

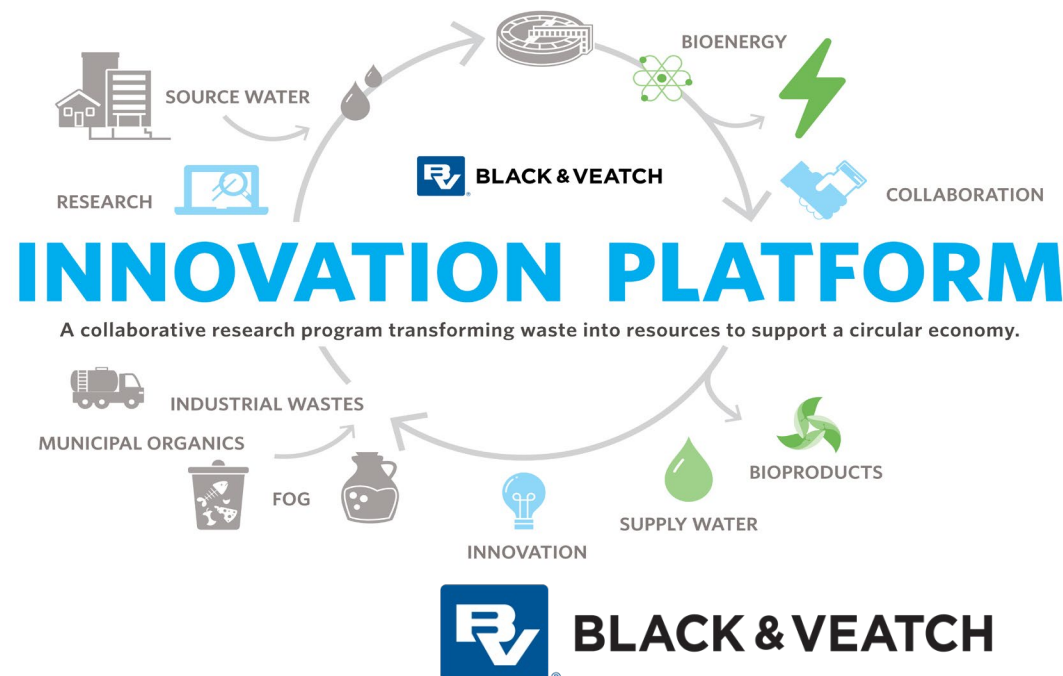


# Intelligent membrane management to enhance resource recovery opportunities

Sandeep Sathyamoorthy

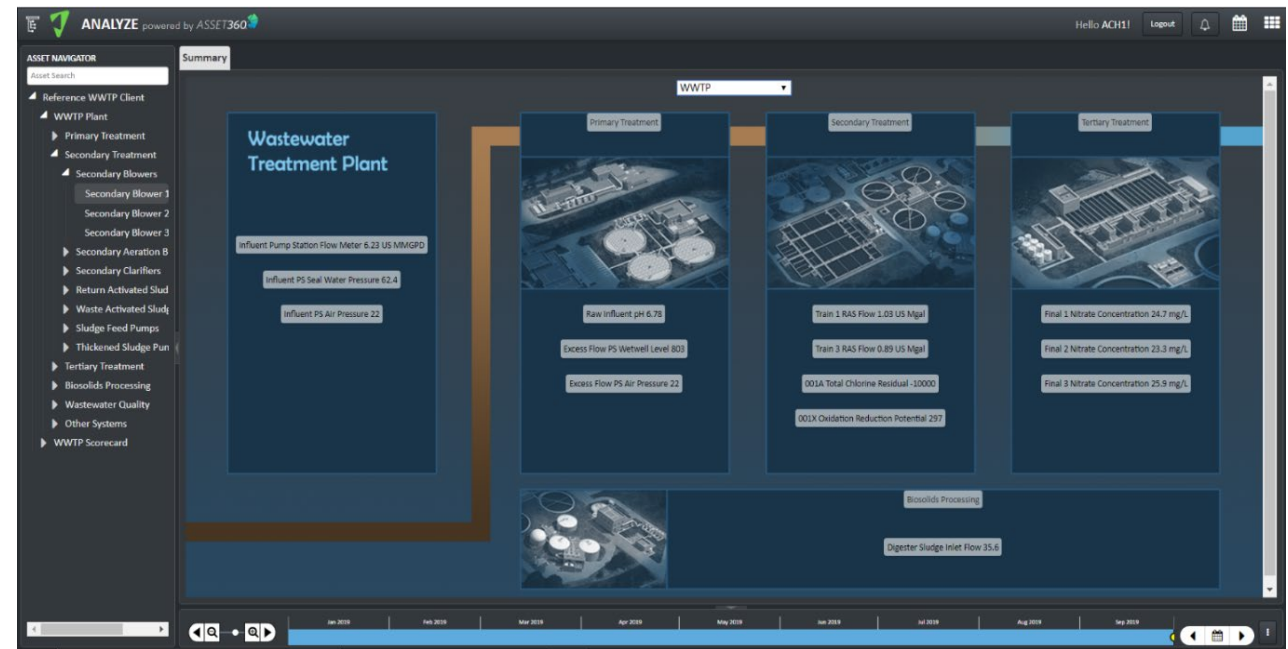
IWA Aspire 2019, Hong Kong  
November 1, 2019

BUILDING A WORLD OF DIFFERENCE®



*IOT & AI now commonly impact  
& benefit our daily lives*

*And is coming to a WRRF  
screen near you*



*Figure courtesy of Atonix Digital*

# Framework for today's talk

**Opportunities**

**Solutions &  
Strategies**

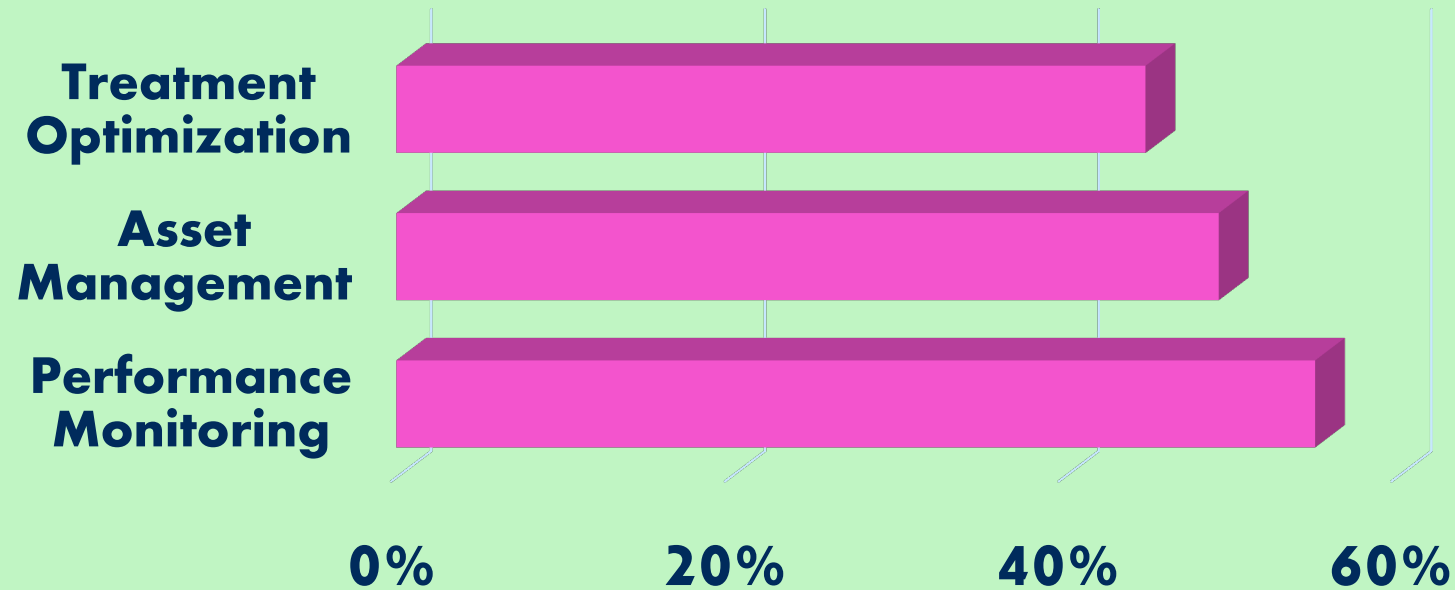
***The Fine  
Print...***



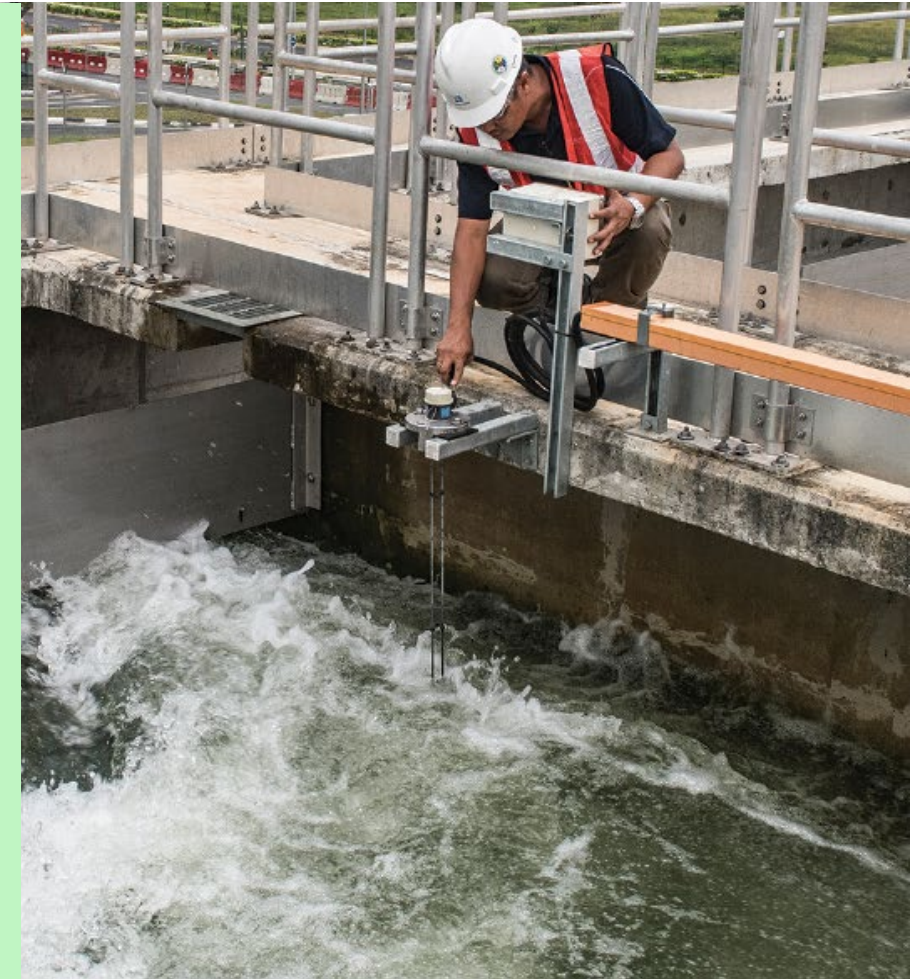


# Opportunities to maximize the value of analytics, machine learning and connected analyses

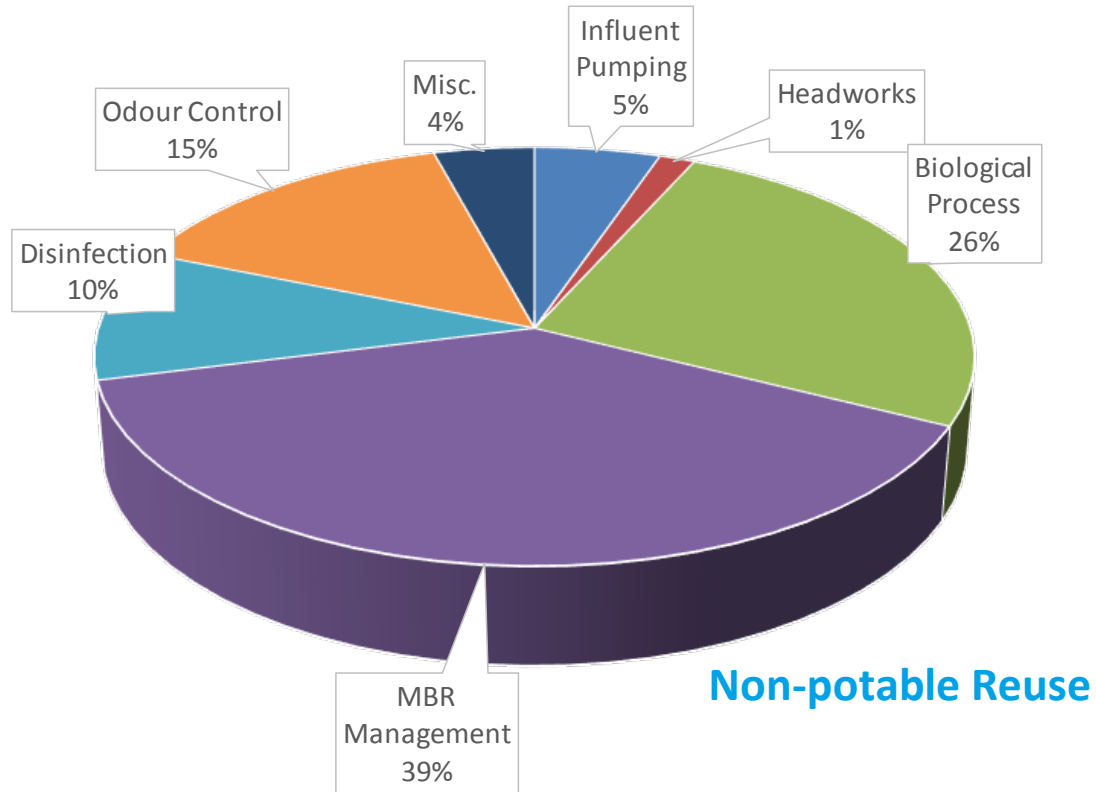
**Operational areas where data analytics and automated monitoring will help improve your organization?**



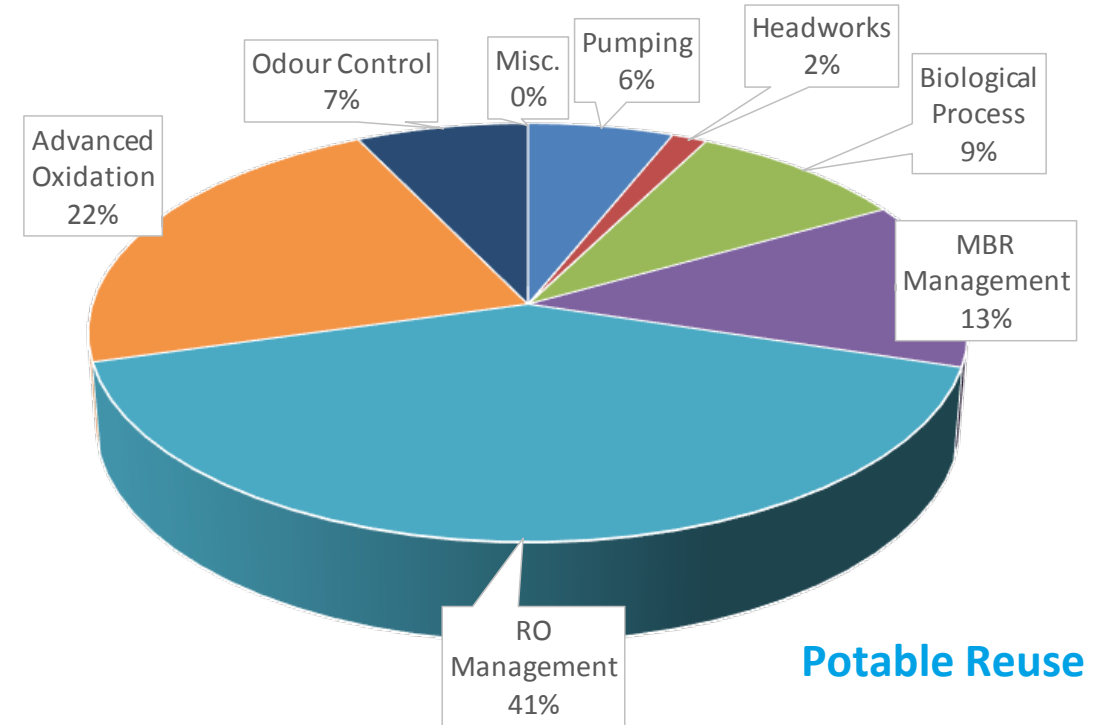
*2018 Strategic Directions:  
Black & Veatch Water Industry Report and Survey*



# Energy costs of membrane management in water reuse schemes

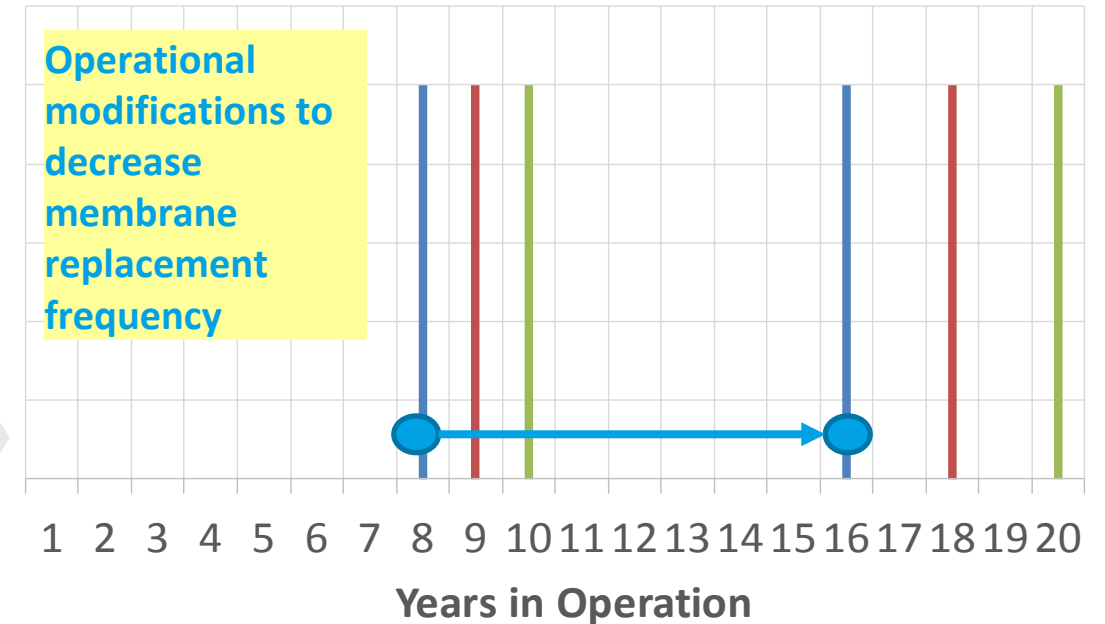
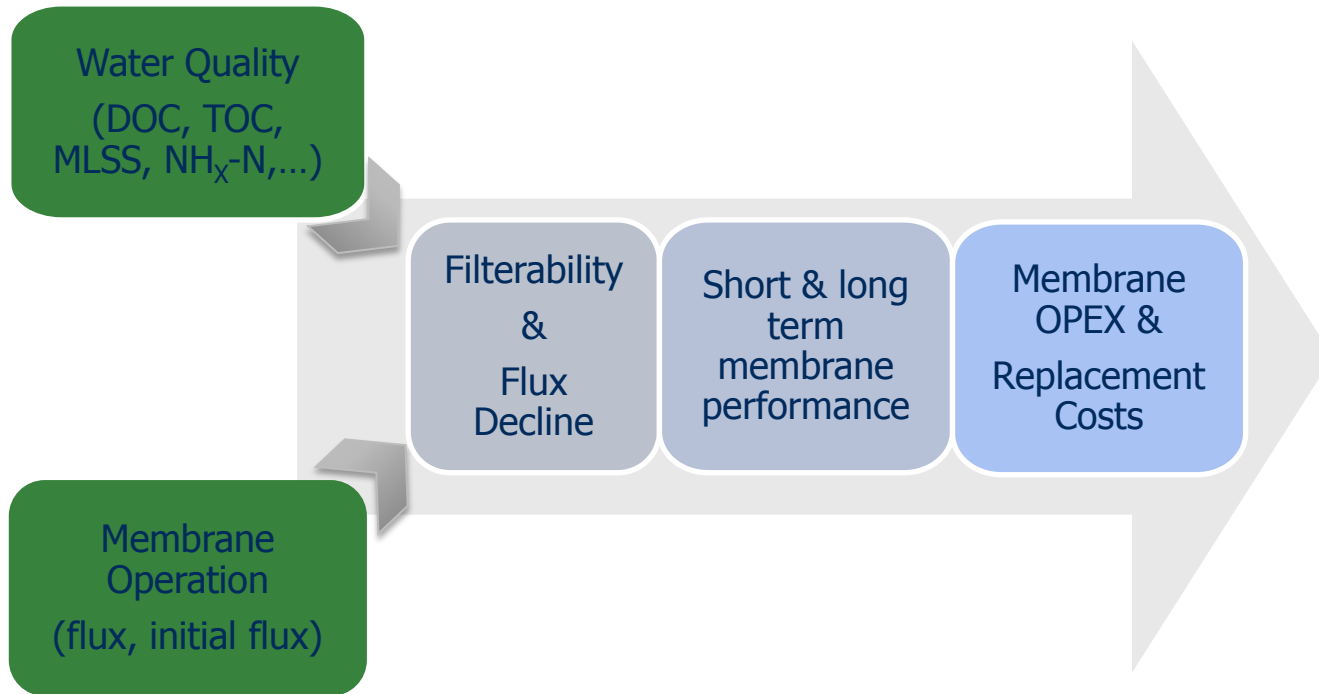


- ❑ 5% reduction in MBR management costs can result in 1-2% OPEX reduction



- ❑ 5% reduction in MBR & RO management costs can result in 2-3% OPEX reduction

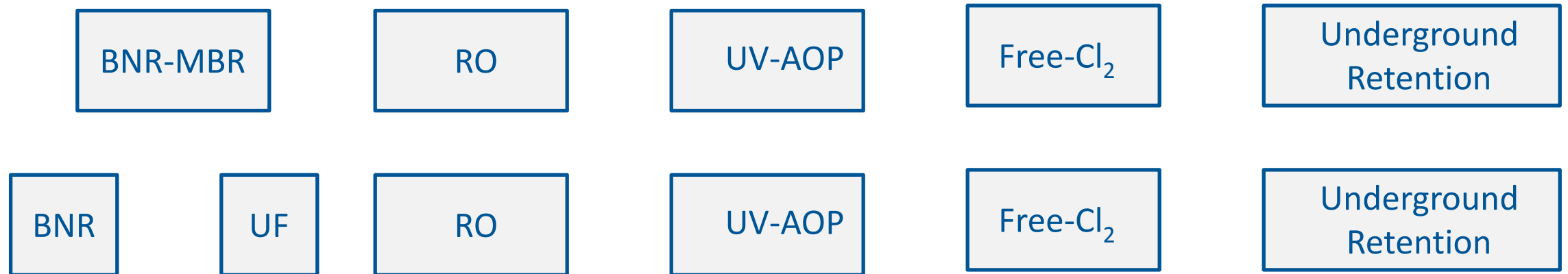
# Membrane replacement costs are directly influenced by operation and water quality



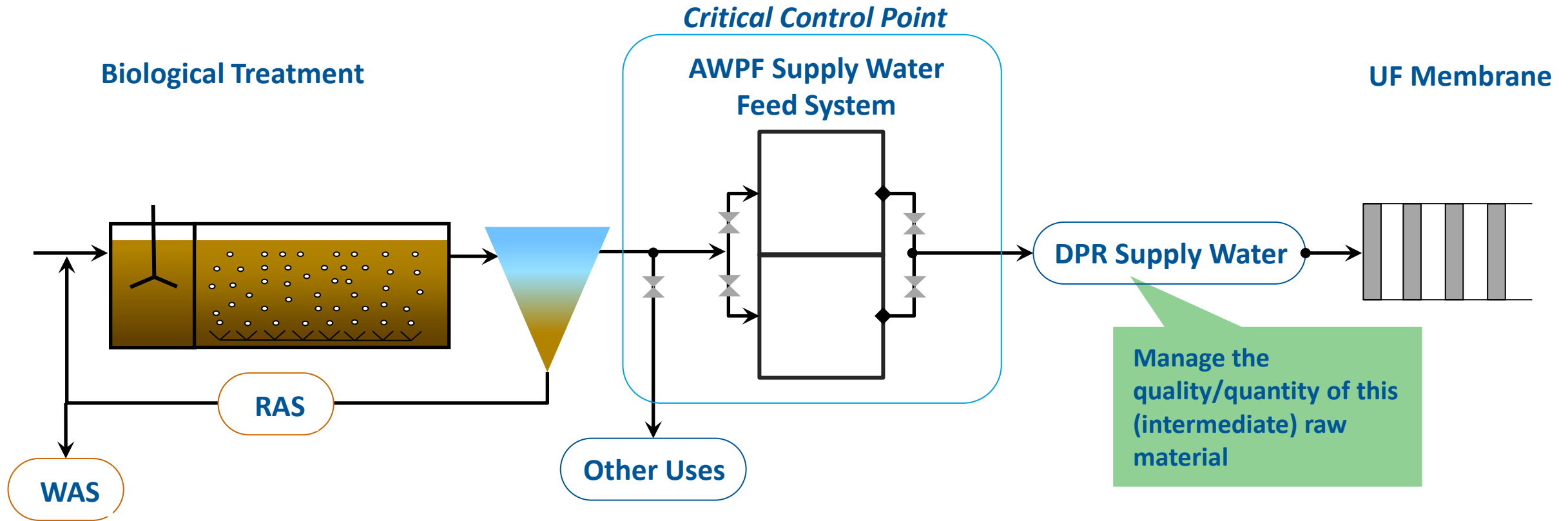
- ❑ *Enhanced operation to increase membrane life results in 2%-5% reduction in 20-yr present worth*

# Process Risk Management & Treatment Performance Optimization

	Virus	Giardia	Cryptosporidium
Regulatory Requirement	12	10	10

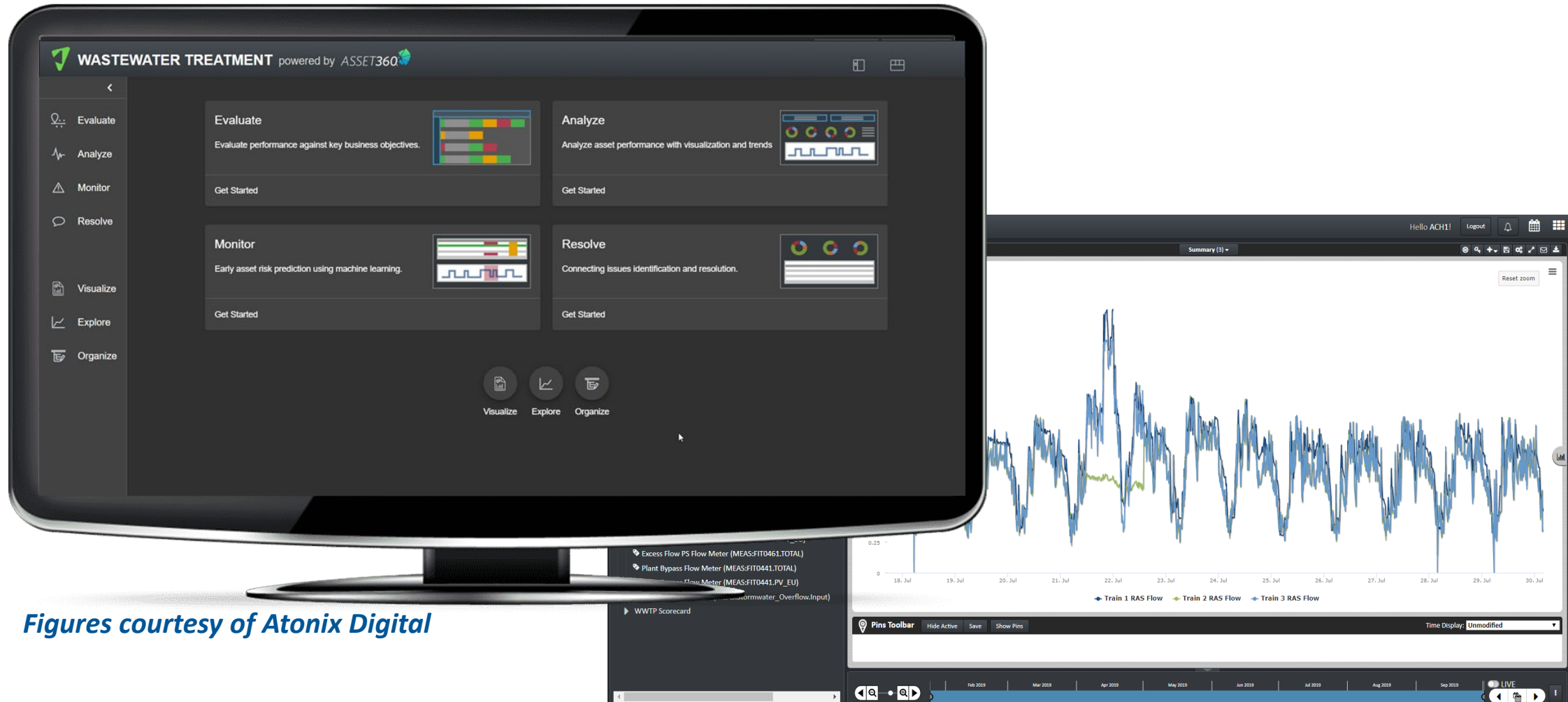


# Process Risk Management & Treatment Process Optimization in Potable Reuse





# Solutions & Strategies – Some Examples



*Figures courtesy of Atonix Digital*



# Actively managing membrane energy requirements

❑ *In an MBR - energy costs driven by air scour*

## Current Approach(es) to MBR Air Scour

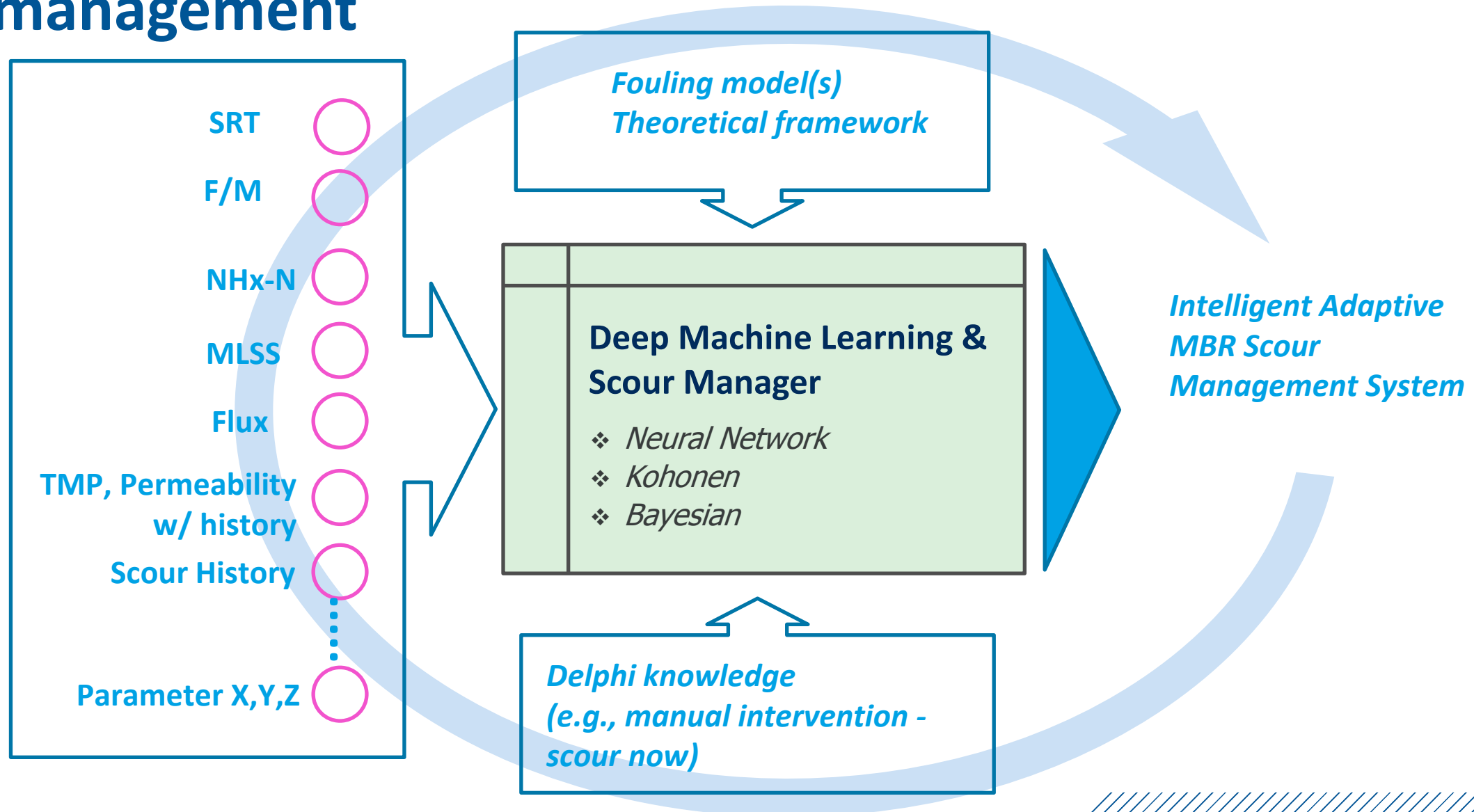
- Continuous aeration (with high/low SPs)
- Intermittent aeration (with high/low SPs)

=> **Two basic control variables:** Air Flow  
Time

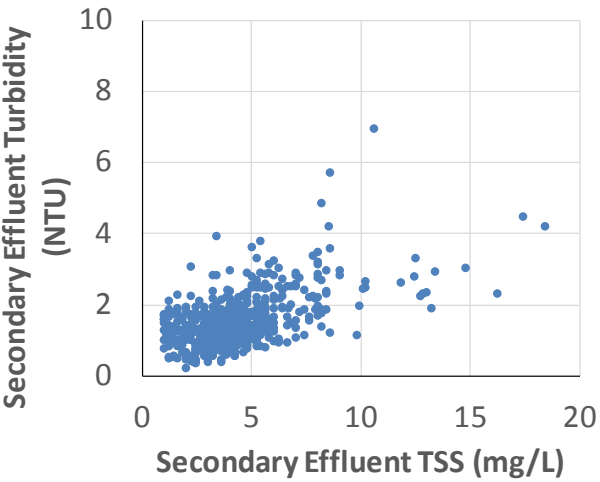
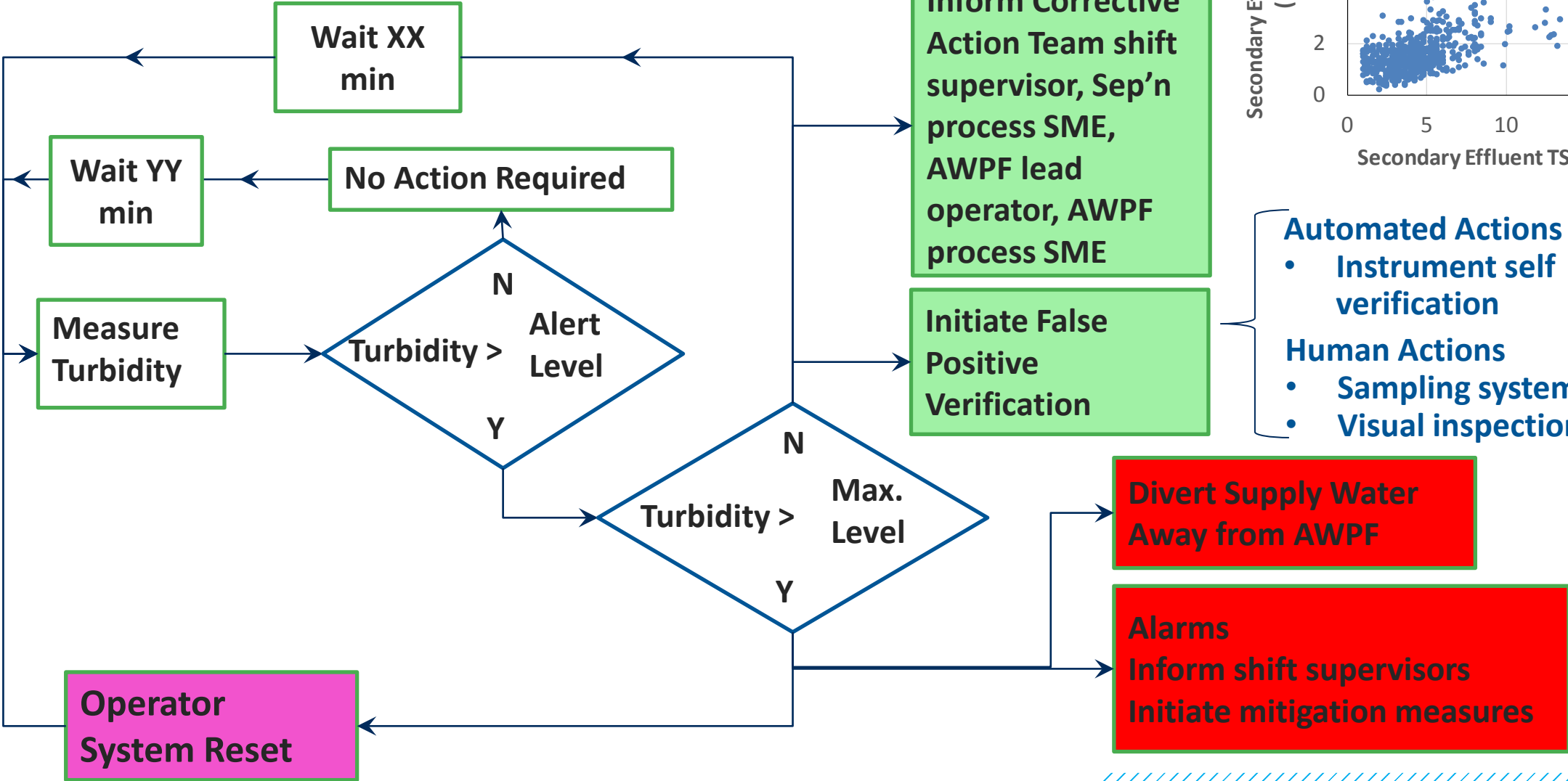


- Results in (sometimes) OVER-scour & (sometimes) UNDER-scour
- Membrane fouling is a complex, multidimensional process impacted by a range of variables
  - Need a scour tool capable of understanding, then managing scour based on fouling needs

# Using machine learning & analytics tools for air-scour management

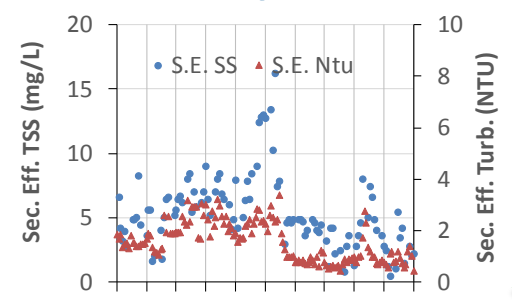


# Managing supply water quality in potable reuse

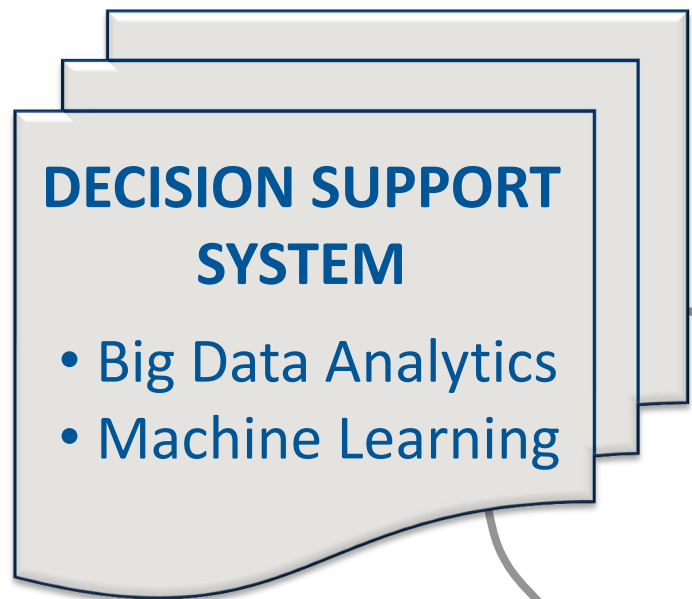
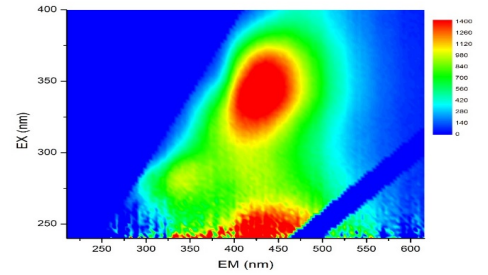


# Using water's fingerprint to manage attention points

Turbidity/TSS



Fluorescence Spectrum



Early Warning Actions

Attention Point Health

KPIs



# Using water's fingerprint to manage attention points

## Turbidity/TSS

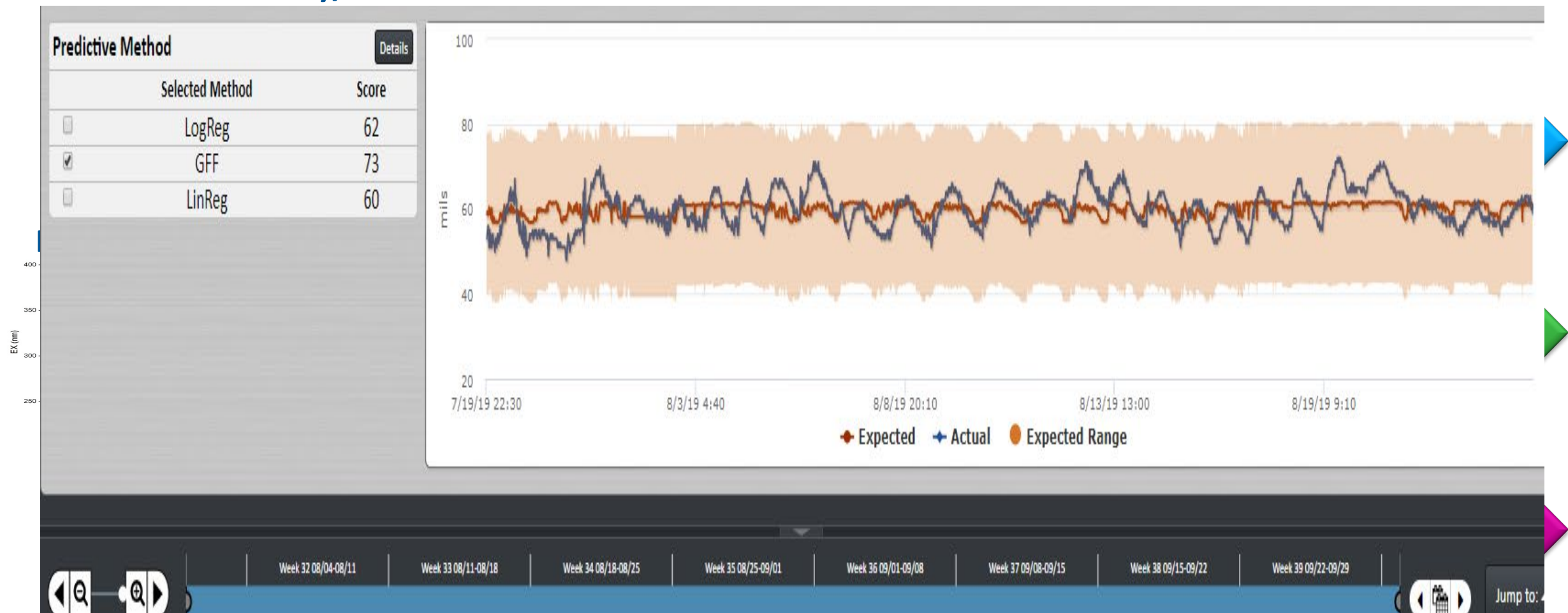
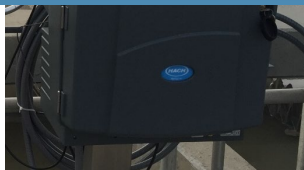


Figure courtesy of Atonix Digital



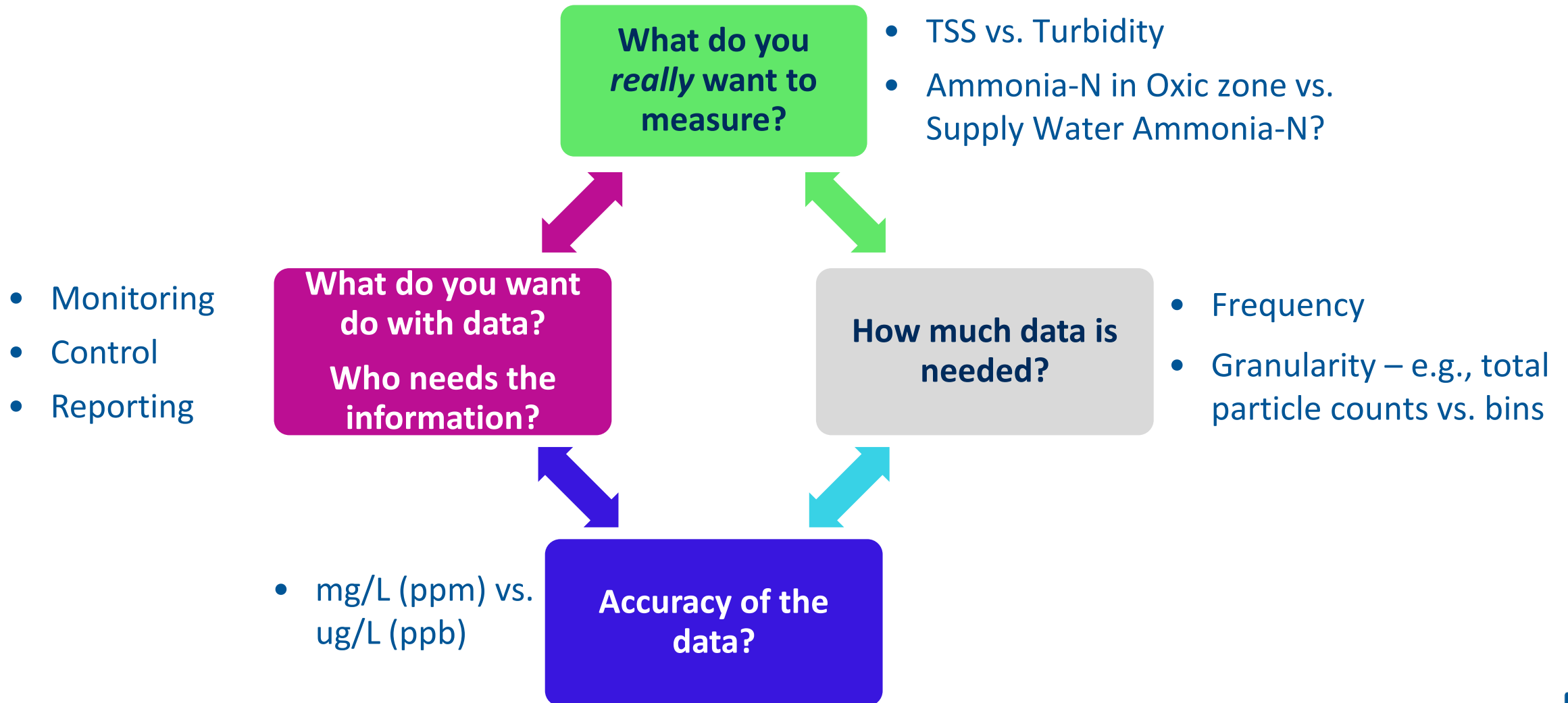
# The Fine Print

Xxx xxx

things you need to  
really, really pay  
attention to if you  
want the system  
to actually work....

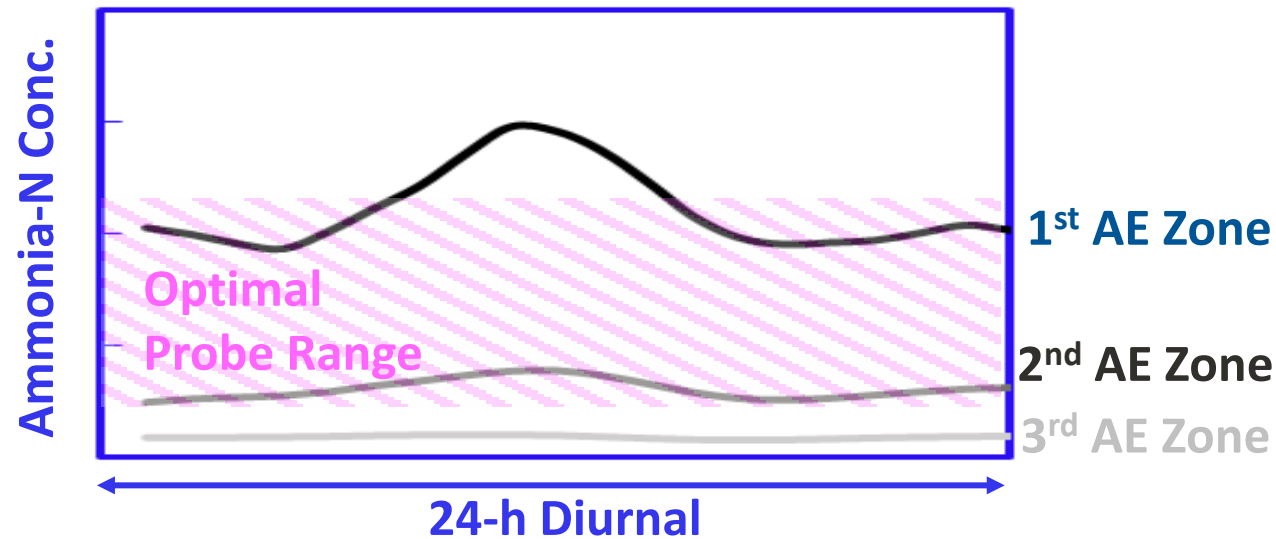


# Managing the data highway



# Using the right tools for the job, in the right way

- ❑ Ammonia-N concentration may be one of many predictor variables in a multivariate feature extraction algorithm or input to a neural net



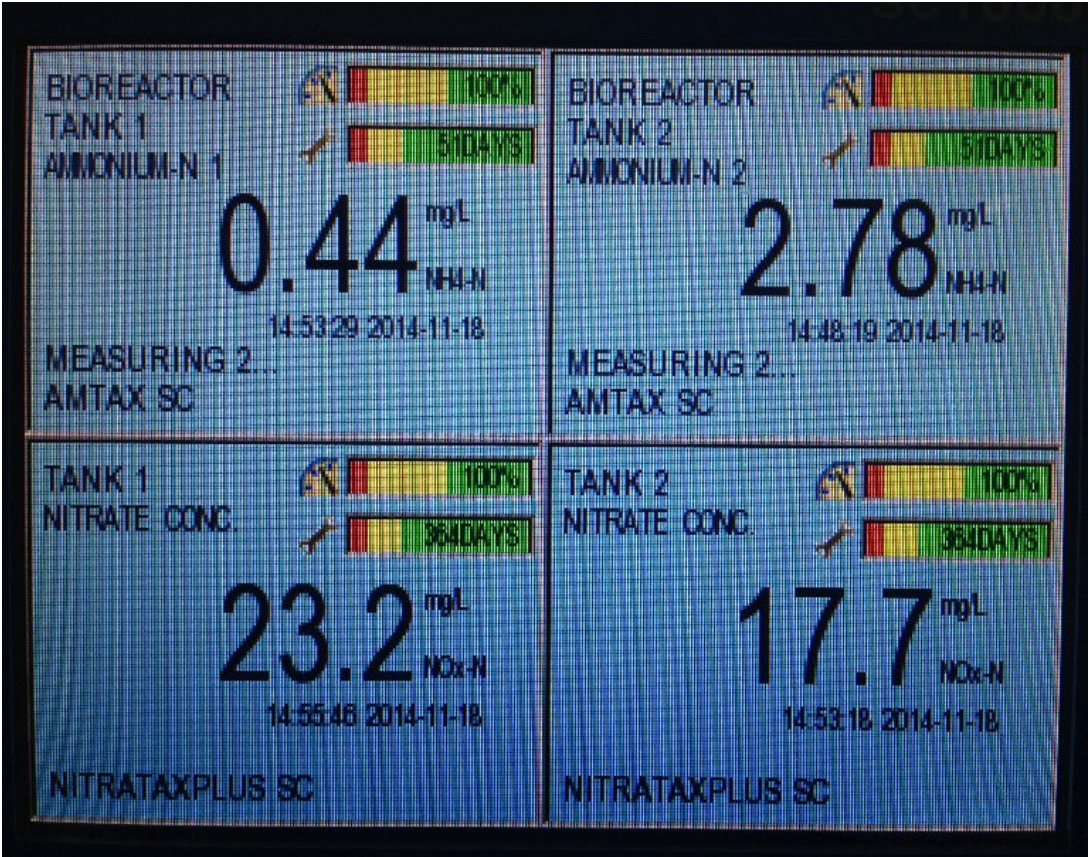
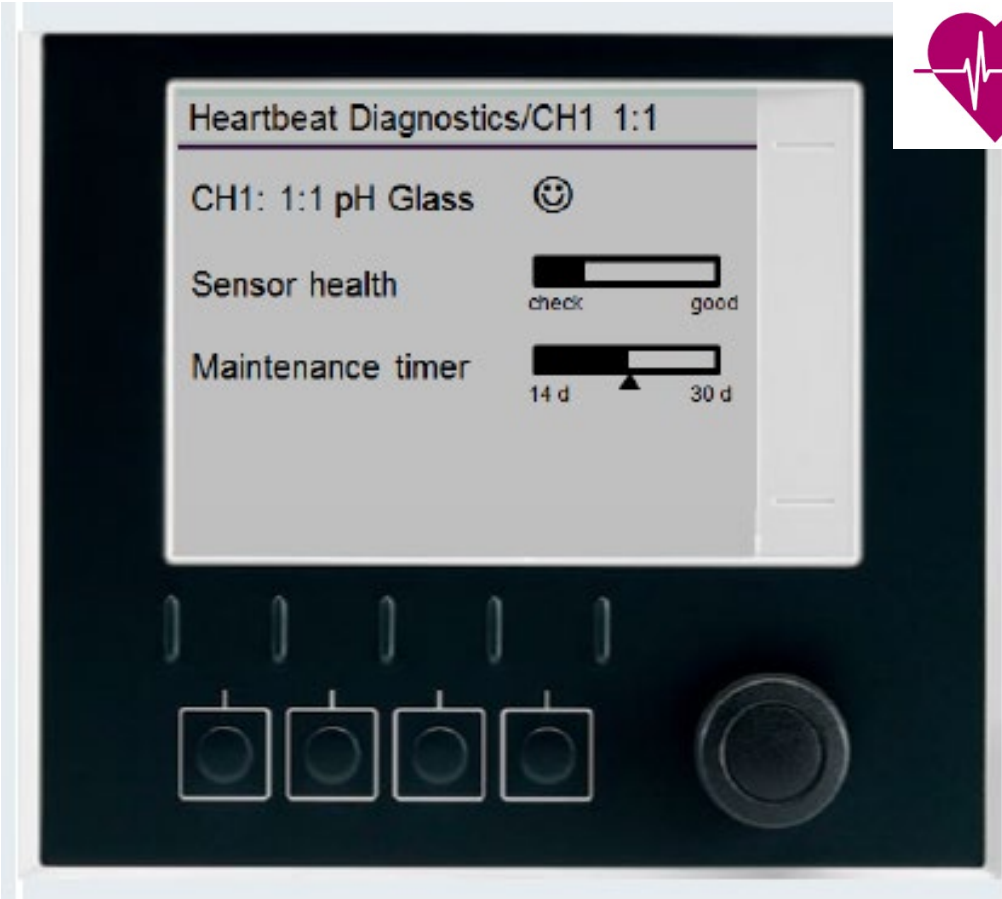
# Tools need to well looked after – enhancing the vernacular to include validation and data quality management

Process Function	Instrument Type	Cleaning	Validation	Calibration	Maintenance
Ammonia-N, Nitrate-N	Ion Selective Electrode (ISE)	1-2 times per week	2-3 times per week	1-2 times every 2 weeks	1-2 times per month
Dissolved Oxygen	optical (e.g., LDO)	1-2 times per week	2-3 times per week	1-2 times every 2 weeks	1-2 times per month
Turbidity	Optical or Laser	2-3 times per week	1-2 times every 2 weeks	1-2 times per month	1-2 times per month
pH/ORP	ISE	1-2 times per week	1-2 times per week	1-2 times per month	1-2 times per month





# Managing instrument risks through self diagnostic tools



# Key Take Aways

- IIOT/AI etc. is here – we need to “acclimate” and find the best applications
- Using AI is not likely to reduce the need for skilled operations professionals – BUT it will require new, enhanced skill sets
- GIGO – manage, maintain and validate instruments

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