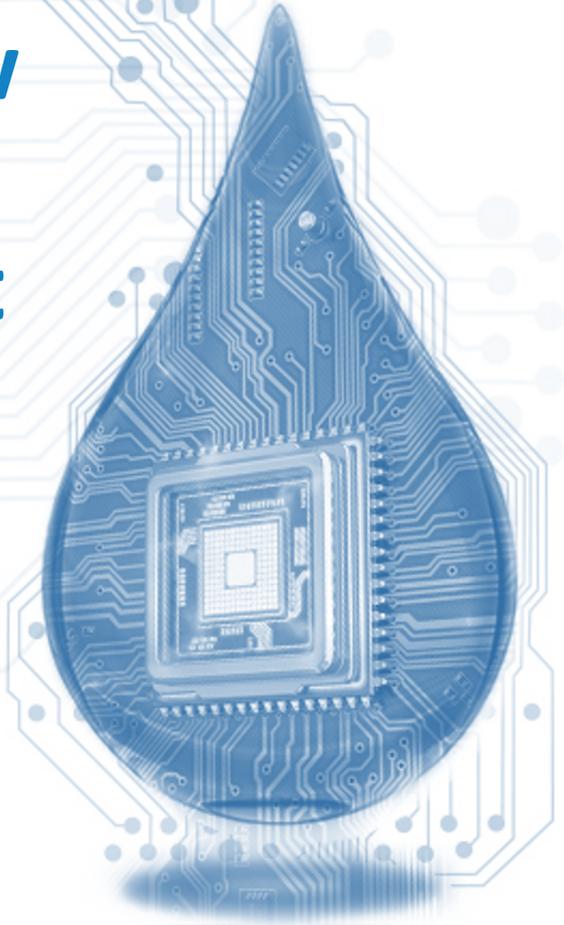


# Trace Metal Monitoring: How to Maximize Monitoring Results with Minimum Effort



Transforming the Way We See Water

# Agenda

- Introduction
- The value of high-frequency, real-time data
- Evaluating online trace metal analyzers
- Analytical method
- Applications of online trace metal analyzers
- Innovations in online trace metal monitoring



# Introduction

- HQ in Silicon Valley, California with an Innovation Center in Wyckoff, New Jersey
- 19 year heritage in technology for monitoring of contaminants of concern
- US market leaders in monitoring of DBPs and Trace Metals (As, Cr, Pb, Cu, Se, Zn)
- January 2020 launch Nitrate, Ammonia, Manganese, Fluoride, Phosphate online analyzer range
- 100+ Installations in Americas and Europe
- Municipal clients: Cal American, Suez, SF PUC, City of Phoenix, El Paso, Birmingham, Des Moines, Scottsdale, Gilbert, Scottish Water, Severn Trent, etc...
- Industrial clients (US): Batelle, Barrick Gold, Sumitomo, Coca Cola, Duke Energy, Samsung, Sandia National Laboratories, Teck Resources
- Engineering Partners (US): Carollo, AECOM, Hazen & Sawyer, Black & Veatch, Corona....



# The Value of High Frequency Real-Time Data

## CHARACTERIZATION

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

## PILOT 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

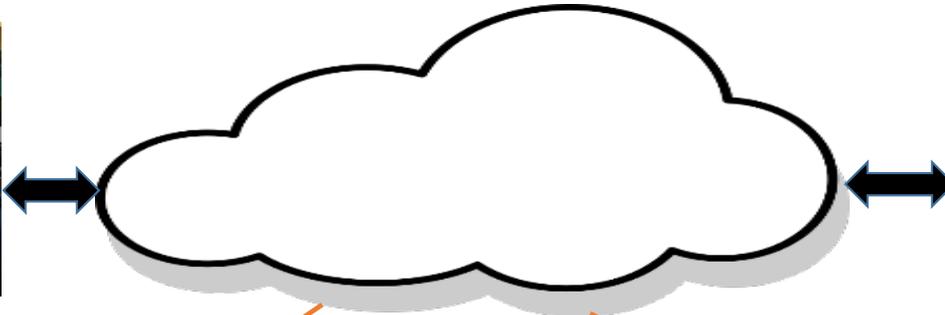
## PROCESS OPTIMIZATION

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

# Real-Time Data Drives Intelligent Water Treatment



**ANALYZER REMOTE  
PERFORMANCE  
MONITORING**



**INFLUENT**

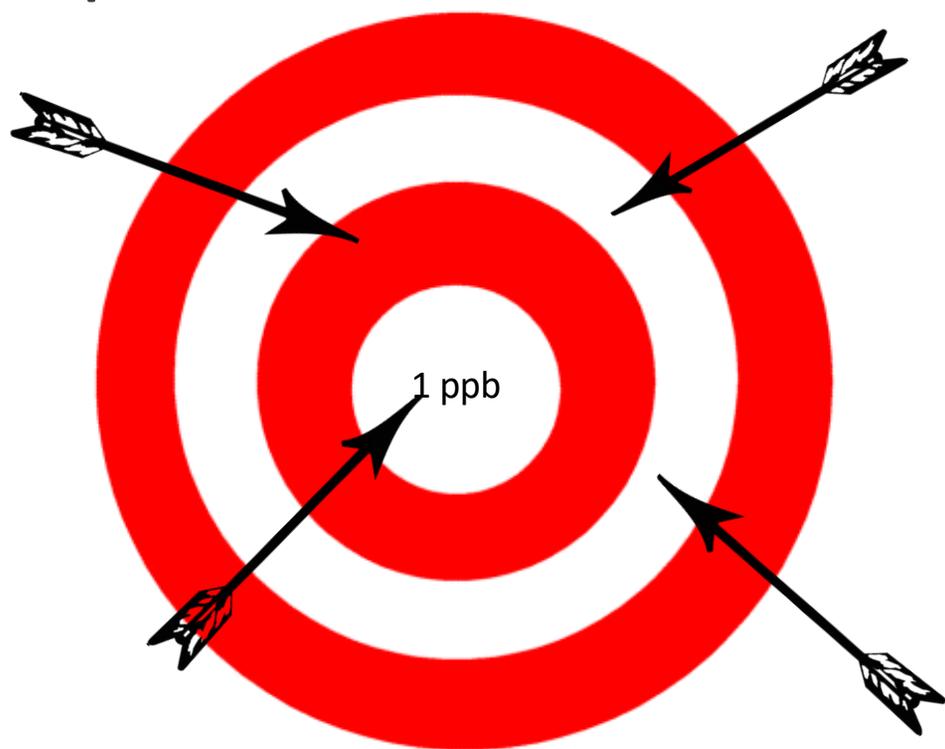
**CONTROLLER**



**TREATED EFFLUENT**



# Data are Mission Critical but not all Data are Equal....



Limit of Detection?

Accuracy and Repeatability in natural matrices?

Automatic sample preparation?

Speciation (e.g. lead, chrome, selenium)?

Self-calibration and validation?

Deliverability (4x120mA/Profibus/Cloud)?

Analyzer availability (mean-time-to failure/mean-time to repair)?

# Multi-Stream Online Trace Metal Analyzer

## MetalGuard™

(Cr, As, Pb, Cu, Zn, Se, Ni, and more)

### Automated online operation

- Eliminates operator variability
- Accuracy to +/-1 ppb or +/-10%
- Limit of quantification 1 ppb or lower
- Measurement time 30-45 minutes
- Correlation with standard method +/- 5% typical
- Multiple streams including grab sample port
- 24/7 Remote Health Monitoring to ensure maximum up-time

### Comprehensive data acquisition

- Easy-to-use front panel HMI
- Programmable on-board data acquisition

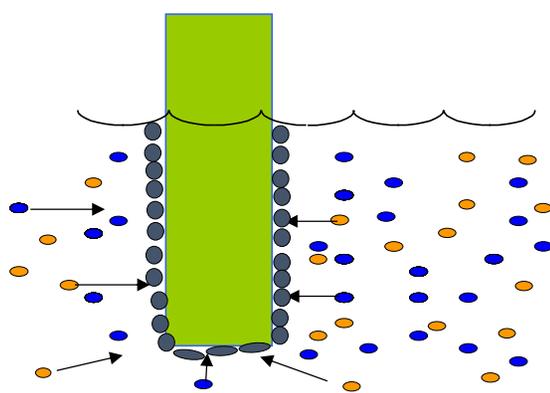
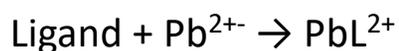
### Low operational costs

- Replaceable reagent tray provides up to 1,000 measurements
- Employs a self-regenerating sensor and is auto-calibrating
- NEMA 4X enclosure

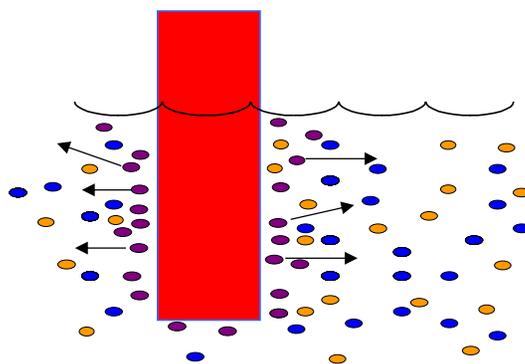


# Trace Metal Determination Using Stripping Voltammetry

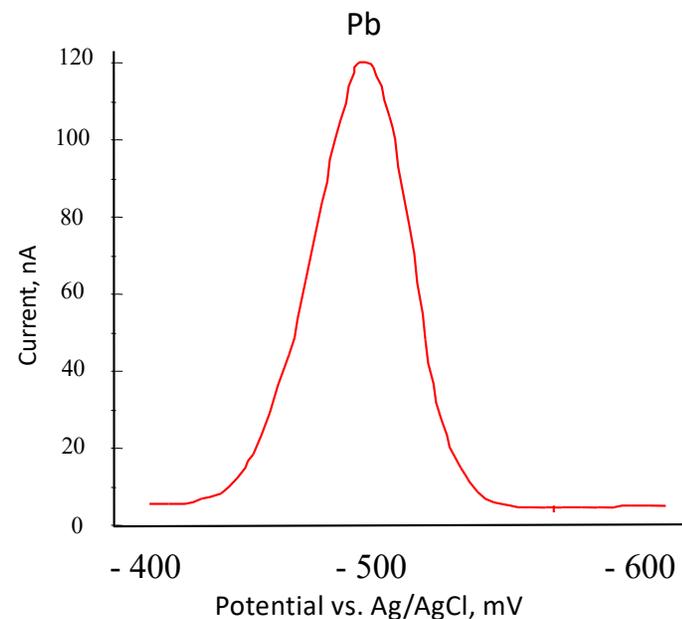
Accumulation step 1: Lead specific ligand forms strong complex with lead ions and precipitates onto the probe



Stripping step 2: resulted complex stripped from the probe surface during cathodic scan generating electric current

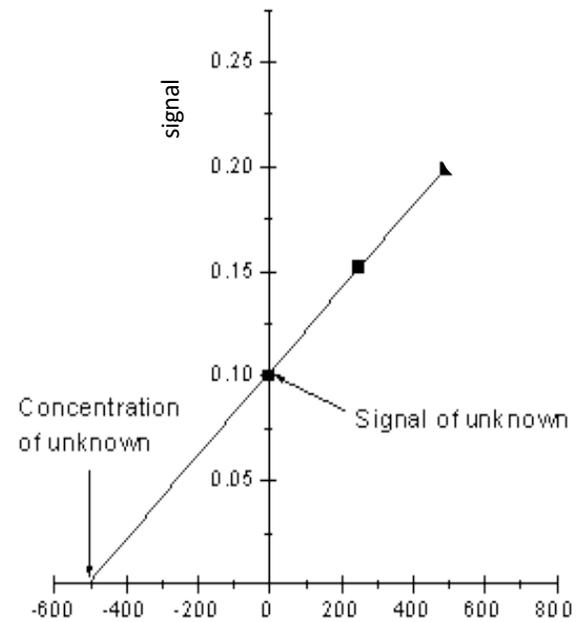
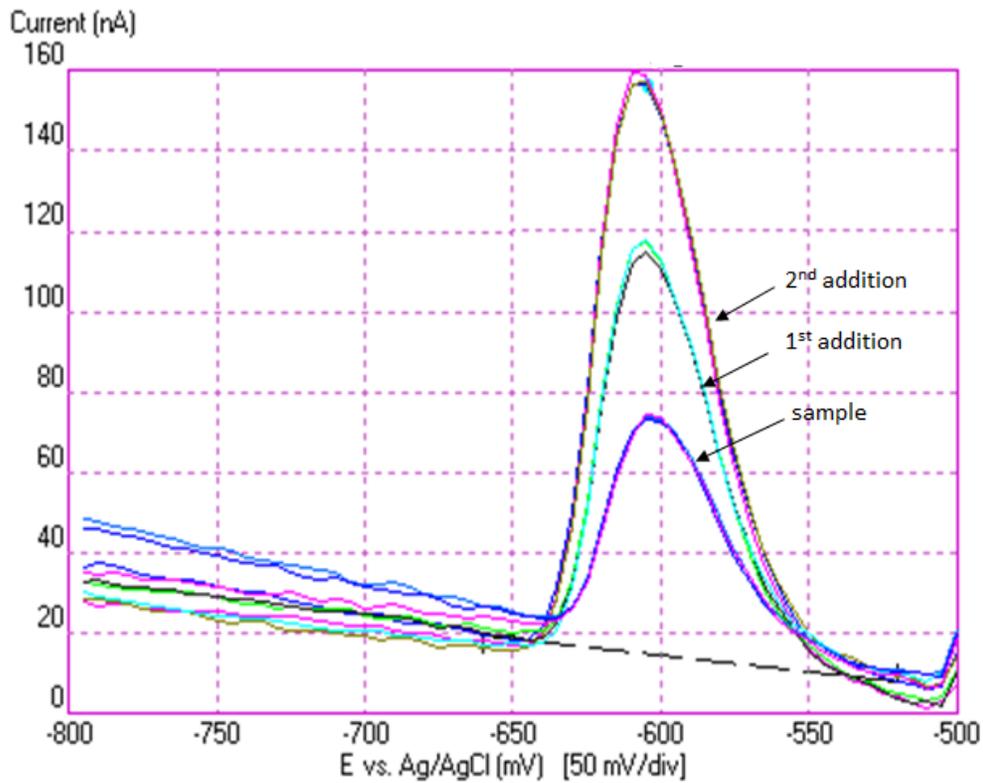


Resulting Signal is proportional to Pb concentration in the sample

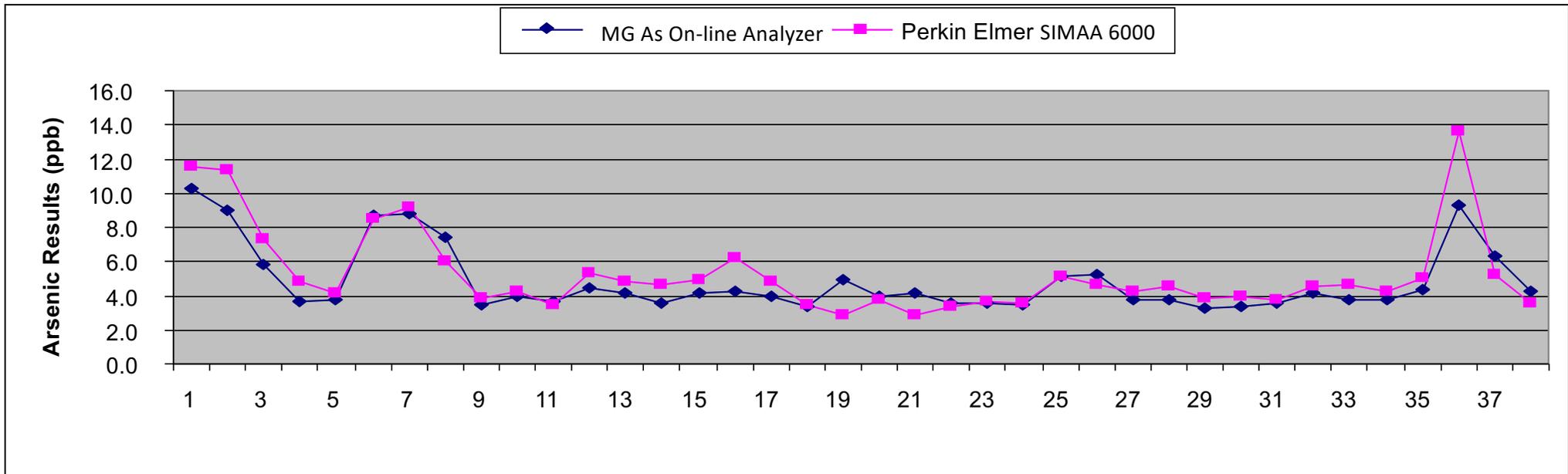


$\text{Pb}^{2+}$     $\text{L}_{\text{sol}}$     $\text{PbL}_{\text{ads}}$     $\text{Pb}^0$

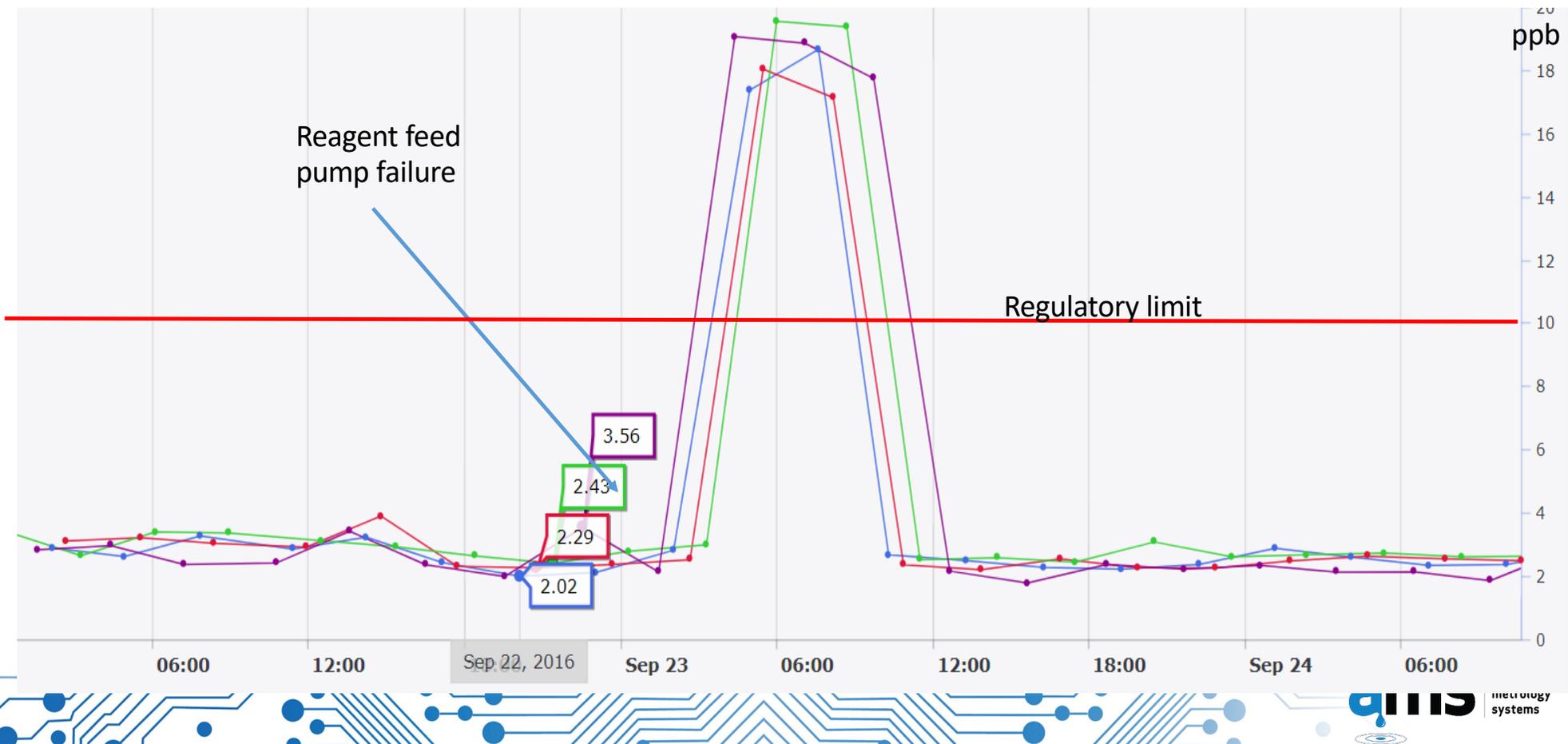
# Quantification by Multiple Standard Additions



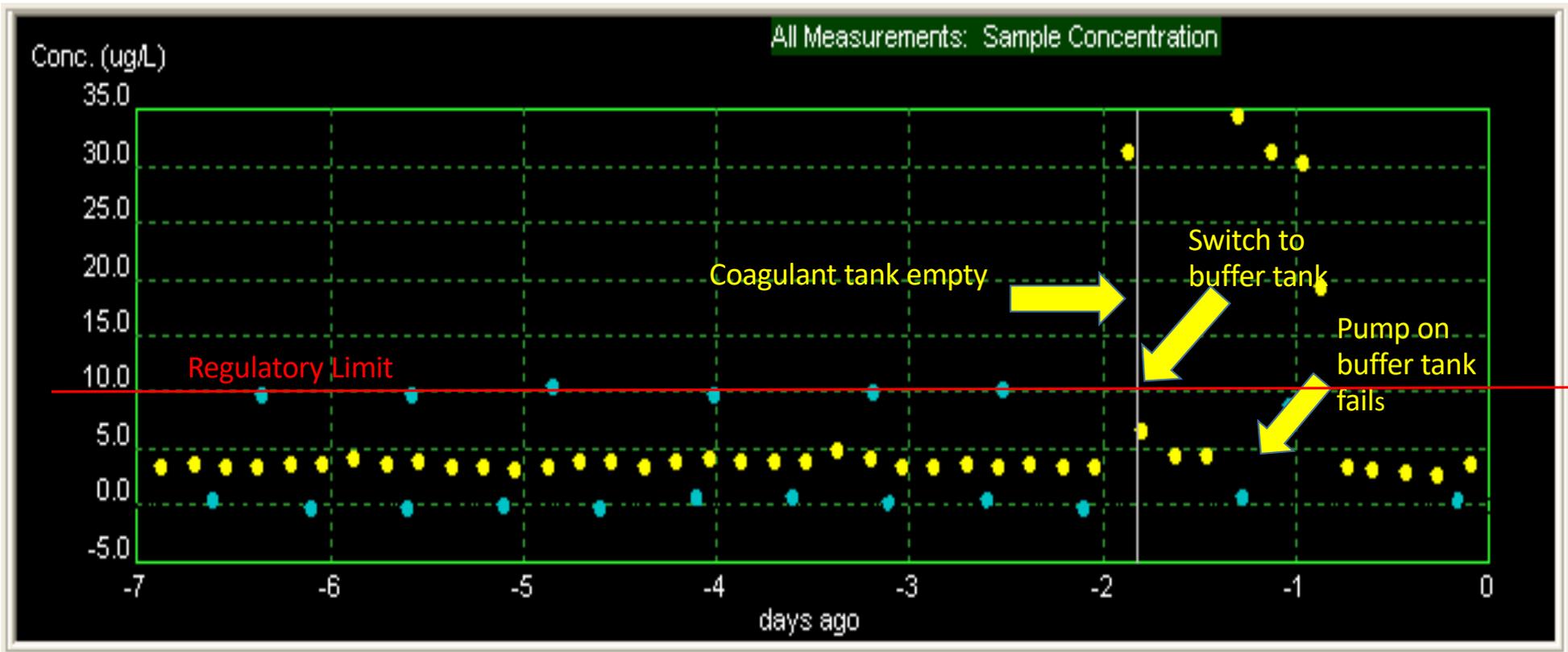
# Laboratory versus Online Analyzer



# Laboratory based methods do not provide for process control and risk management but Risk Management: Cr(VI) Treatment

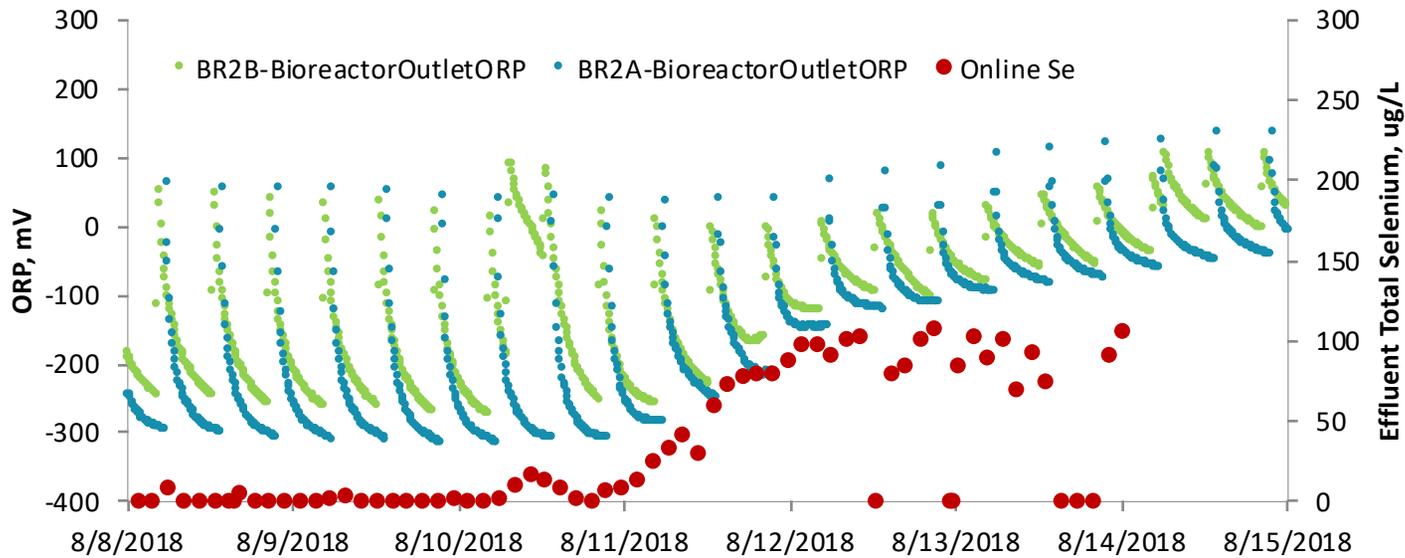


# Laboratory based methods do not provide for process control and risk management



# Monitoring Performance: Effluent Selenium

Selenium probe courtesy of Aqua Metrology Systems



- Effluent monitoring:
- ORP versus selenium probe
  - ORP has historically been a slow response – once you are sure something is happening it is too late
  - Selenium probe has proven reliable in measuring influent to low effluent selenium concentrations.

# Lead Contamination Risk Management

## *The Need for a Proactive Approach*

### US Lead and Copper Rule Limitations

- Limited sample size
- Limited frequency
- Can only confirm presence of elevated lead **AFTER** exposure
- Children's blood testing is the default 'call-to-action' for comprehensive lead contamination testing and remediation

**An analytical system is required to predict when consumers are at increased risk of exposure to lead so that they and their utility can take timely remedial action **BEFORE** contaminated water is consumed**

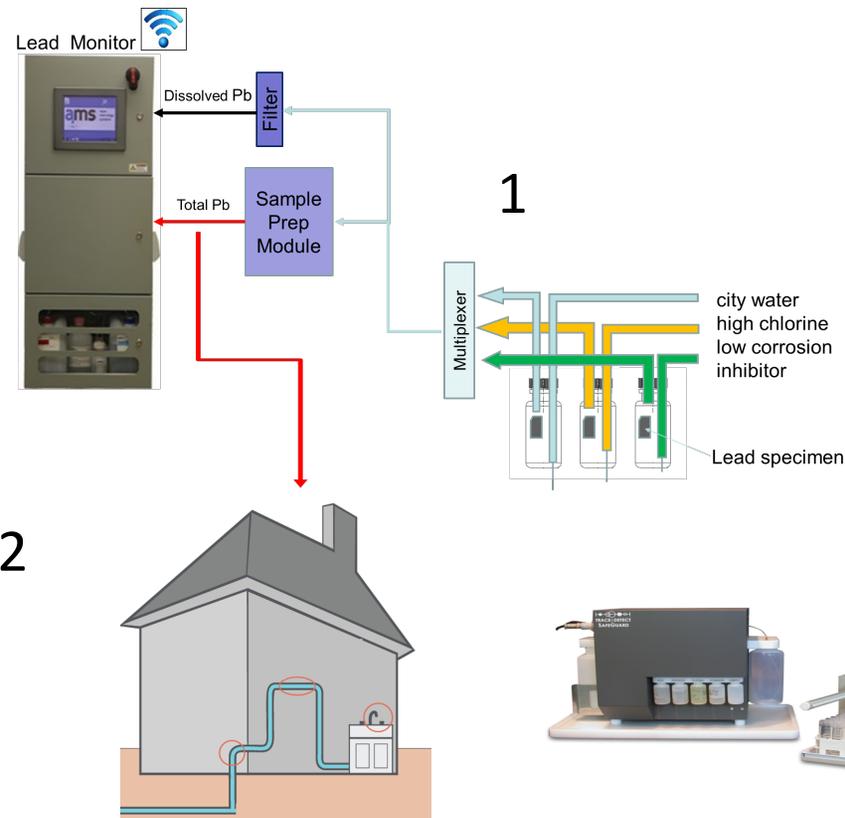


# MetalGuard Lead Alert™

1. MetalGuard Lead Alert™ monitors in real-time city water flowing through sample chambers containing lead coupons and detects immediately any increase in lead corrosion rates (dissolved **and** undissolved lead)

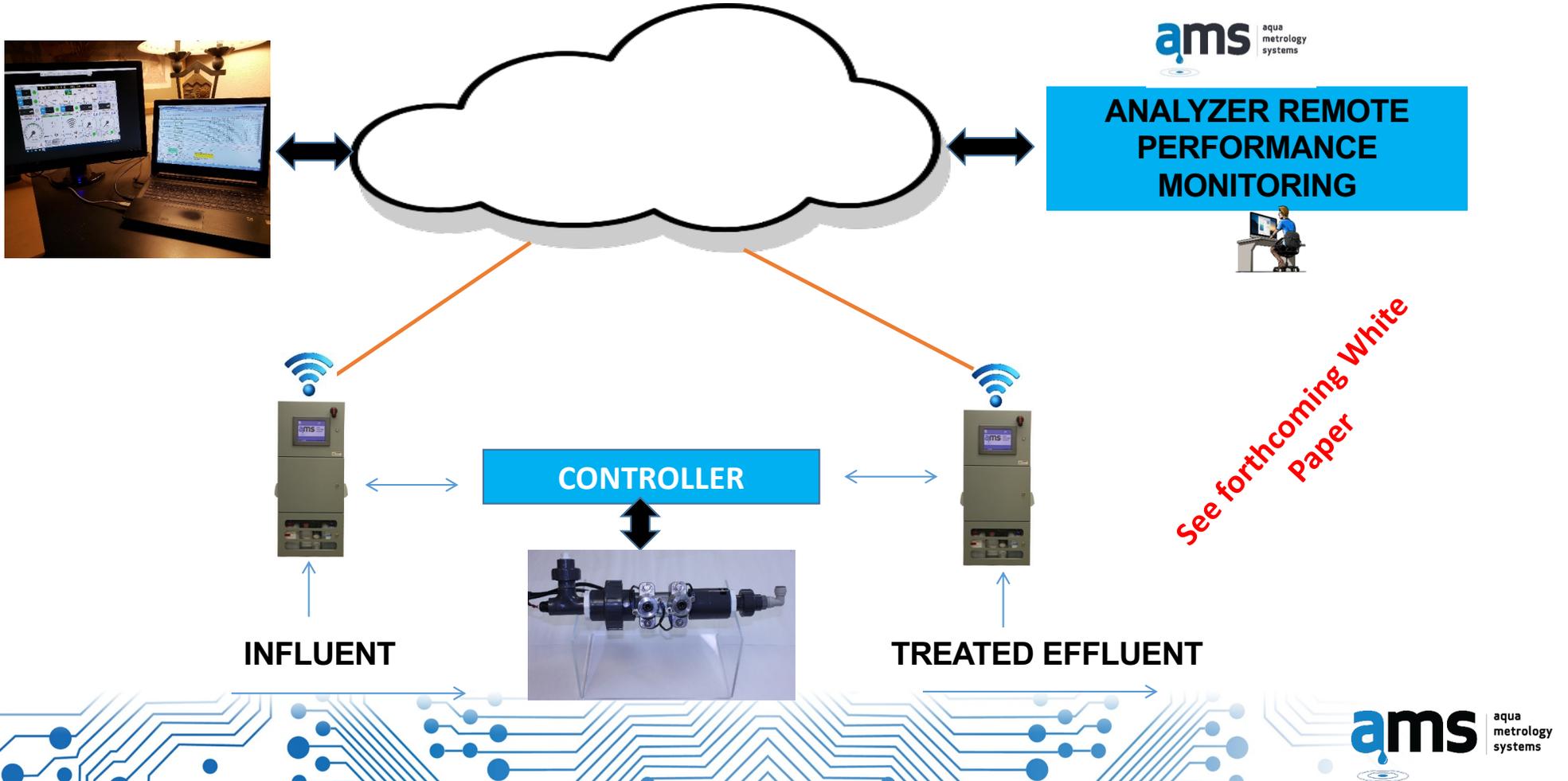
2. Utility warned of increased risk of lead corrosion **BEFORE** consumers exposed to risk of lead poisoning. Prompts risk mitigation and high frequency monitoring

3. SafeGuard deployed for rapid high-frequency monitoring of at-risk buildings and communities



3

# Intelligent Hexavalent Chrome Removal System



# Innovation

## *Made Possible by Real-time Monitoring*

High-frequency, real-time measurement of treatment system throughput and contaminant levels in influent and effluent enables a mass-balance to be automatically calculated.

Treatment system vendors can now offer:

Performance Guarantees

Pay-for-Performance

- \$/gallon treated to compliance
- \$/weight of metal removed



# The Value of High Frequency Data

“The MetalGuard Cr(VI) analyzer enabled California American Water to have higher visibility of contaminant levels in real-time. The fast and reliable online data allowed us to maintain the wells operational while continuing to deliver safe drinking water to our customers.”

**Lacy Carothers, P.E., Project Manager for California American Water**



# The Value of High Frequency Data

“AMS’ MetalGuard™ automated, online arsenic analyzers have been an asset to our facility and they have given us a peace of mind that was not possible before when we relied on more traditional analytical methods. Staying on top of water quality changes and its impact on arsenic levels has allowed us to adjust our treatment process in real-time to remain in compliance with EPA arsenic regulations.”

**Ray D. Shay, Superintendent, Upper Valley WTP, El Paso, TX**



# Learn More

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[www.aquameterologysystems.com](http://www.aquameterologysystems.com)

[www.linkedin.com/company/aqua-metrology-systems-limited](http://www.linkedin.com/company/aqua-metrology-systems-limited)

