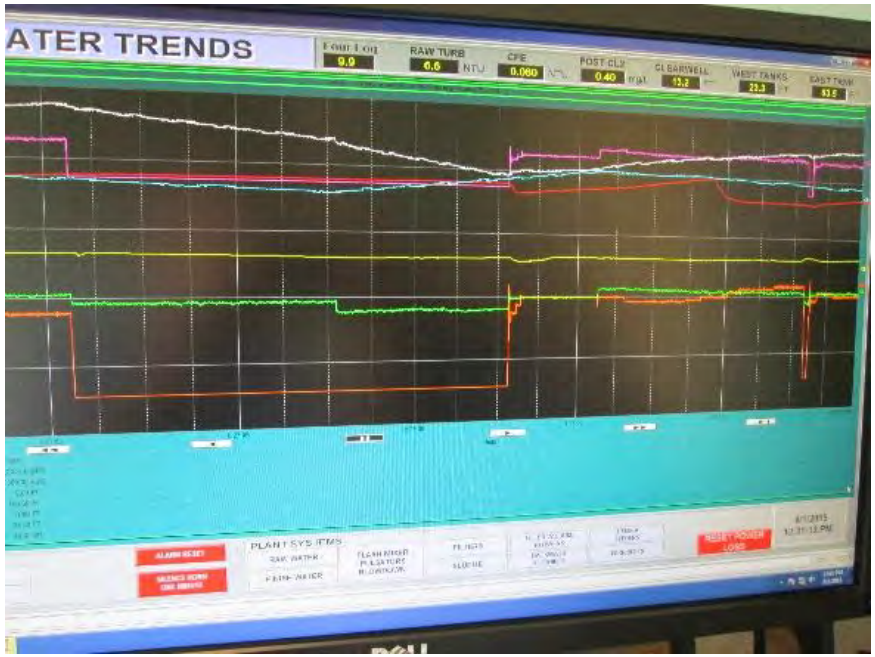
Manually pulling the data from a trend line on a monitor might be the best way to do it.

Draft White Paper: Content

- Turbidimeter Settings
  - Signal span (Analog data transfer)
    - 0-5.1 NTU is recommended
      - Provides regulatory data (IFE and CFE) without “capping” below regulatory limits
      - Provides adequate resolution with most processors (if a 12 bit processor is used the resolution would be 0.0012 NTU increments)
      - Warning(!) do not try to change analog spans unless you know PLC and SCADA CPU programming.
        - » Changing the span on an all digital system would be much easier.
        - » From the perspective of turbidity data signals, a digital SCADA system would be much preferred (no need to adjust calibrations when adjusting span, fewer “data capping” issues)

Draft White Paper: Content

- Turbidimeter Settings
  - Loss of signal to the controller (specific to Hach SC100 and SC200 controllers)
    - Most default settings are to **hold the last received reading**
    - This can lead to delays in determining a lost signal
    - The alternative is to have the controller transmit a known signal (e.g., “0” or “10”)



Would you notice a straight line?

Draft White Paper: Content

- Turbidity Data Logs
  - Data log files should be located in a directory **easily accessible** to plant operators
    - Newer SCADA systems address this
    - Systems with older SCADA systems often collect and record valuable data but are very limited in their ability to process the data and with limited access to operators.

Draft White Paper: Desired Outcome

- Increased awareness by water systems of electronic turbidity data handling issues
  - AWOP normally works through State primacy agencies, who would share these issues with their water systems.
  - Could also be addressed on an individual water system basis (e.g., through PfSW network/systems)
- Increased awareness among the manufacturer and vendor community
  - Open dialogue with SCADA and instrument manufacturers and vendors

Summary

- Data integrity issues and potential public health concerns have been identified by the AWOP network
  - Efforts have begun to increase awareness (i.e., training of State Drinking Water Program Staff, operator training within AWOP)
  - A white paper discussing electronic turbidity data handling has been drafted and is currently being reviewed
- This issue likely impacts many water systems from all states (not just those within AWOP states) for both optimization data collection efforts and compliance.