OWEA 2019

A cost effective solution to Total Dissolved Solids

June 26, 2019

APPLIED ENVIRONMENTAL SOLUTIONS

Outline

- *Disclaimers*
- *Scope of challenge*
- *Technology Overview*
- *Preliminary Results*
- *Summary*

Disclaimers

Disclaimers

This presentation summarizes a Work In Progress currently focused on one significant aspect of TDS

- *Cost effective "temporary hardness" management*
- *A second phase for total TDS reduction is in early stages of investigation*

While effort is focused on treated wastewater effluent application, it is directly applicable to source water application as well

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Scope of Challenge

Total Dissolved Solids challenges

- There is a growing recognition of the importance of TDS in assessing overall water quality.
  - *"Next to nutrients, TDS is the biggest challenge we face…"* (OEPA)
- Increasing inclusion in permit renewals for wastewater treatment plants
- Current water plant treatment options limited to ion exchange, reverse osmosis, lime softening – often resulting in increased loading for wastewater plants.
- TDS management CAN have a significant impact on economic development

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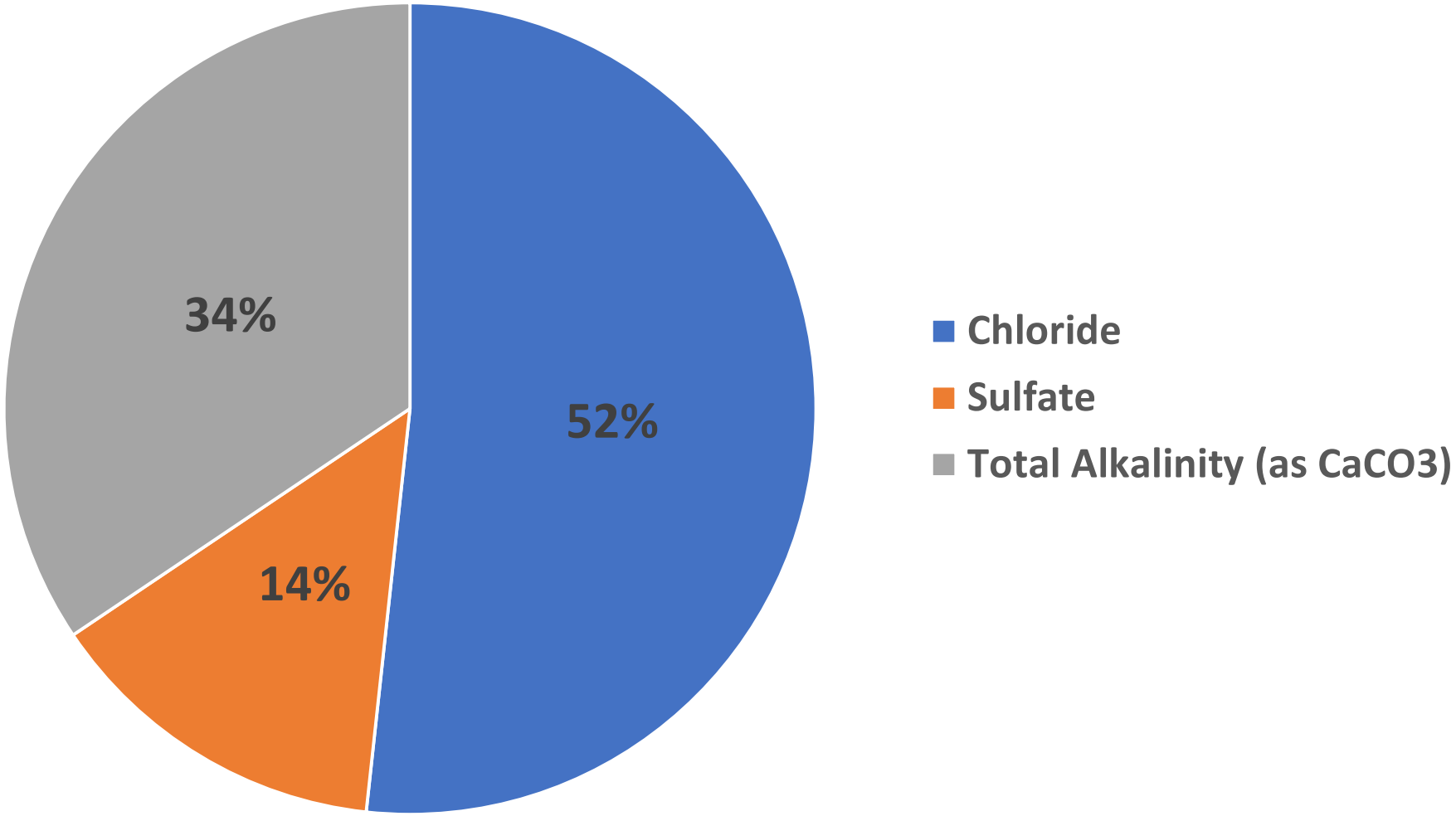
Do we want true Total Dissolved Solids…



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Tap Water may be the highest source of TDS…

Constituent, ug/L	Raw Water	Tap Water	Effluent
Total Ca	120000	26200	90700
Total Fe	2400	54	95
Total Magnesium	47900	10900	34700
Total Manganese	58	10	48
Total Sodium	28300	206000	224000

Constituent, % of measured	Raw Water	Tap Water	Effluent
Total Ca	60.41%	10.77%	25.95%
Total Fe	1.21%	0.02%	0.03%
Total Magnesium	24.11%	4.48%	9.93%
Total Manganese	0.03%	0.00%	0.01%
Total Sodium	14.25%	84.72%	64.08%

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Constituent	Result, mg/L							
	WWTP 1	WWTP 2				Industrial		
	Effluent	Influent	Influent	Effluent	Effluent	Raw Water	Mid-Process	Post UV
Total Alkalinity (as CaCO3)	250	210	210	120	130	330	1600	170
Alkalinity, CO3 (as CaCO3)	<5	<5	<5	<5	<5	<5	<5	<5
Alkalinity, HCO3 (as CaCO3)	250	210	210	120	130	330	1600	170

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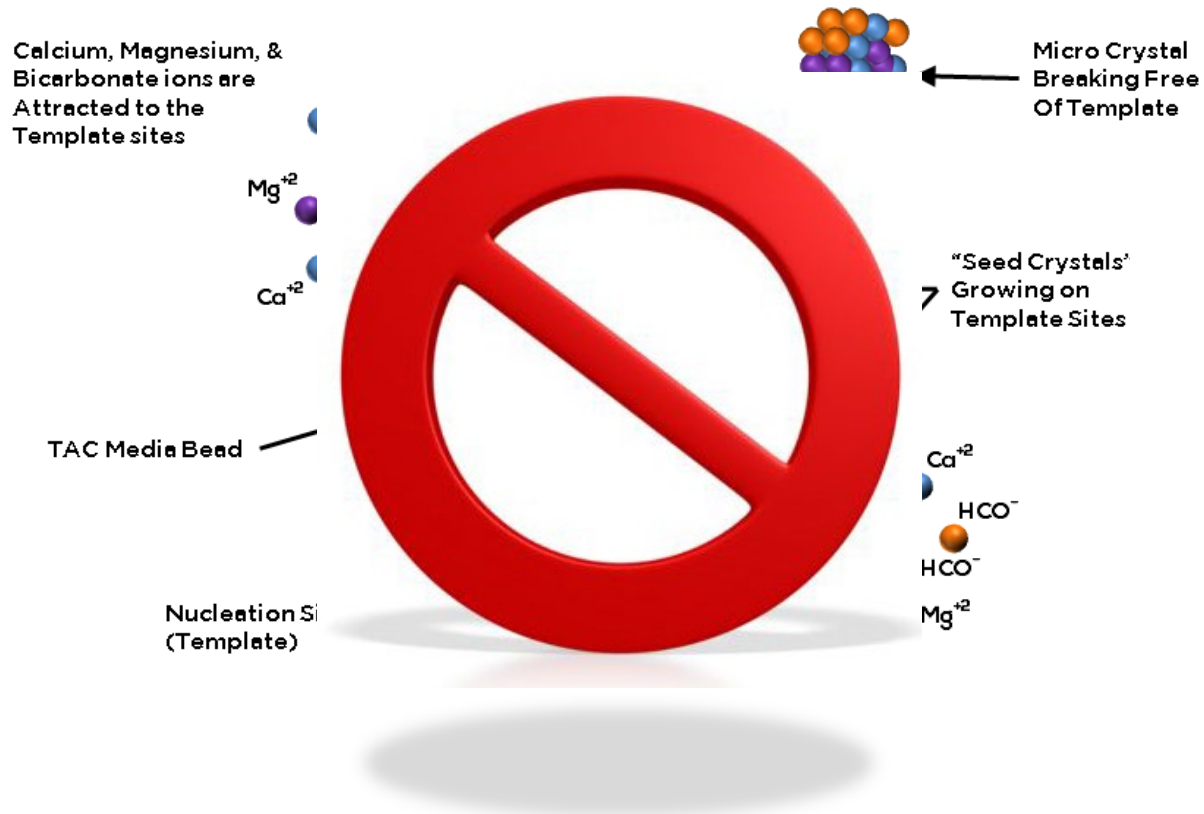
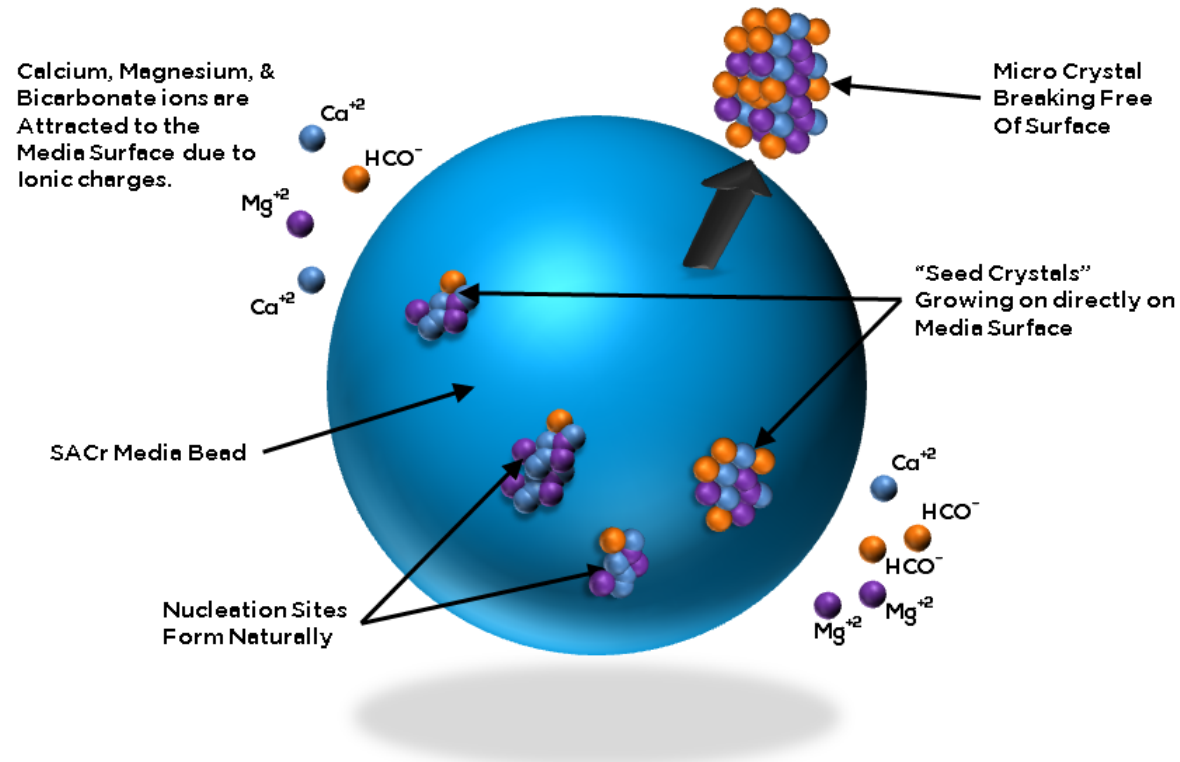
Technology Description

Template Assisted Crystallization (TAC)



Surface Accelerated Crystallization (SACr)



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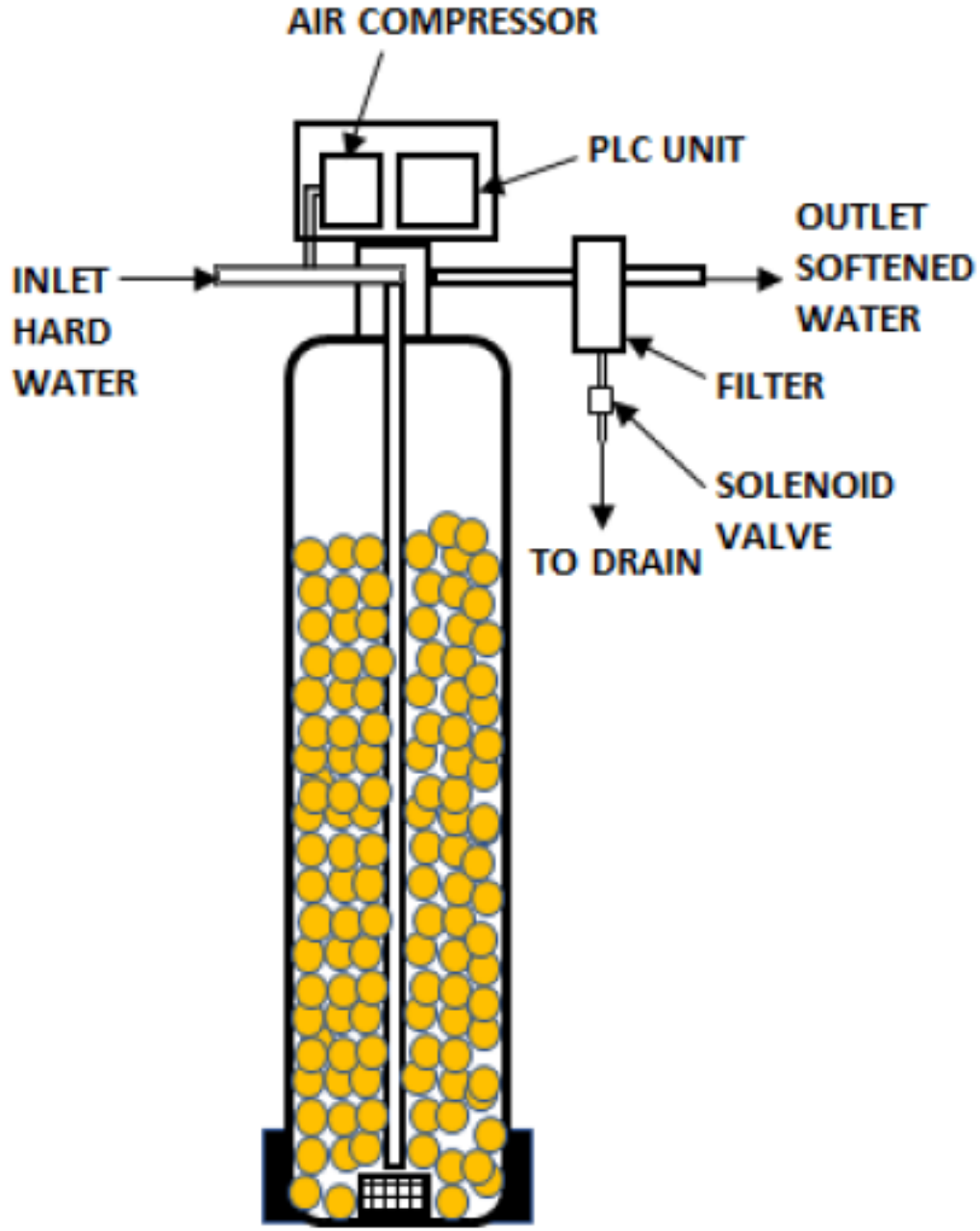

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Media Characteristics	Value
Bead Description	Solid bead
Average Bead size (mm)	0.65
Average Moisture Content (%)	17.5
Recommended Operating Temp (°C)	5-80
Recommended pH range	6.5 – 9.5
Maximum Hardness (mg/L or ppm)	1800 (105 grain per gallon)
Maximum Salinity (ppm)	37,000
Maximum Iron (mg/L or ppm)	1.1
Maximum Manganese (mg/L or ppm)	0.1
Maximum free chlorine (mg/L or ppm)	3.5

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Parameter	Ion Exchange	Reverse Osmosis	Lime Softening	SACr
Chemical Usage	Yes	Yes	Yes	No
Waste Management	High	High	High	Low
Fouling Potential	High	High	Moderate	Low
Downstream process impact	Yes	No	Possible	No
Energy Consumption	Moderate	High	High	Low
Footprint (relative to ion exchange)	NA	Moderate	High	Small
Operator Intervention	Low	High	High	Low
Maintenance	Moderate	High	High	Low

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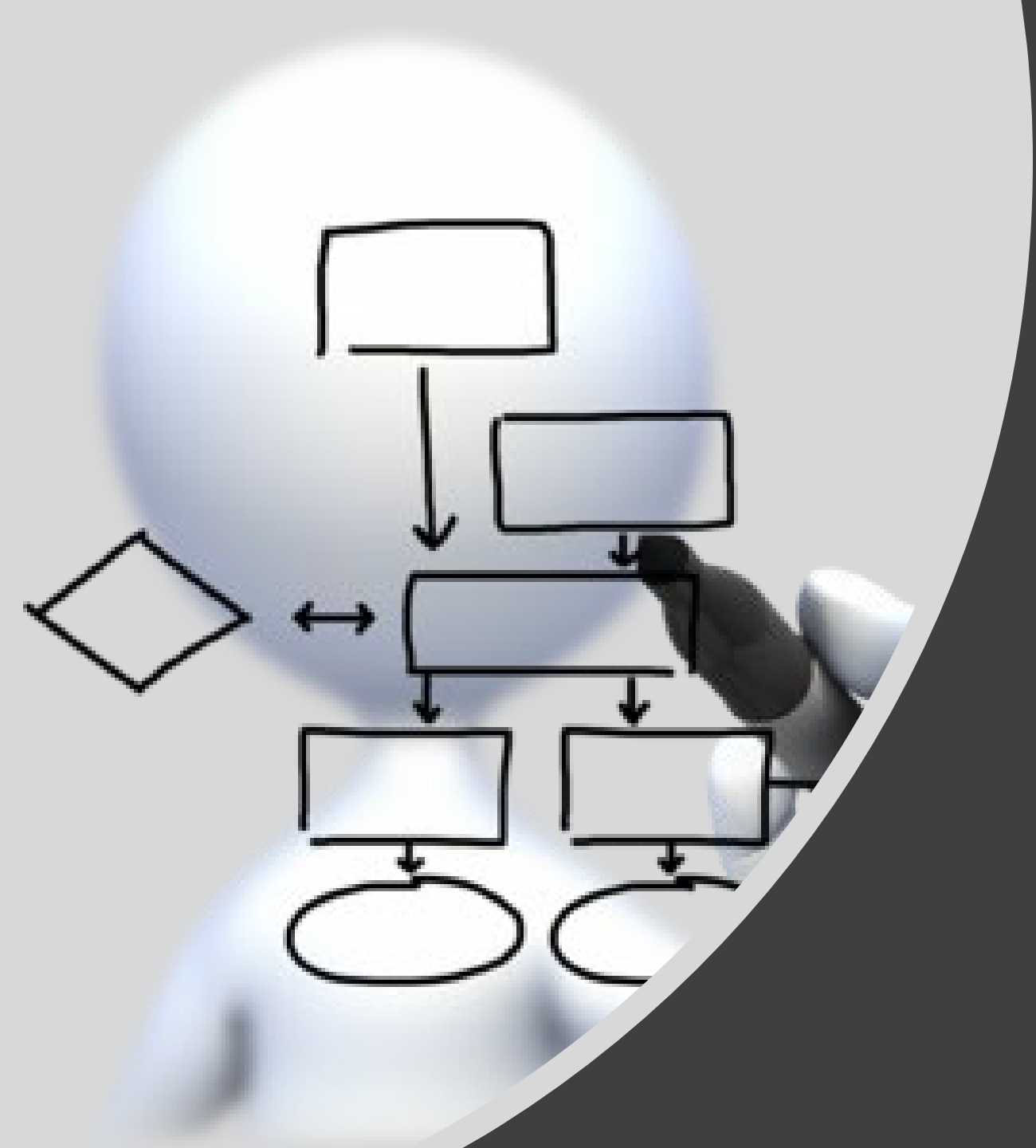

Initial Assessment

- *Municipal*
- *Industrial*

Test Program

- Objective: Confirm ability to reduce TDS (proof of concept)
- Small scale pilot unit rated at 1gpm max incoming
- Fixed duty cycle
  - 60 minutes operation
  - 10 minute back flush purge
- Continuous TDS measurement (conductivity)
  - Calibrated against 2 separate standards
    - 1413µs/cm
    - 84µs/cm

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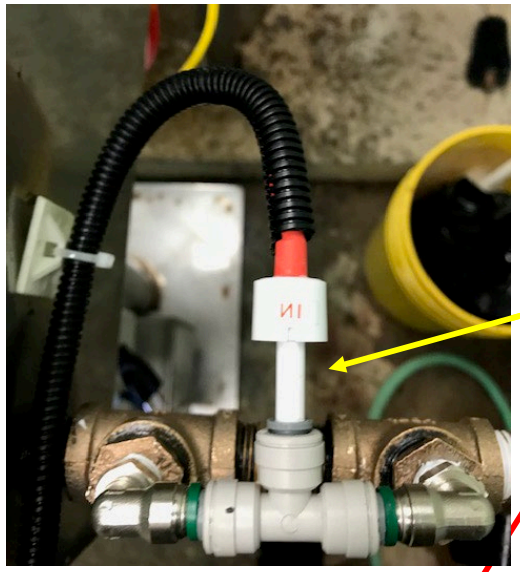

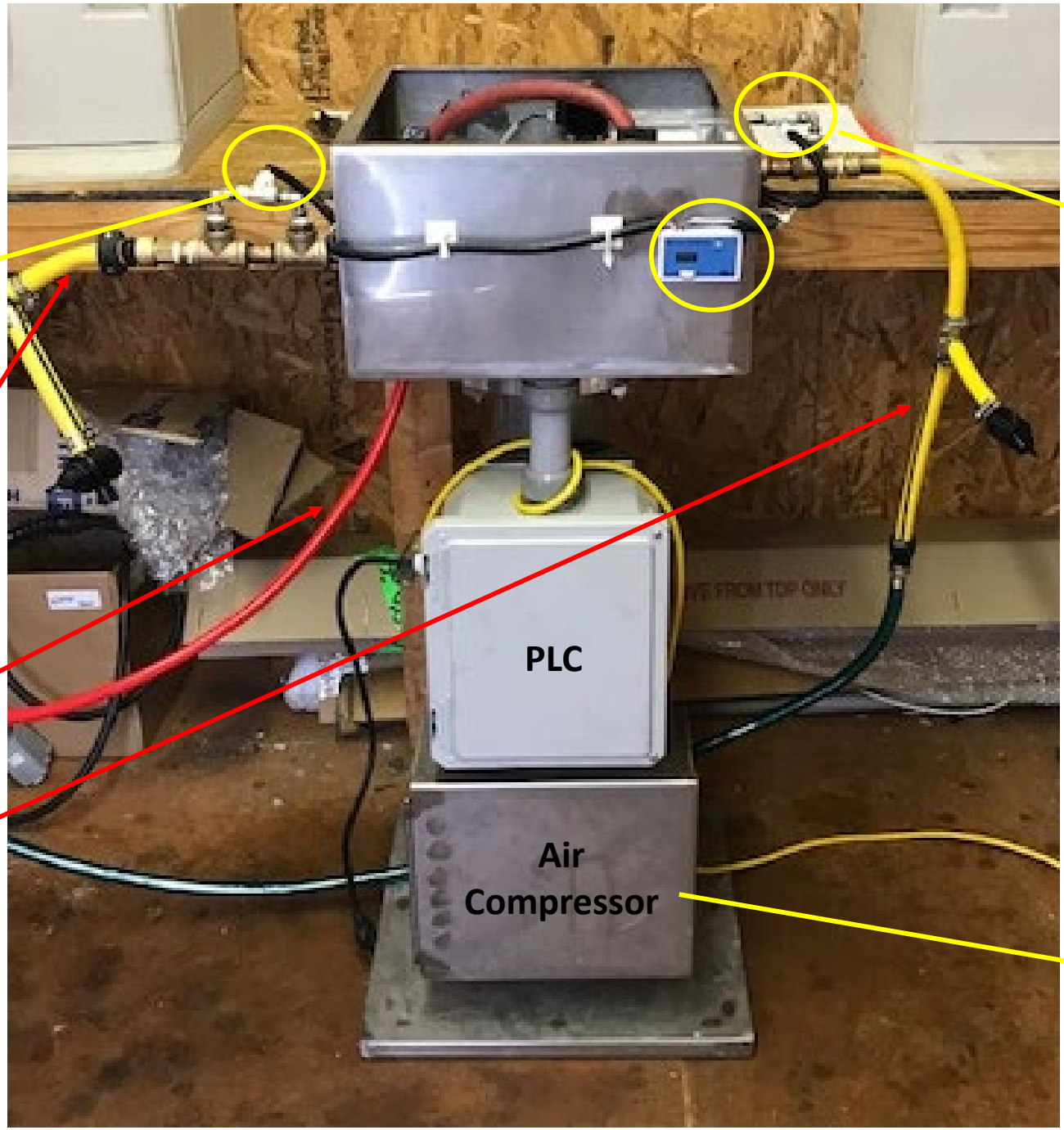

Incoming Stream

Reject Stream

Treated Stream

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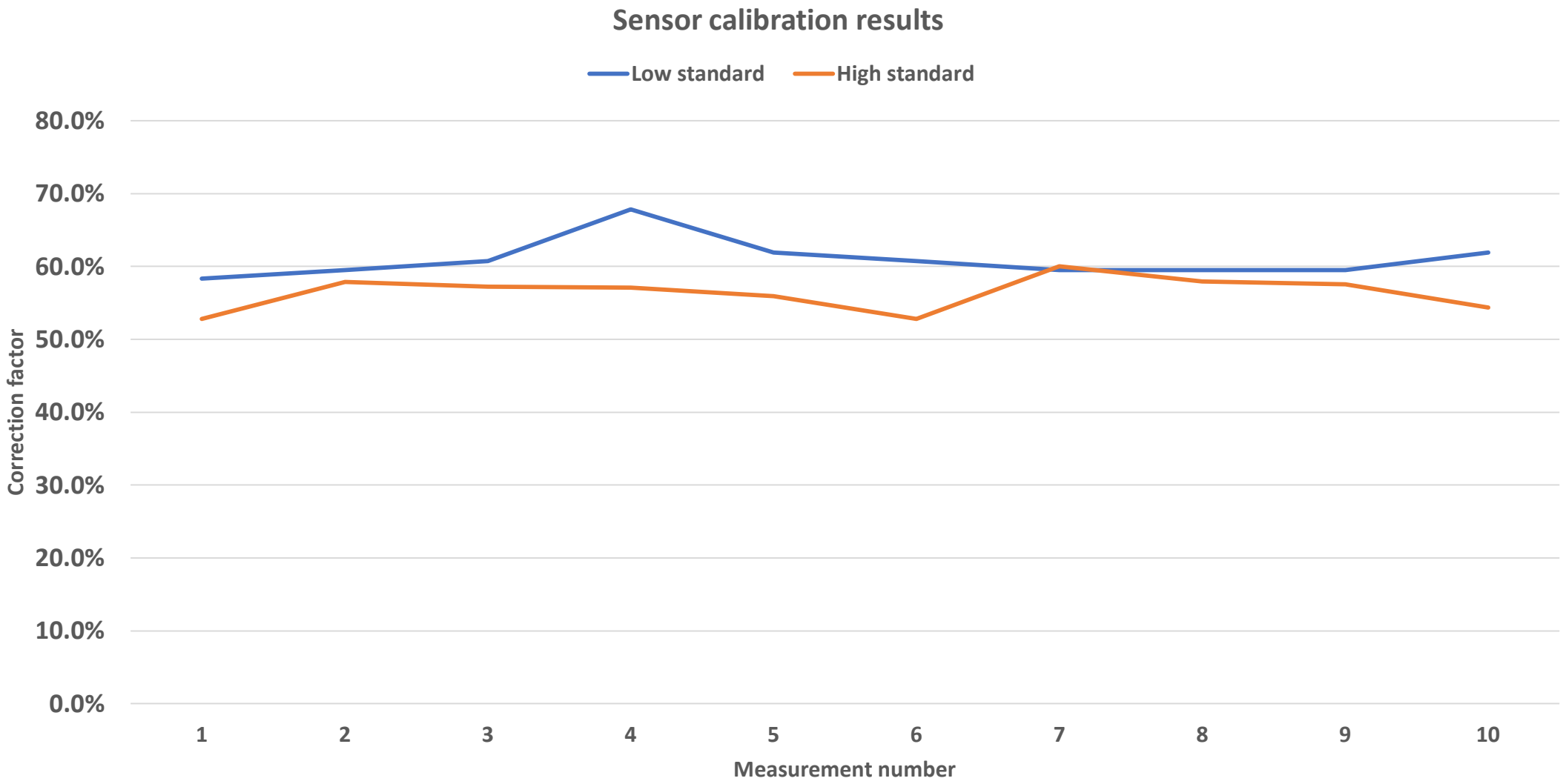

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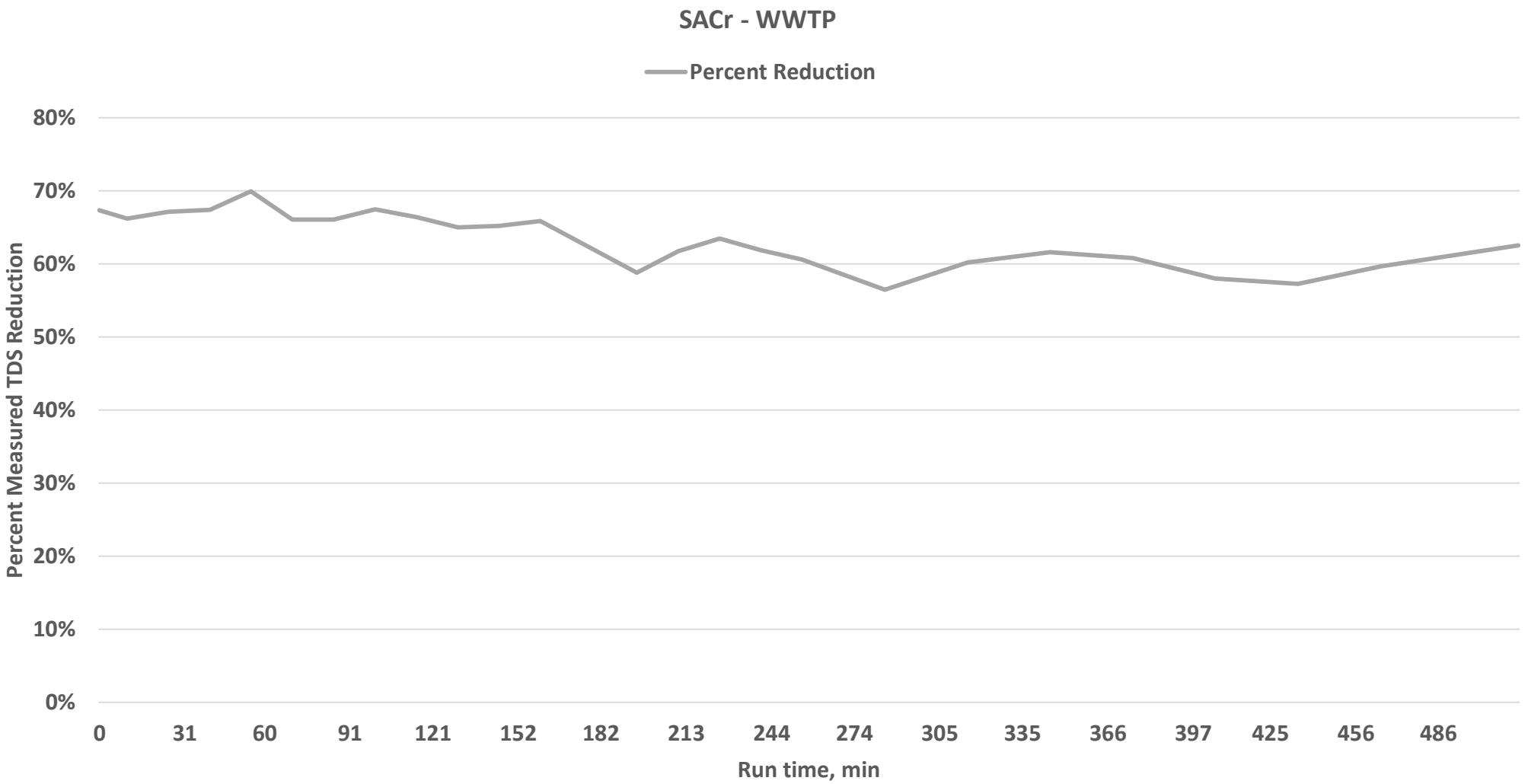

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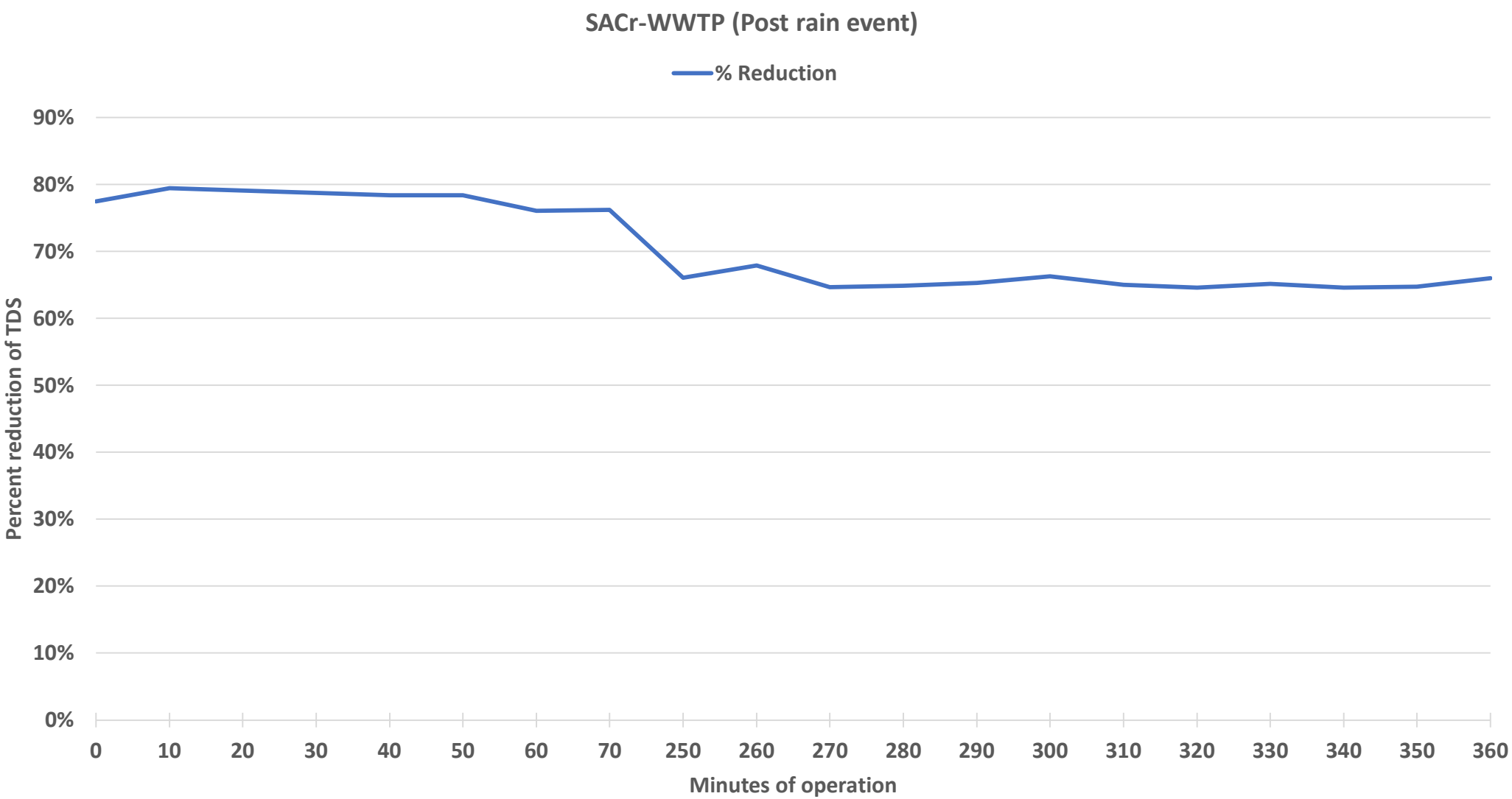

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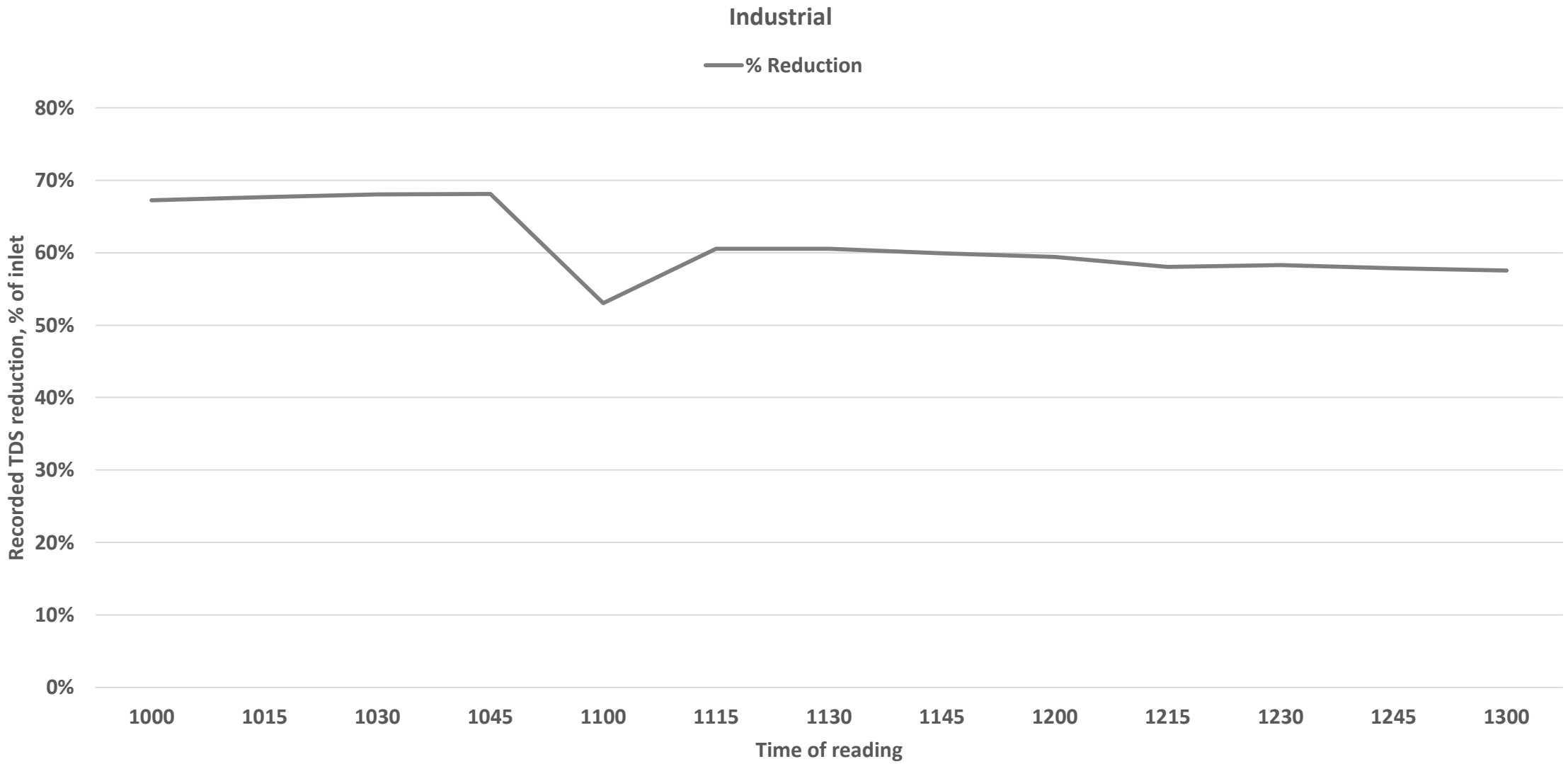

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Summary

Statistic	WWTP	WWTP	Industrial
Count	25	20	13
Average	63.3%	70.4%	61.3%
Max	69.9%	79.4%	68.1%
Min	56.5%	64.6%	53.0%
SD	3.7%	6.4%	4.9%

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Conclusions

1. Abbreviated testing at both a municipal and industrial discharger demonstrated a considerable reduction in measured TDS

2. Further opportunities for optimization were identified, including
   - Treatment duration
   - Backflush duration and frequency

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What's Next - 2019

What's next?

- Larger flow evaluation (ie. 30gpm+)
- Duty cycle optimization
- Longer duration @ continuous flow
- Characterization of TDS pre/post treatment
- Reject stream composition and potential recovery

Questions?

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