



Online Instrument for Raw-Water THM Precursor Analysis



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Our History

- Founded in 2007
- R&D, technical support and management located in Sunnyvale, CA (Silicon Valley)
- US and California's first online THM analyser (2011) (Benicia, CA)
- 2016 ISO 17025 approval awarded to Suez for use of THM-100 for regulatory readings
- US and EU market leader in online THM analysis, 100+ THM-100 installations
- Tristate References: SF PUC, East Bay MUD, Phoenix, Gilbert, Benicia, Ranch Santa Fe, Stockton, Goleta, Paso Robles (WWTP), Pima County (WWTP), Scottsdale

The Value of High Frequency Real-Time THM Data

CHARACTERIZATION

Extensive data stream to enable the design of cost- effective remediation processes

PILOT AND WHAT IF STUDIES

Simulation (“what if ?”) of the impact of multi-parameter operational changes on contaminant levels

TECHNOLOGY VALIDATION

Fast feedback permits rapid assessment and validation of remediation process

PROCESS OPTIMIZATION

Captures changes in contaminant levels to enable timely and cost effective remediation

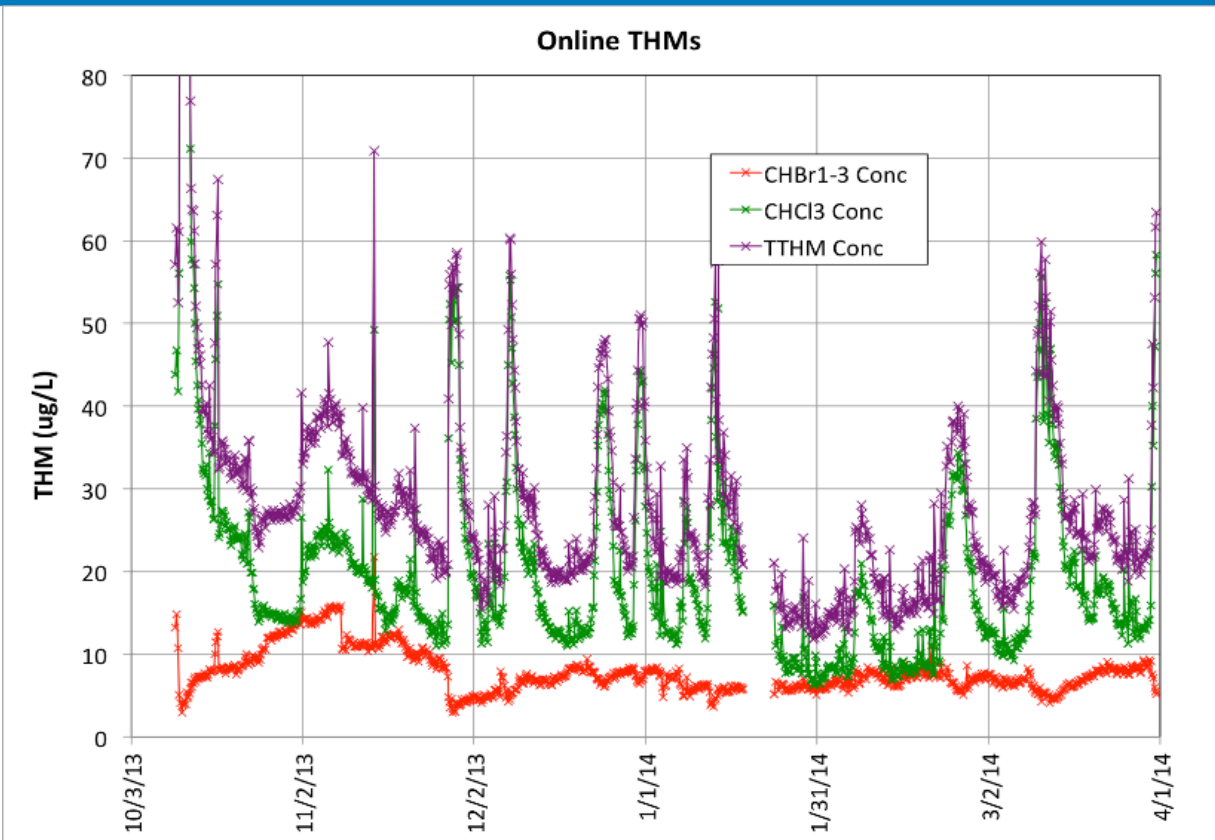
RISK MANAGEMENT

Captures non-compliance risk to enable timely action before non compliance occurs, ensures regulatory and contract compliance

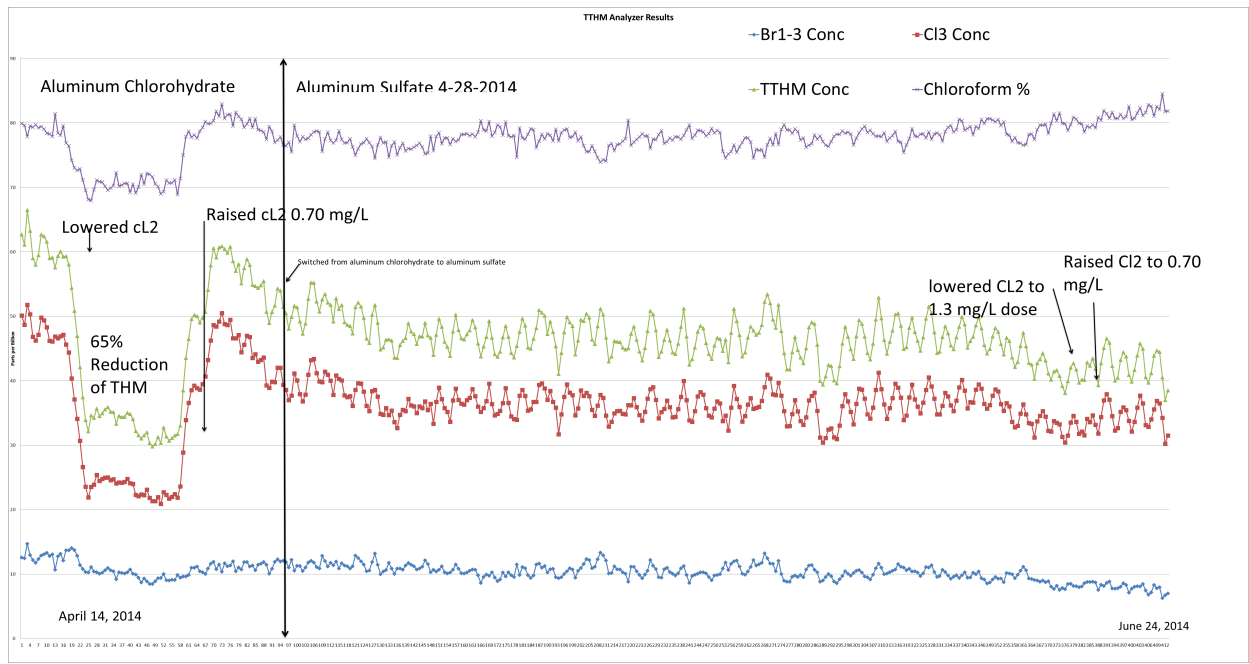
Regulatory Compliance

- In August 2016, Aigües de Barcelona's Laboratory received accreditation to the **ISO/IEC 17025:2005 Standard** for the use of the online THM monitor to continuously monitor THMs.
- Accurate and repeatable results plus regular quality controls are required to meeting ISO accreditation requirements.
- No other commercially available online THM analyzer operates or is validated to such rigorous standards:
 - Significant breakthrough in the application of online field-based instruments for regulatory control of water quality

High Frequency Data Capture Changes in Water Quality

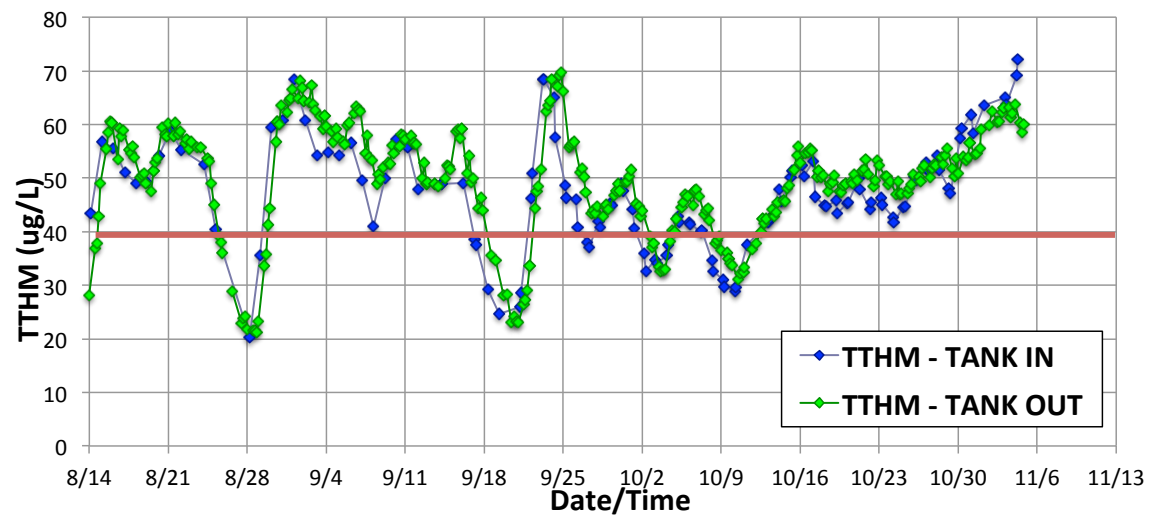


Modelling Operational Changes

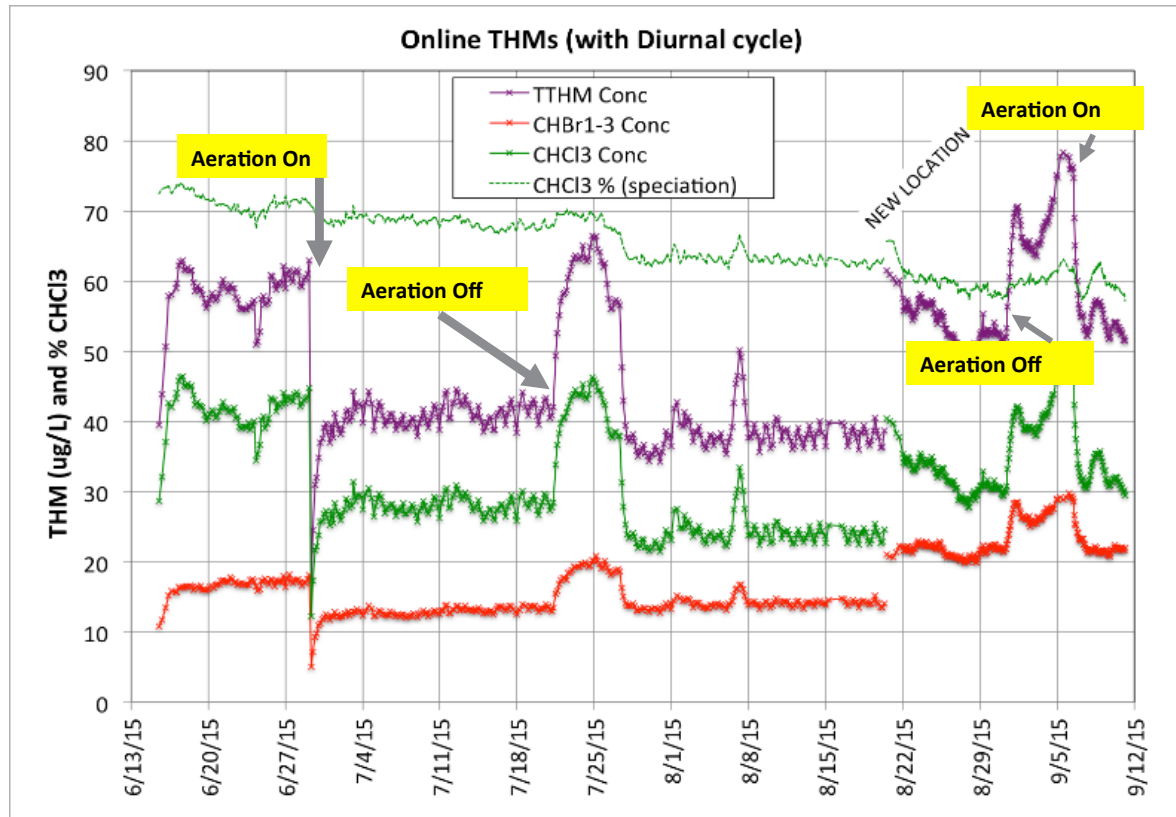


Designing a Solution is Risky Without Data...

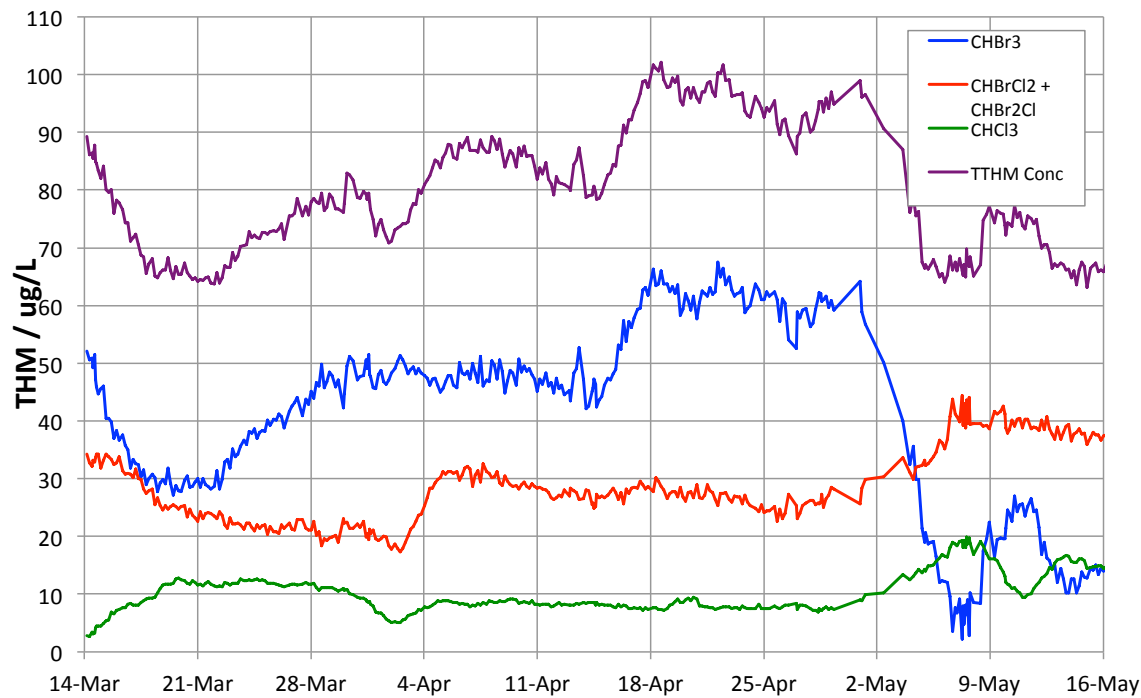
In the absence of in-tank THM formation data the aeration system designed to deliver out-flow water with THM concentration of 40ppb did not meet requirements



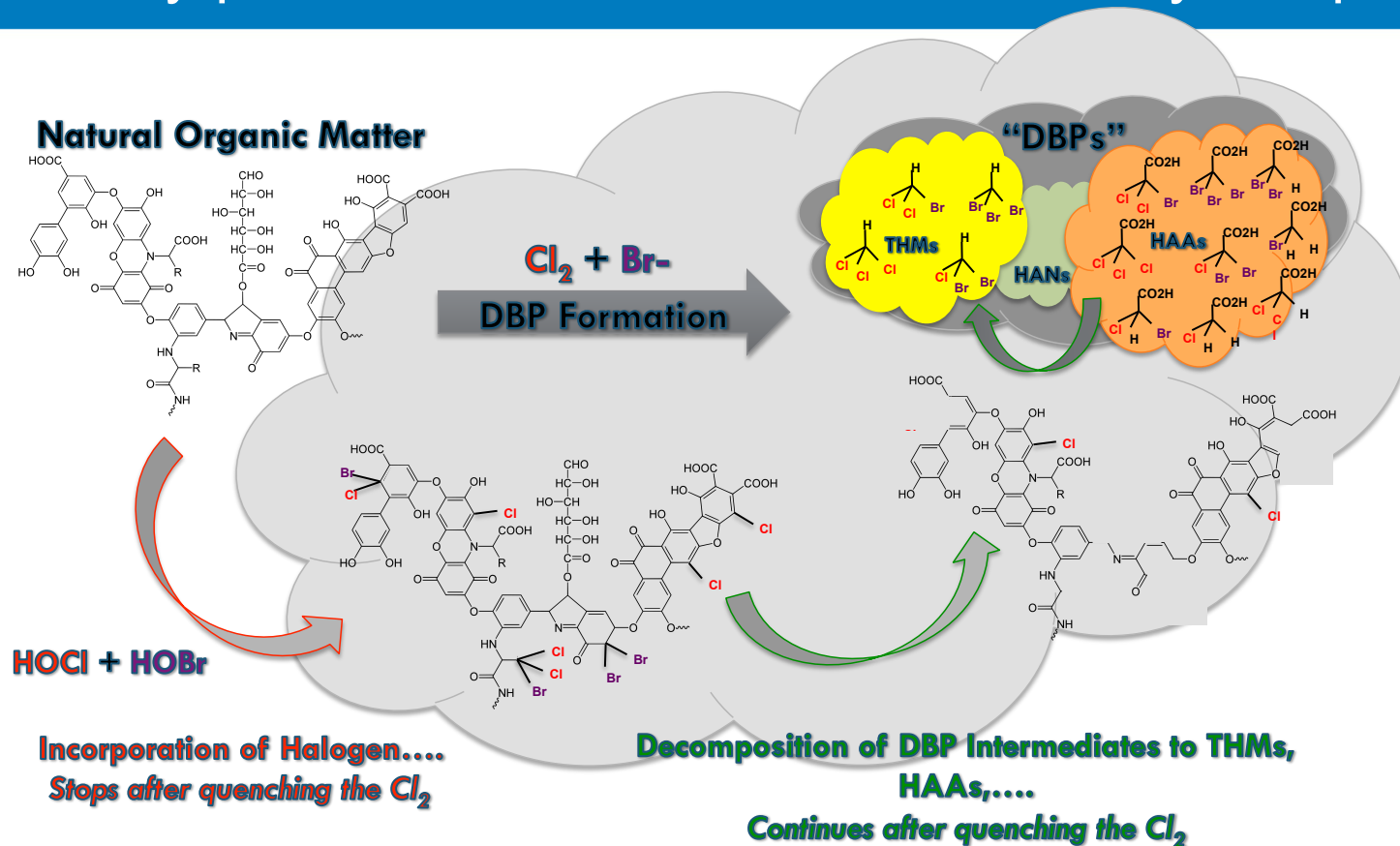
Validating Aeration Performance Post-Installation



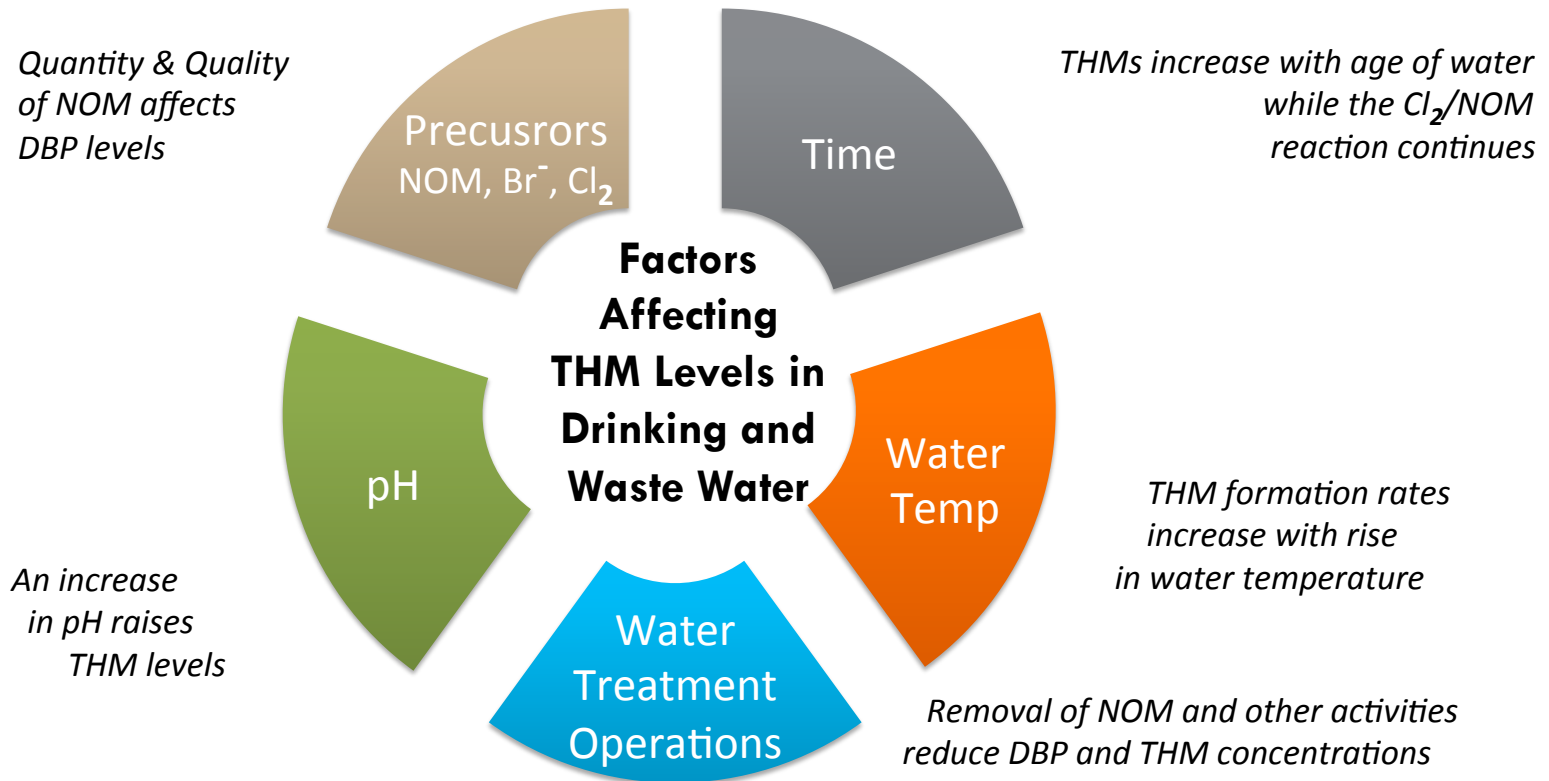
Changing Raw Water Quality - Measuring both Chloroform and Bromoform



Disinfection By-product Formation – THMs are very complicated!

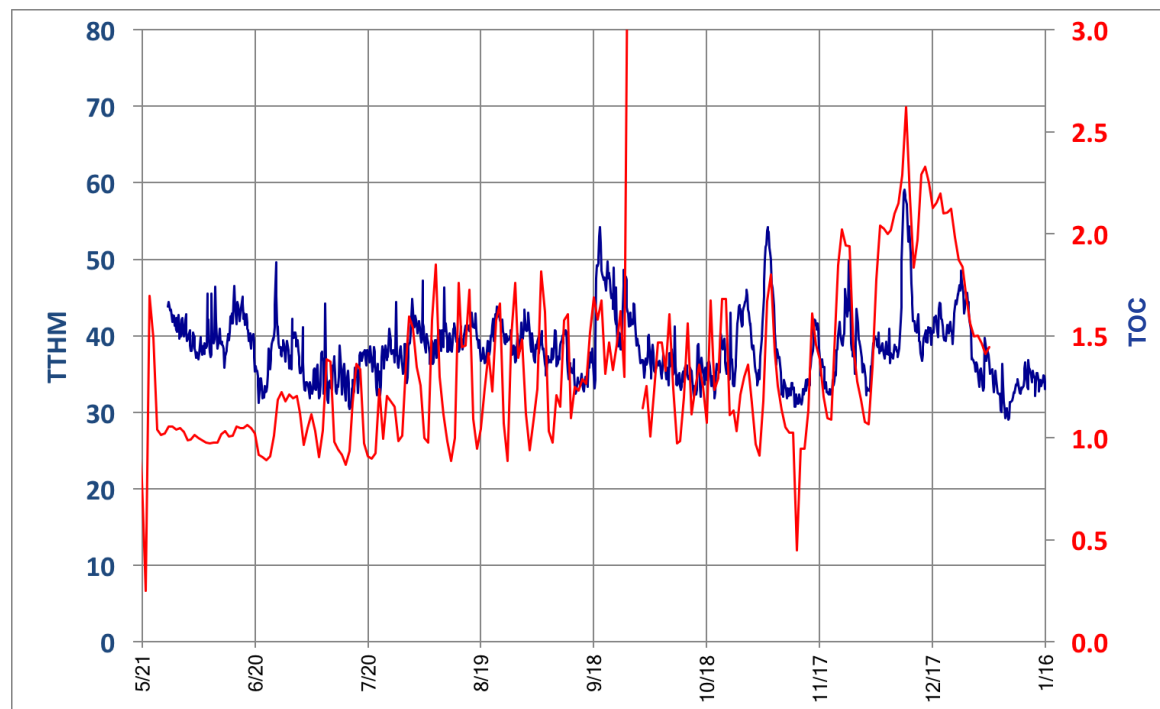


THMs Levels Fluctuate Unpredictably

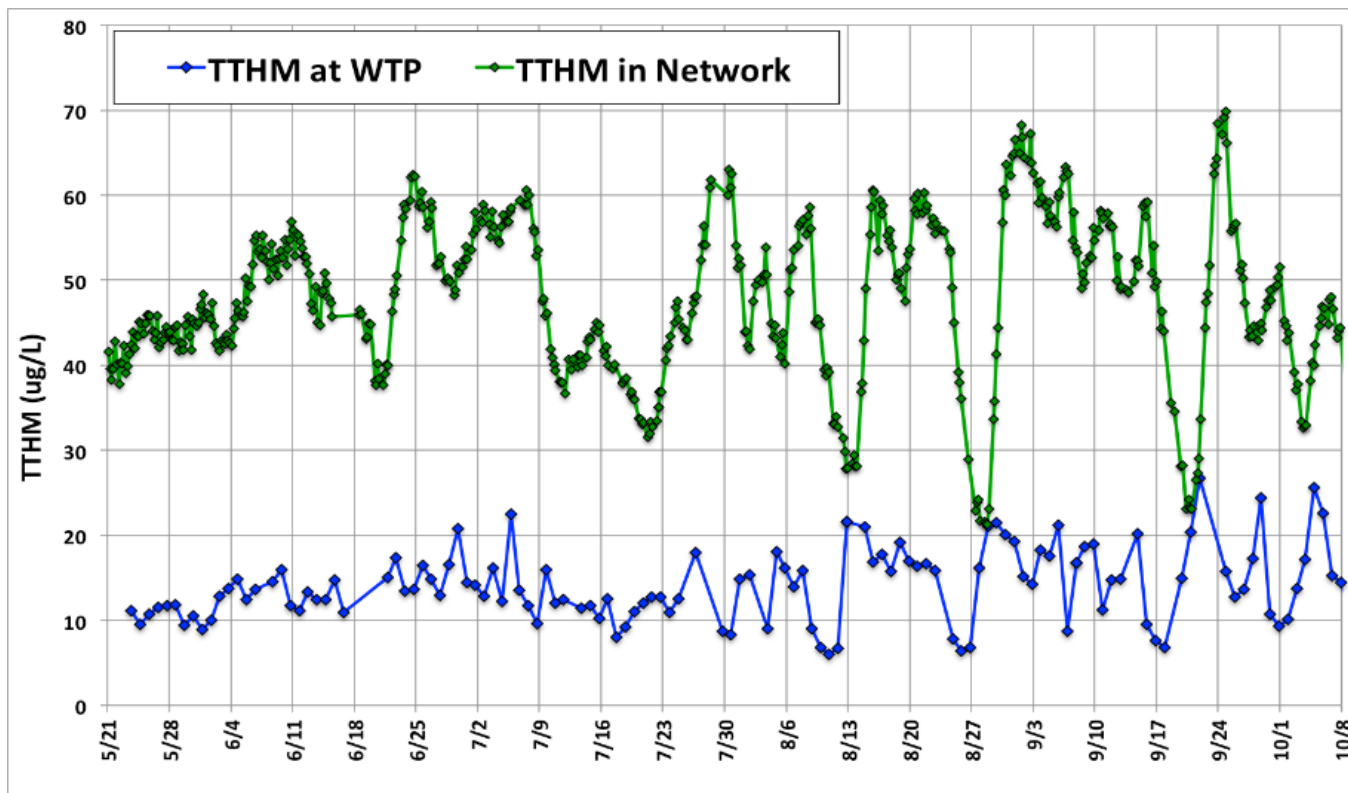


Surrogate Methods for Prediction of THM are Unreliable

- At this California WTP blending water from rivers, dams and wells, the TOC correlated poorly with THMs



The Daily Challenge for WTP Operators....



The Importance of Real-Time THM Formation Potential Data

The only data that is relevant for DWP operators is real-time THM Formation Potential Data...

Let's find out why!

On-line THM Analyser

- Accurate and reliable ($\pm 5\%$)
- Uptime $>99\%$
- Self calibrates and validates
- 5 Year Warranty

The only online THM analyser that provides:

- Real-time THM data
- Real-time Prediction of THM Formation in Treated Water,
- Real-time THM Formation Potential of Raw Water data

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THM Formation Potential

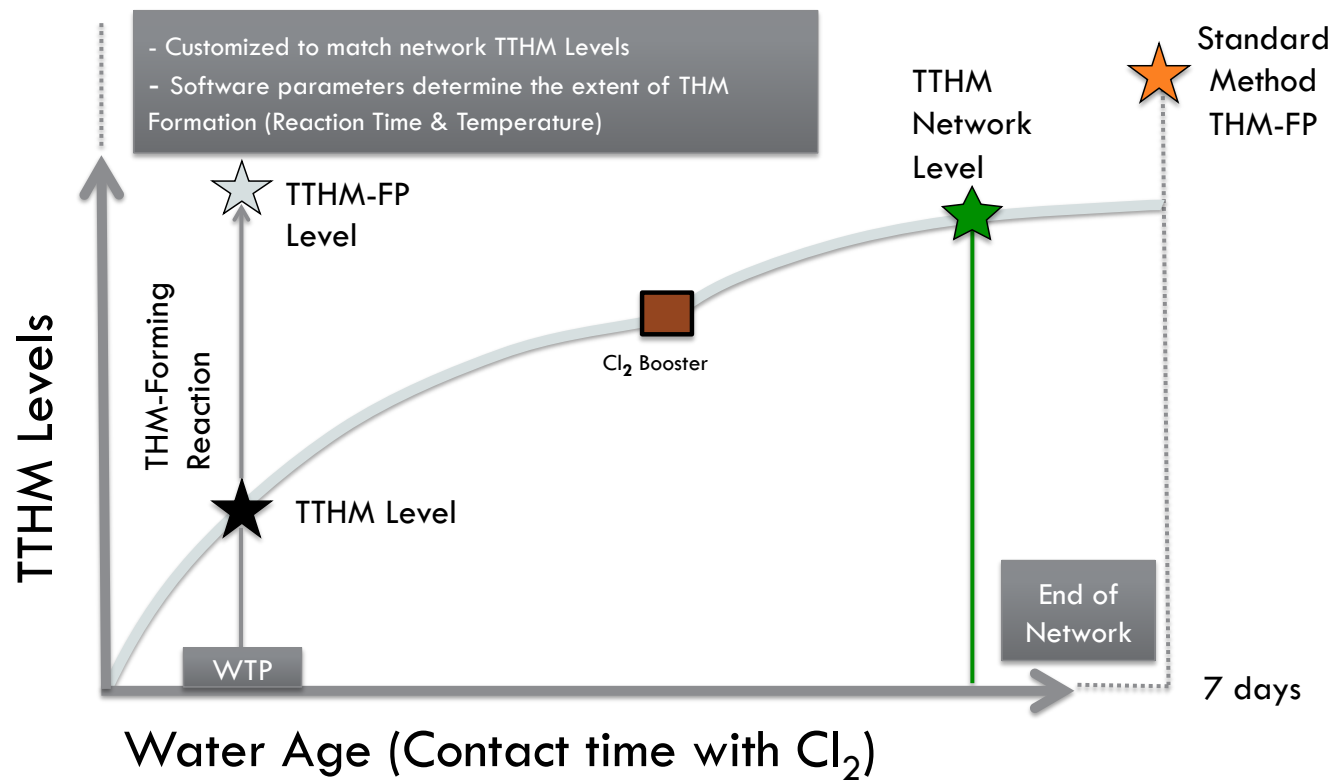
CASE STUDY 1: REAL TIME PREDICTION OF NETWORK THM LEVELS

Case Study- Aigües de Barcelona

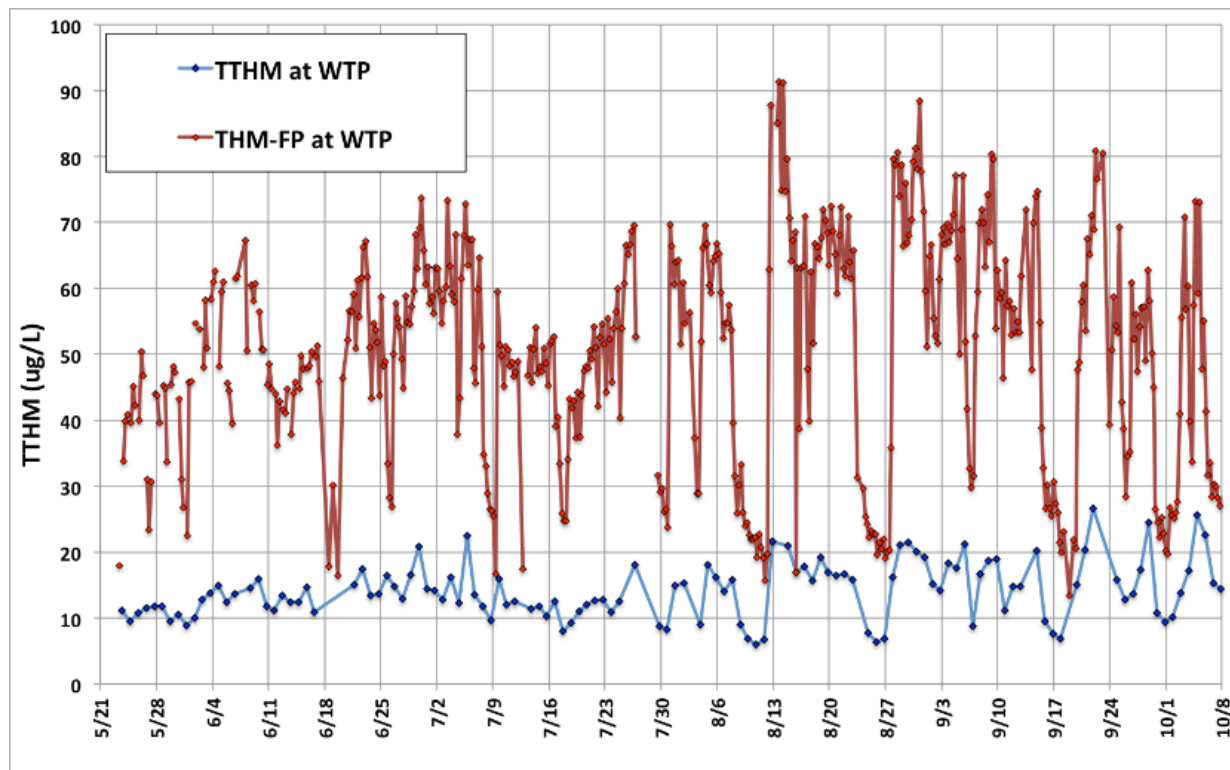


- Sant Joan Despí WTP
- Servicing > 3 million people
- Mixed conventional & advanced treatment
- Wanted continuous and real-time measurement of THM Formation Potential
- Worked with AMS to develop an accelerated online THM-FP method
 - 6-month study results presented
 - Suez NY, Santa Cruz

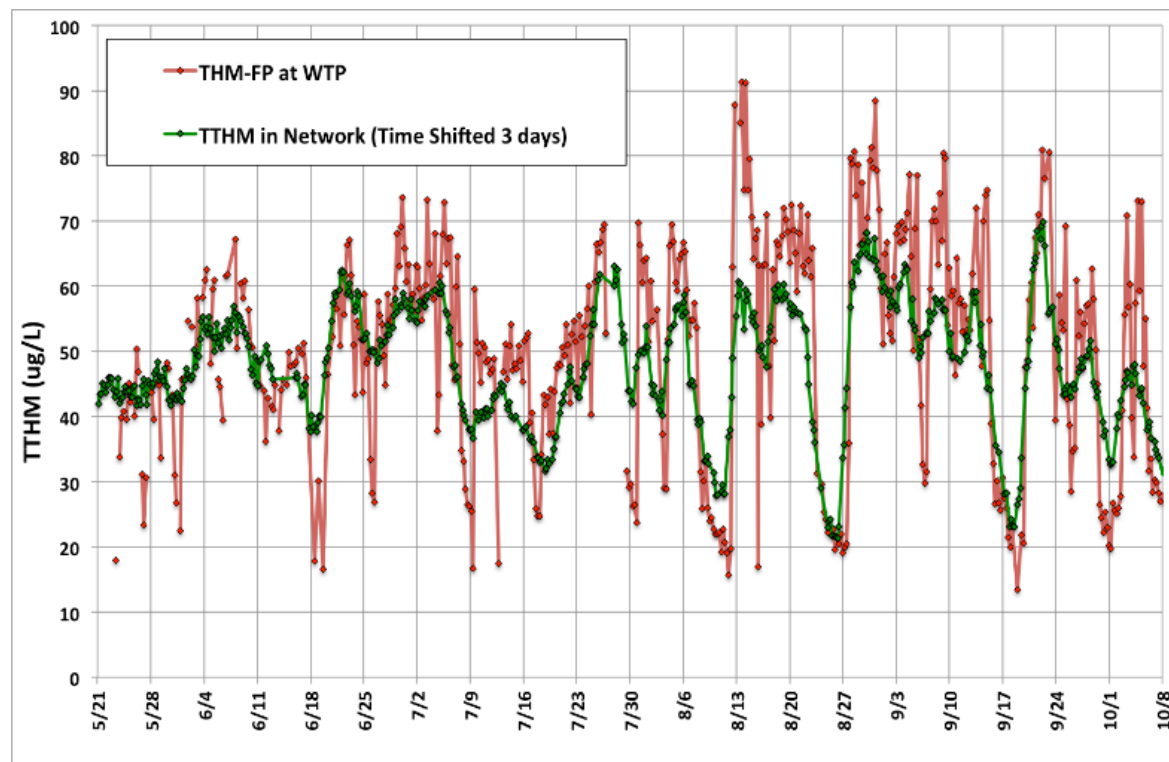
Accelerated Online THM-FP Method



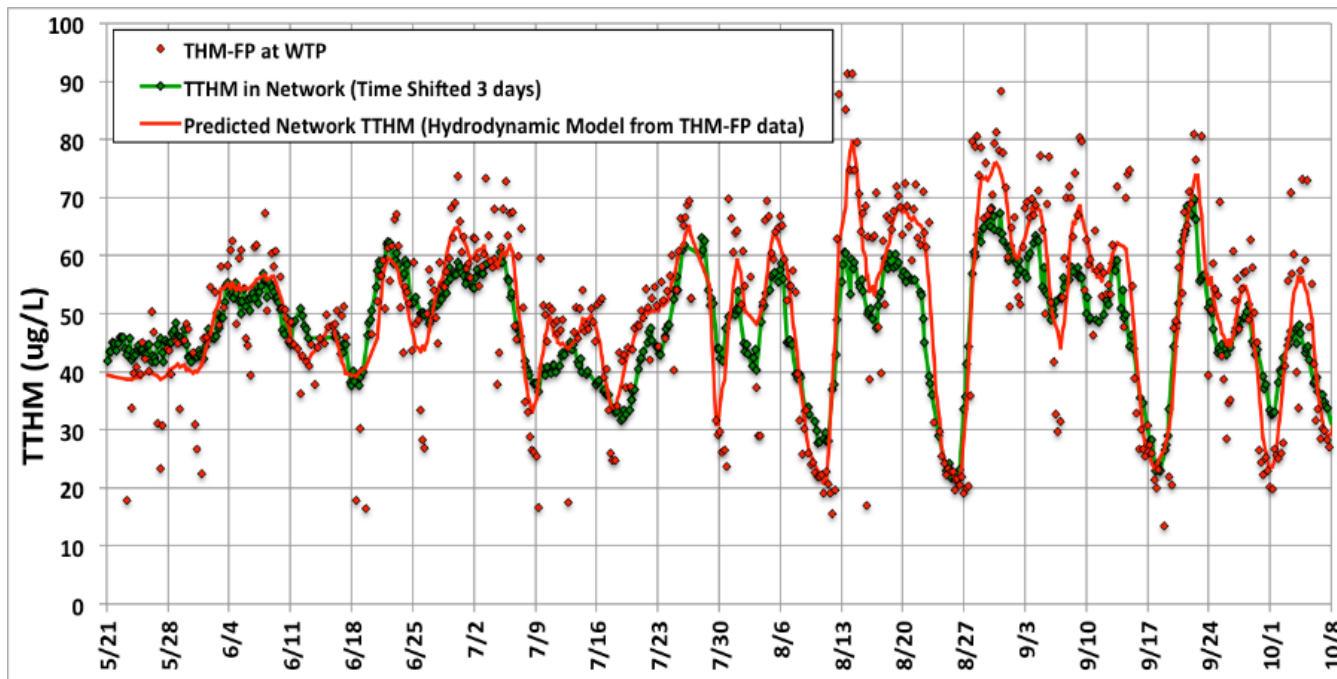
Sant Joan Despí WTP THM & THM-FP Levels



Sant Joan Despí WTP TTHM-FP & 72-hr Time-Shifted Network TTHM Levels



PN-TTHM Derived from Online THM-FP Values, Compared with 'actual' Network TTHM Levels



THM Formation Potential of Raw Water

CASE STUDY 2: REAL-TIME PREDICTION OF RAW WATER THM FORMATION POTENTIAL

Real-time Water Quality Data Driving Smart Water Treatment
Systems

THM-FP of Multiple Raw Water Sources

New York City

- University of Massachusetts Project with Prof. D. Reckhow
- Funded by Massachusetts Center for Energy Efficiency


Application


- 4 Remote Reservoirs 120 miles from point of chlorination
- THM Formation Potential of raw water sources changes unpredictably
- Surrogate THM prediction methods inadequate:
 - TOC (Total Organic Carbon)
 - UV absorbance at 254 nm
 - SUVA (combined TOC/UV)

Benefit

- Minimize THM formation at WTP by optimizing blend of raw water sources according to THM Formation Potential



 Potential locations in the NYC watershed for the THM-100-FP instrumentation.

 Disinfection with Chlorine

Evaluation of the Online THM-FP Monitor at UMASS Amherst

- MILL RIVER:
- Located in north Amherst and goes through a natural greenbelt southwest to Hadley and the Connecticut River
- Typical NE water quality, e.g., low alkalinity, low hardness
- Continuously pumped into Water and Energy Testing Facility for sampling and water quality monitoring



Monitoring Location (ELAB III)

Equipment for Online Monitoring of Raw Water at UMASS



THM-FP (Raw Water)

UV

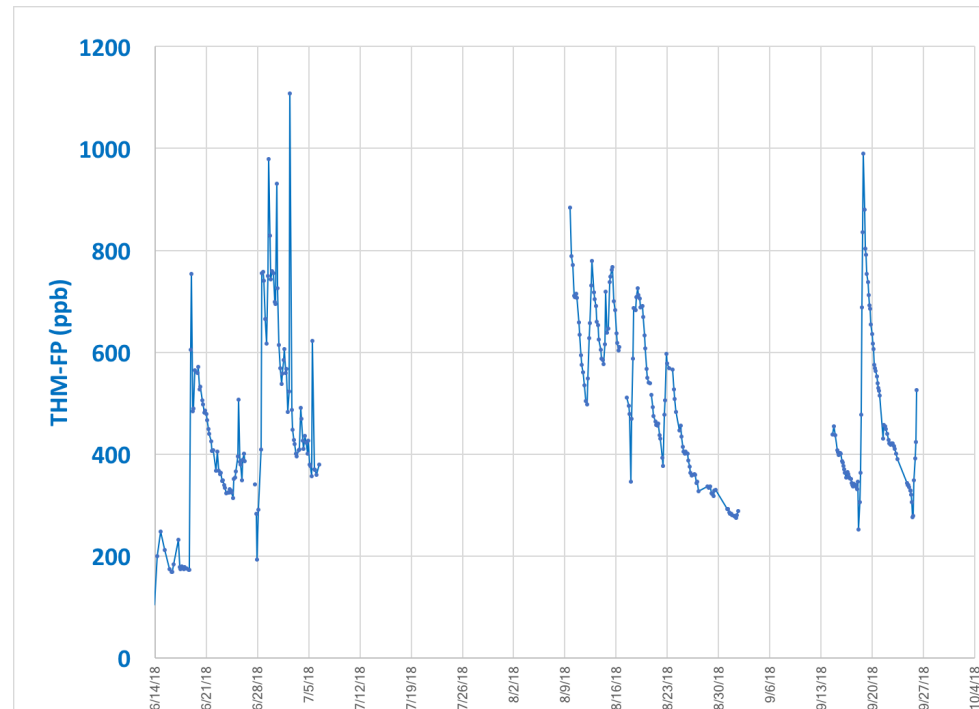
TOC

GC

COD

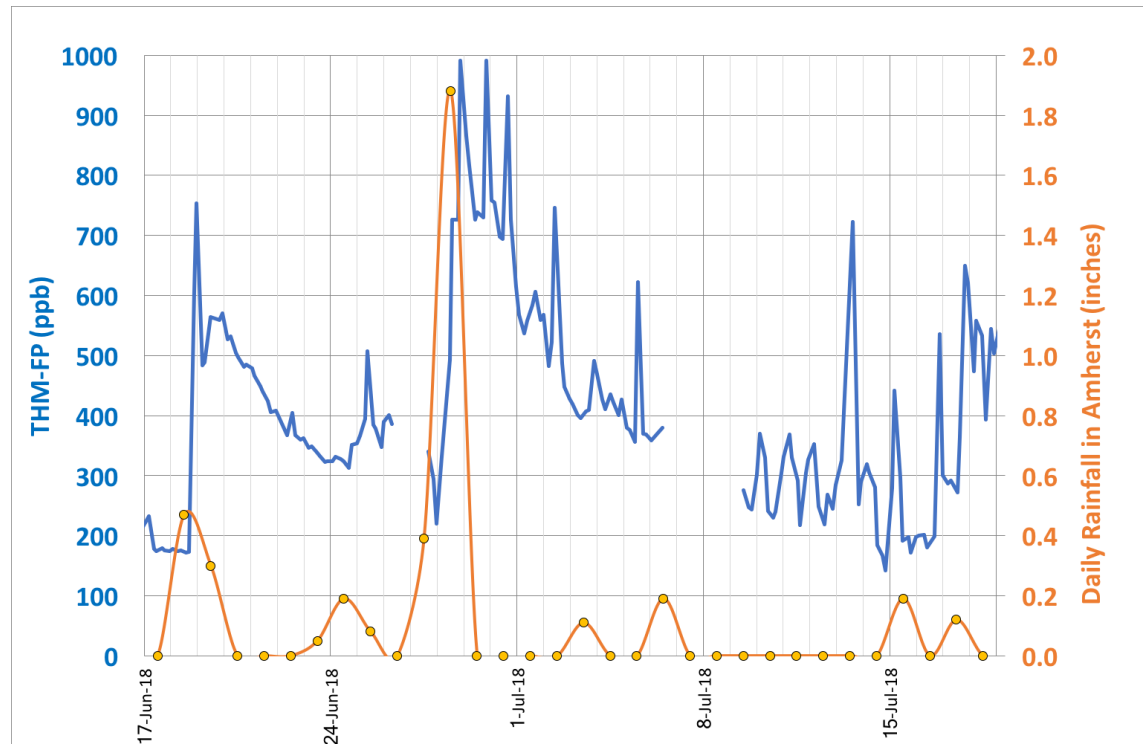
THM-FP Raw Water: 40 ppm Cl₂, at 50 C for 60 mins

- Summer 2018 (June-Sept)
- THM-FP responds rapidly to changes in raw water quality
- Other intervals not shown correlate with periods of method development with different operational parameters (e.g. variations in Cl₂ dose, reaction times and temps), or no water sample



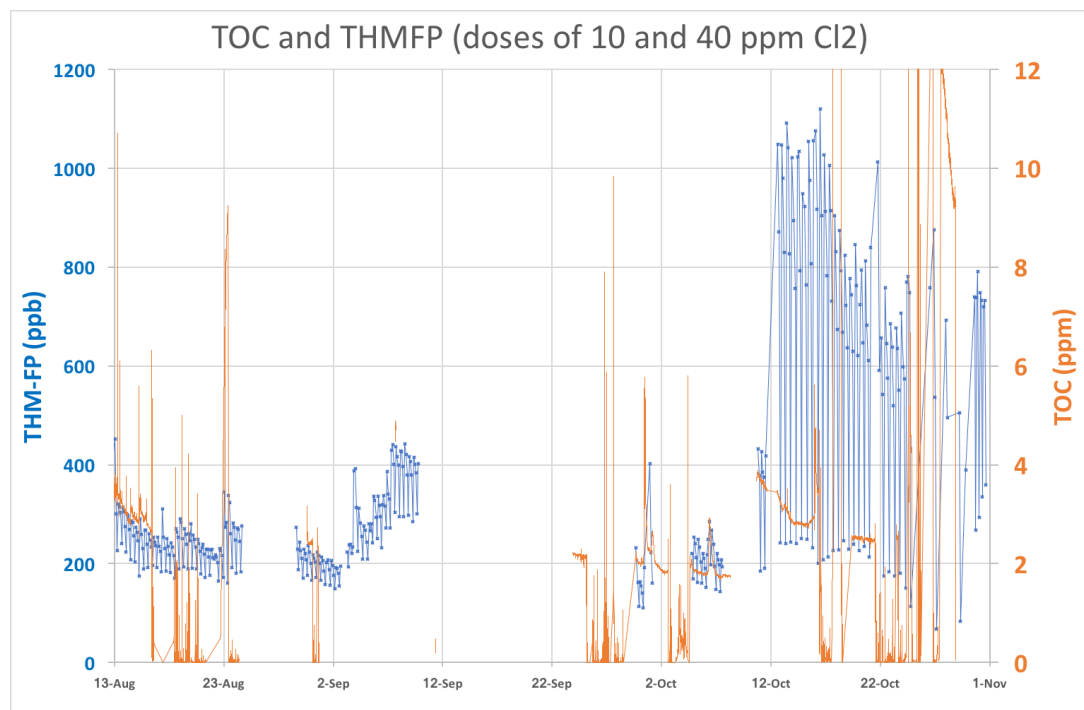
Online THM-FP of Mill River responds to local rain events

- Rain events within a mile of the sampling location on the Mill River always preceded large rises in online THM-FP levels.
- Other spikes in THM-FP would reflect water flow rate changes related to the broader catchment area.



Online THM-FP and TOC of the Raw Water Source Mill River

- The degree of correlation between TOC and THM-FP is 'mixed' over these summer months.
- Monitoring of THM-FP offers direct indicator of THM problems, avoiding surrogate techniques such as TOC and UV.
- At this small trial, problems with pumps and micro-filters (for TOC and UV) prevented access to a continuous supply of raw water.



THM Formation Potential of WTP with Single Water Source

Characteristics

- Single raw water source
- Small (5-10 MGD)
- Secondary storage capacity
- Challenges meeting MCL

Opportunity

Real-time prediction of THM Formation Potential of raw water allows for WTP to adjust throughput vs secondary storage volumes to minimise THM production

WE ARE SEEKING A DEMONSTRATION SITE!

Case Studies

ROI DATA

Return on Investment Using THM Formation Potential: SUEZ

COSTS

List Price: \$65,000 (includes shipping, installation and training)

Annual Service Charge: \$18,000

5 Year Warranty, 24/7 Remote data access and health monitoring

Rental: Treatment System Validation and pilot plants: \$15k/quarter (credit for purchase) (ASC included)+ shipping

SAVINGS - \$30k/month

Reduction in chemical usage, sludge removal, carbon filter replacement, power consumption (aeration/RO), blended water use

PAYBACK: 3 months

Return on Investment – San Jose Water Company

- San Jose aeration system controlled using results from THM-100 monitor to target an effluent value of 40 ppb TTHM and take advantage of off-peak energy rates (Peak rate = \$0.18/kwh vs. Off-peak rate = \$0.10/kwh).
- THM reduction and energy optimization yielded a total estimated energy cost savings of USD \$35-45K per year.
 - Energy cost for 24/7 operation of seven aerators for one year is approximately USD \$70k
 - Initial results indicate the probable use of 3-4 24 hour equivalents to maintain < 40 ppb
 - Energy cost for 24/7 operation of three aerators is approximately USD \$30k
 - Potential time of use savings is approximately USD \$5k

PAYBACK: 2 years

A large, dynamic splash of water in shades of blue and white, occupying the left side of the slide. The water is captured in mid-air, creating a sense of movement and freshness.

Questions



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