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SPR's Advanced Predictive Model vs. Finely Tuned ABAC

Comparing Aeration Process Control Methods

Anna Schroeder, P.E.

AVEVA



South Platte Renew



3rd Largest Water
Resource Recovery
Facility

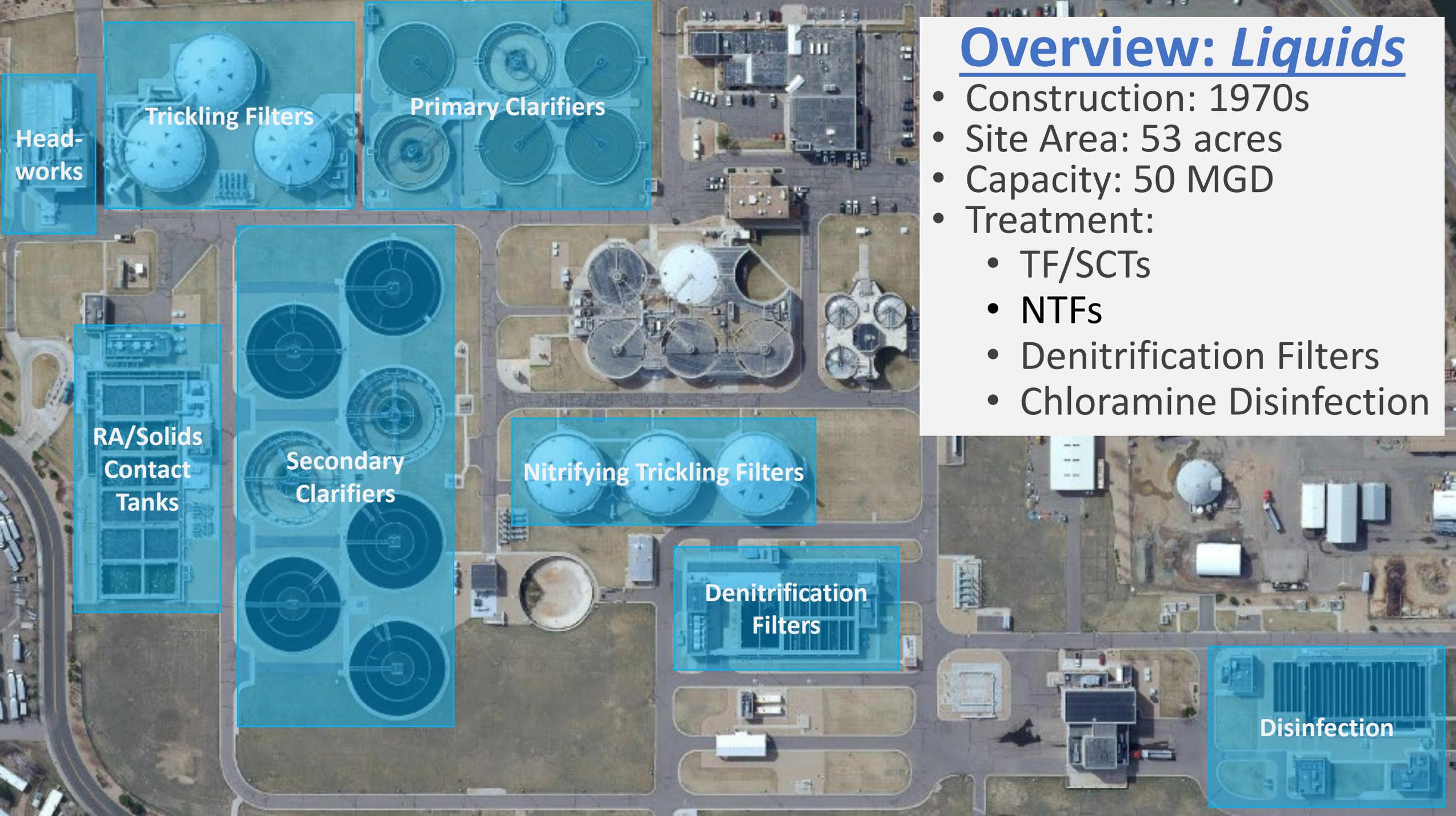


*Vision: **Renewing**
water for Colorado's
future*



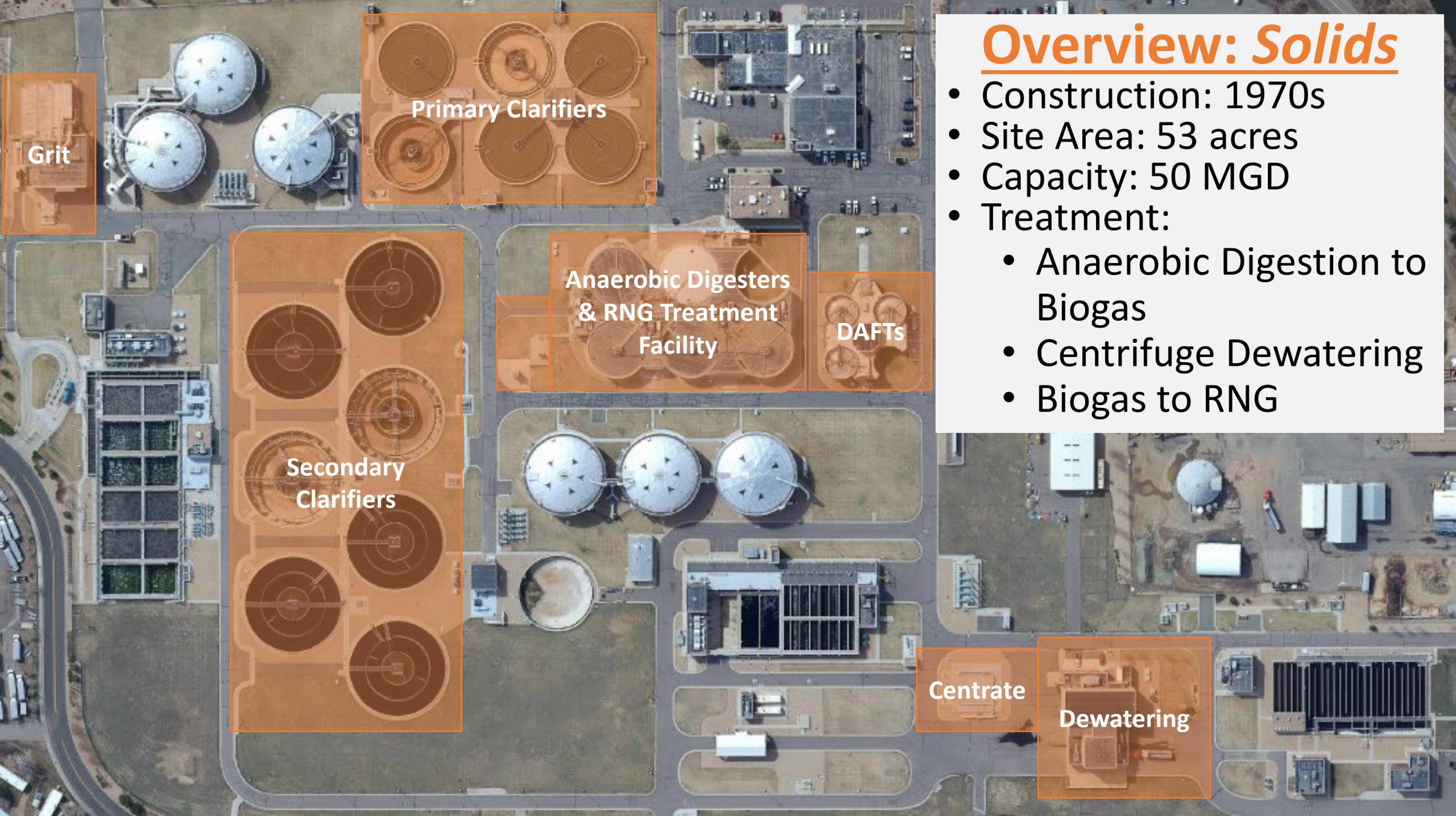
Owned by the Cities of
Littleton and Englewood

Service Population:
300,000



Overview: Liquids

- Construction: 1970s
- Site Area: 53 acres
- Capacity: 50 MGD
- Treatment:
 - TF/SCTs
 - NTFs
 - Denitrification Filters
 - Chloramine Disinfection



Grit

Primary Clarifiers

Secondary Clarifiers

Anaerobic Digesters
& RNG Treatment
Facility

DAFTs

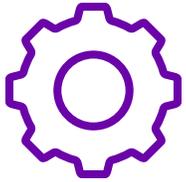
Centrate

Dewatering

Overview: Solids

- Construction: 1970s
- Site Area: 53 acres
- Capacity: 50 MGD
- Treatment:
 - Anaerobic Digestion to Biogas
 - Centrifuge Dewatering
 - Biogas to RNG

Efficient Aeration Control



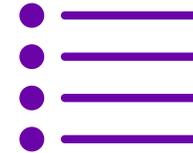
Challenge

- The diurnal ammonia loading fluctuates between lbs/hr. To maintain the ammonia setpoint and nitrification, the SCTs require real-time monitoring and quick response in such a dynamic environment.



Solution

- Deployed AVEVA APC System technology for Aeration Process Control for nitrification at one of the five SCTs to measure ammonia loading and calculate the optimal air flow in real-time. Staff used PI Historian data for process monitoring and analysis.



Benefits

- Real-time nitrification measurement and control adjusts the air flow to achieve the ammonia setpoint. Decrease in operations staff time adjusting setpoints, increased operational efficiency compared to DO control and opens the possibility for lower aeration energy costs.

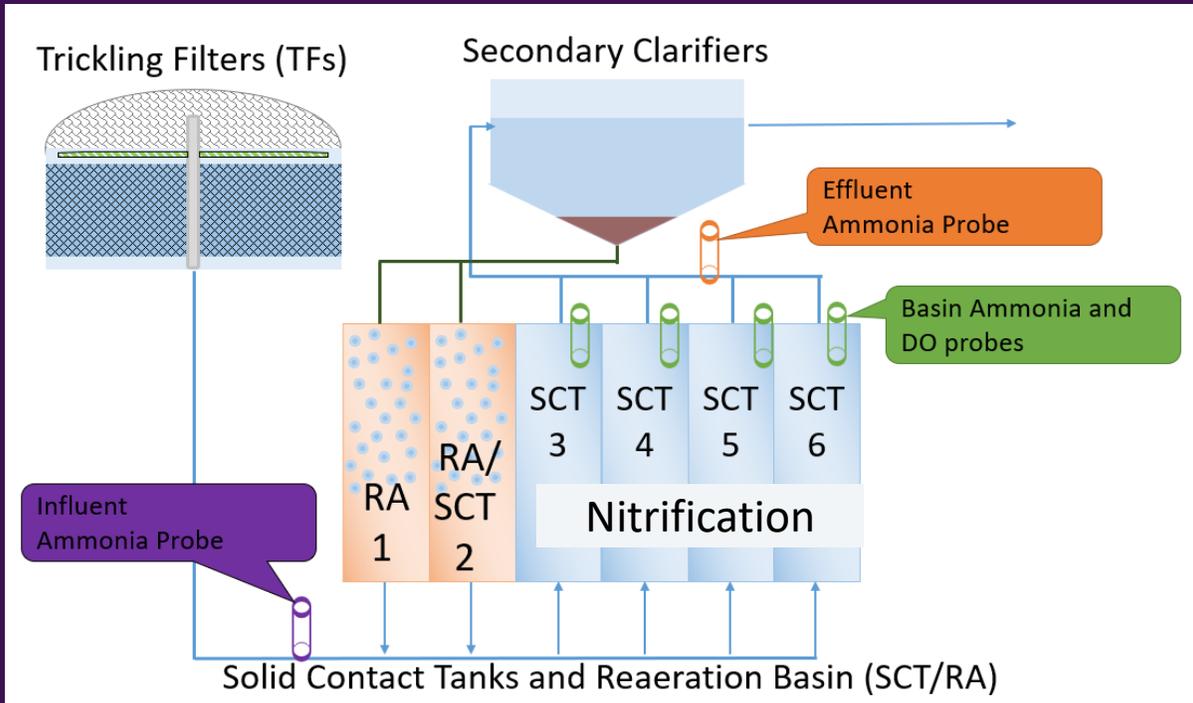
SPR Permit Compliance

Discharge Permit

- Ammonia
- Total Inorganic Nitrogen

Solids Contact Tanks

- Nitrifies Ammonia to Nitrate
- Hydraulic Retention Time (HRT) of <60 min
- Solids Retention Time (SRT) of 1-3 days



Challenge: Nitrification Treatment Efficiency

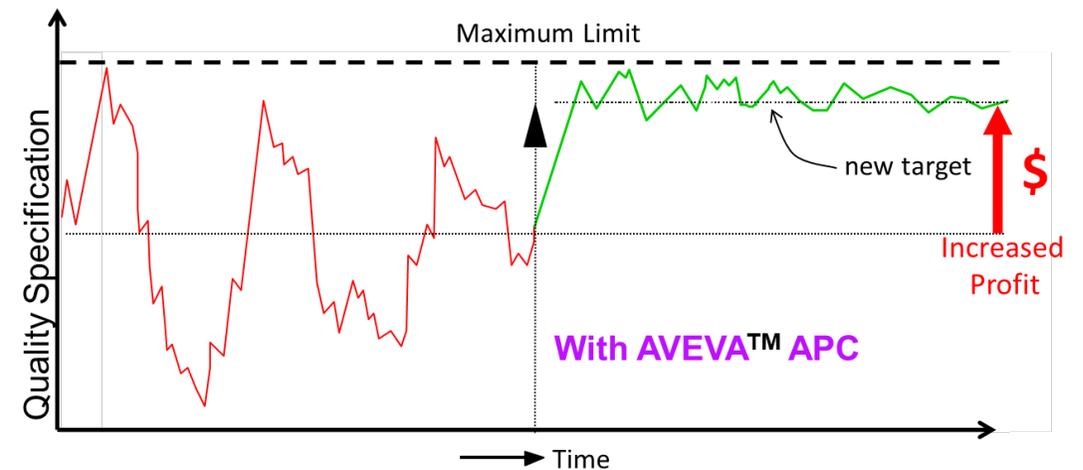
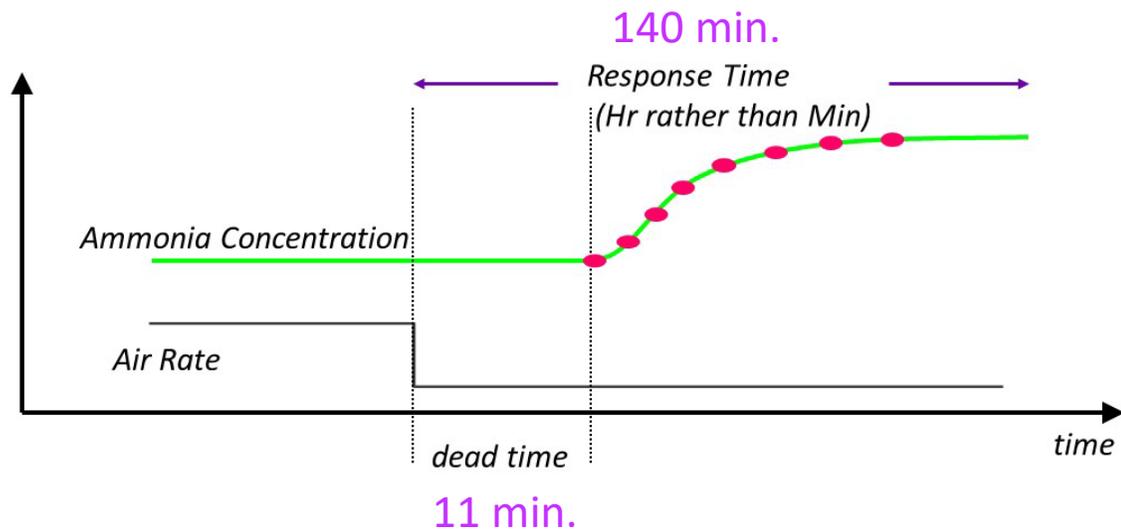
SCT Process

- Highly dynamic process
- Requires an ammonia control response time
 - Short HRT (<60 min.) requires fast control response
- Numerous significant process disturbances
- Nitrification is mandatory for **permit compliance**
 - Reliability and accuracy



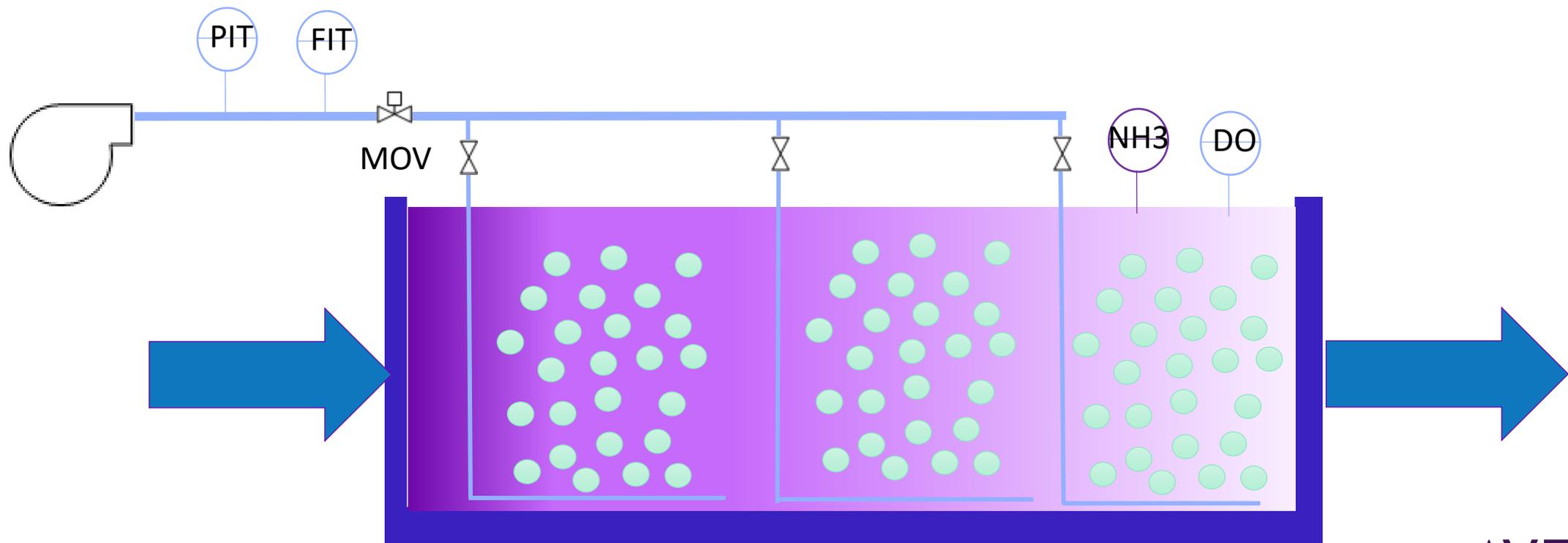
Solution: Optimized Aeration Process Control

ABAC	APC (AVEVA)
Reacts to required control changes	Anticipates required control changes

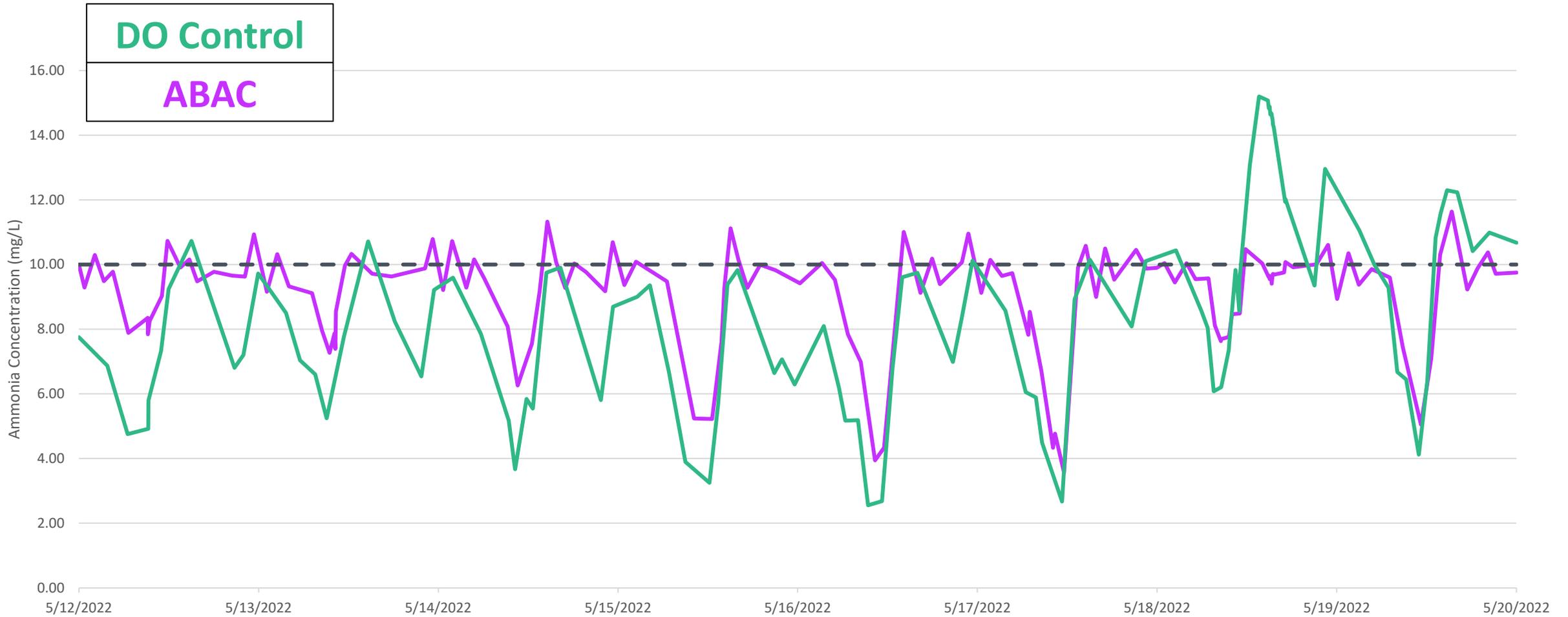


Ammonia Based Aeration Control

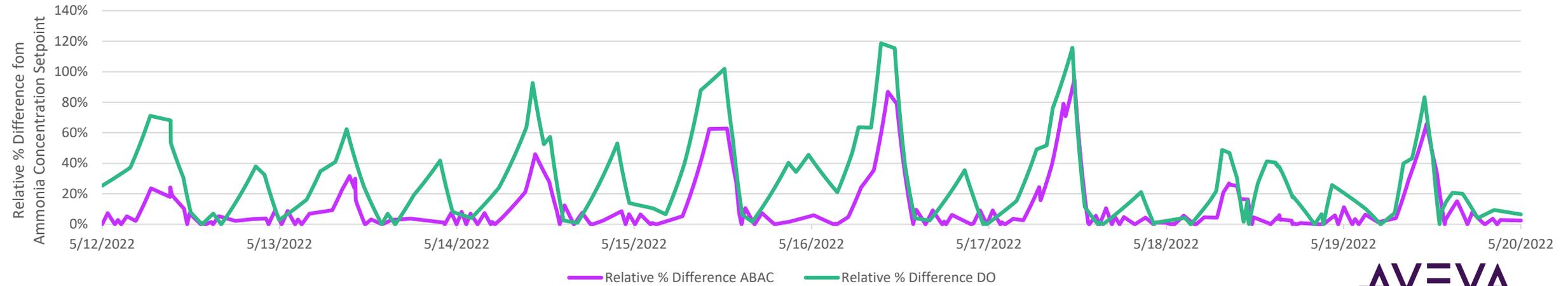
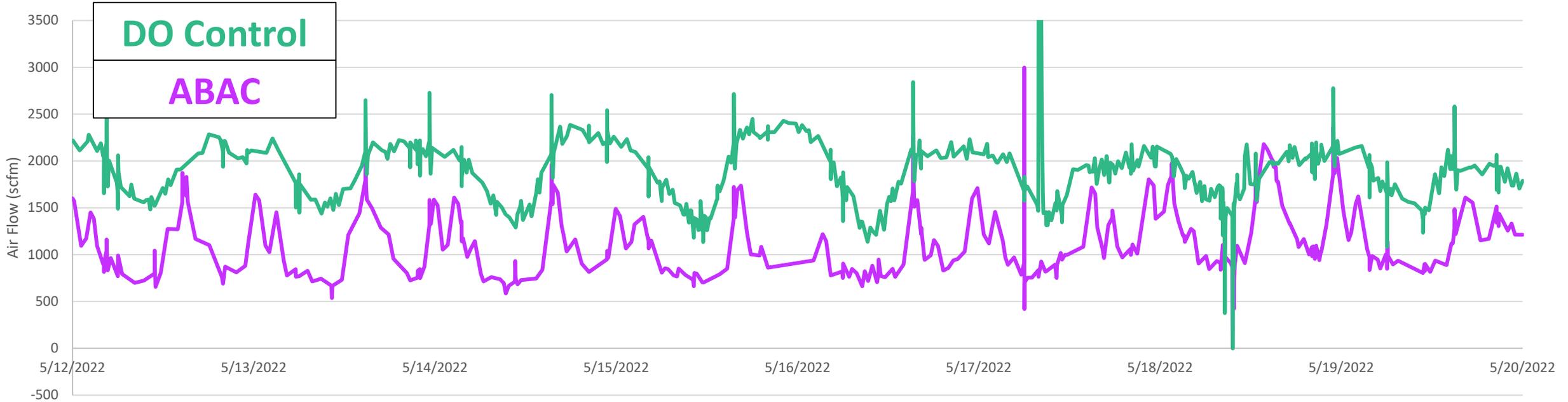
- Ammonia probe at effluent, ammonia concentration setpoint
- Adjustable NH₃ setpoint
- Air flow is increased or decreased based on NH₃ reading



Ammonia Concentration – DO Control vs ABAC

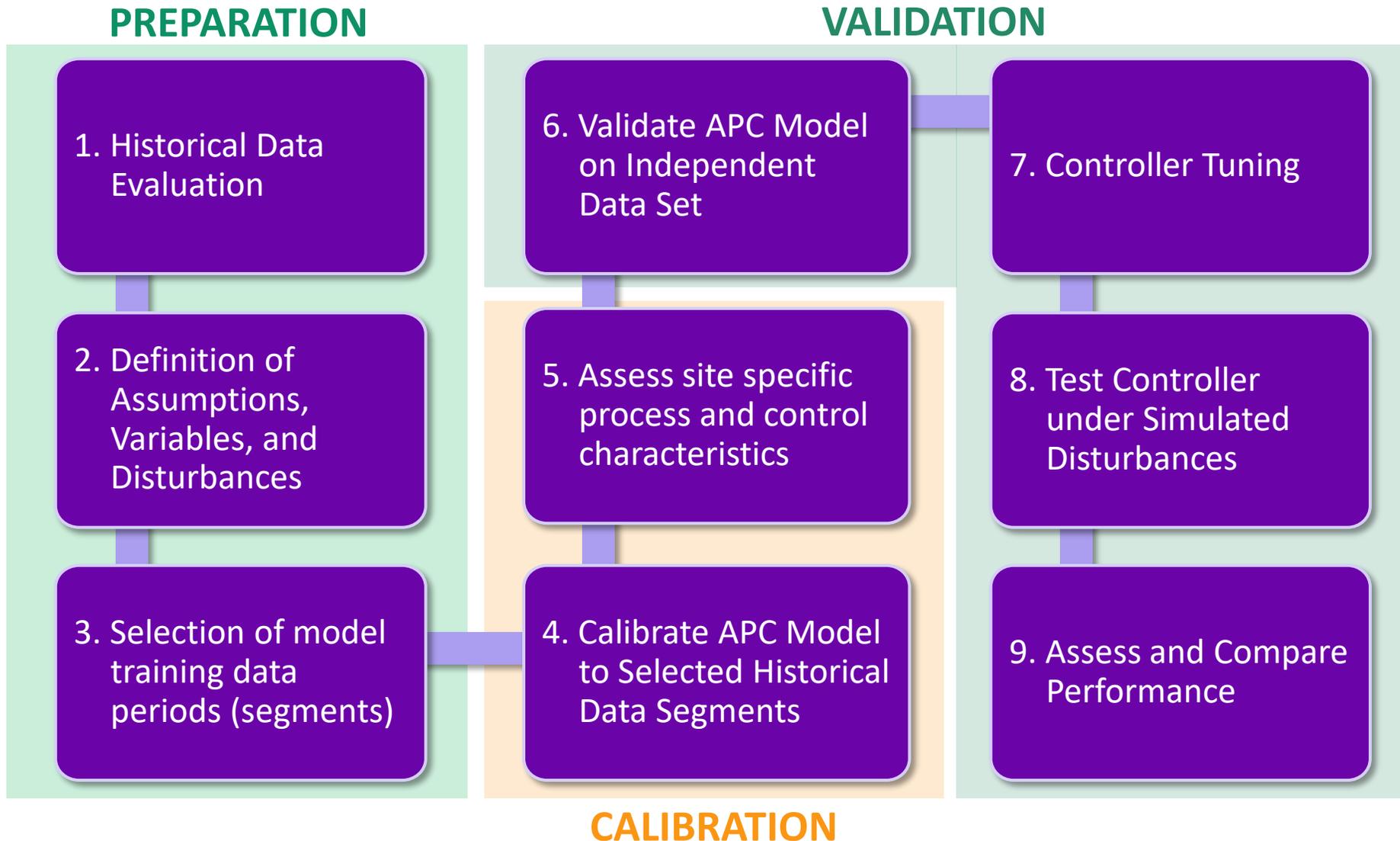


Air Flow - DO Control vs ABAC



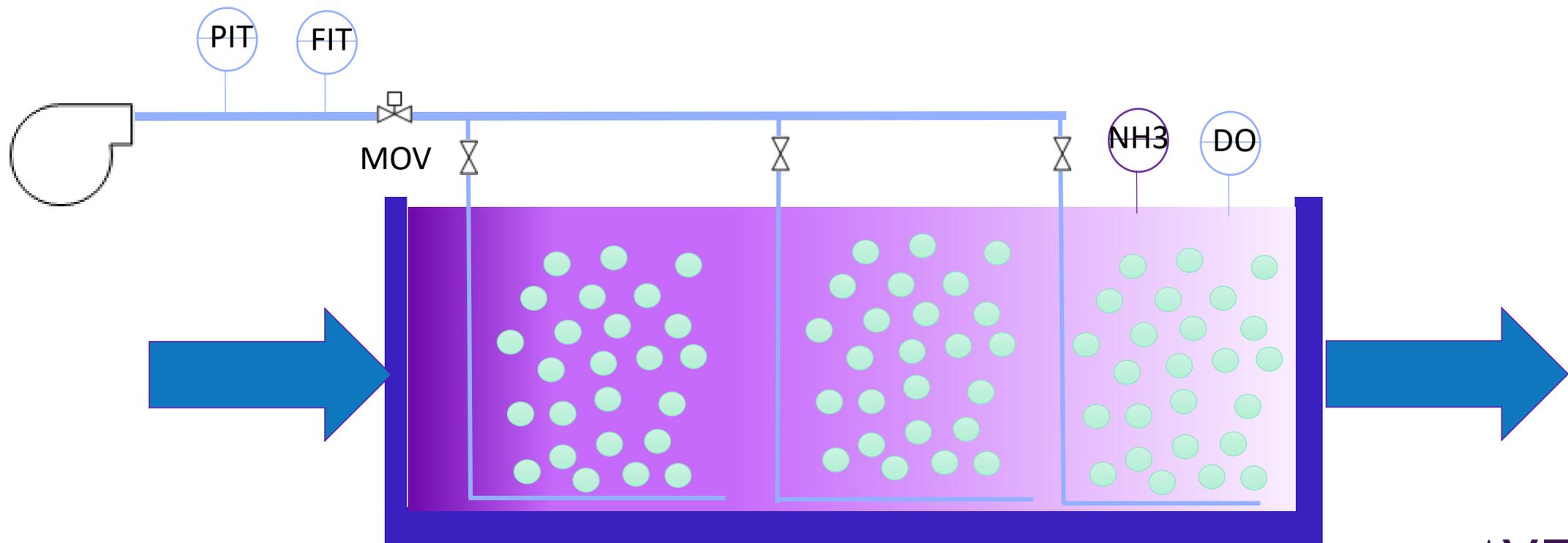
Relative % Difference ABAC Relative % Difference DO

Overview: Controller development – Approach

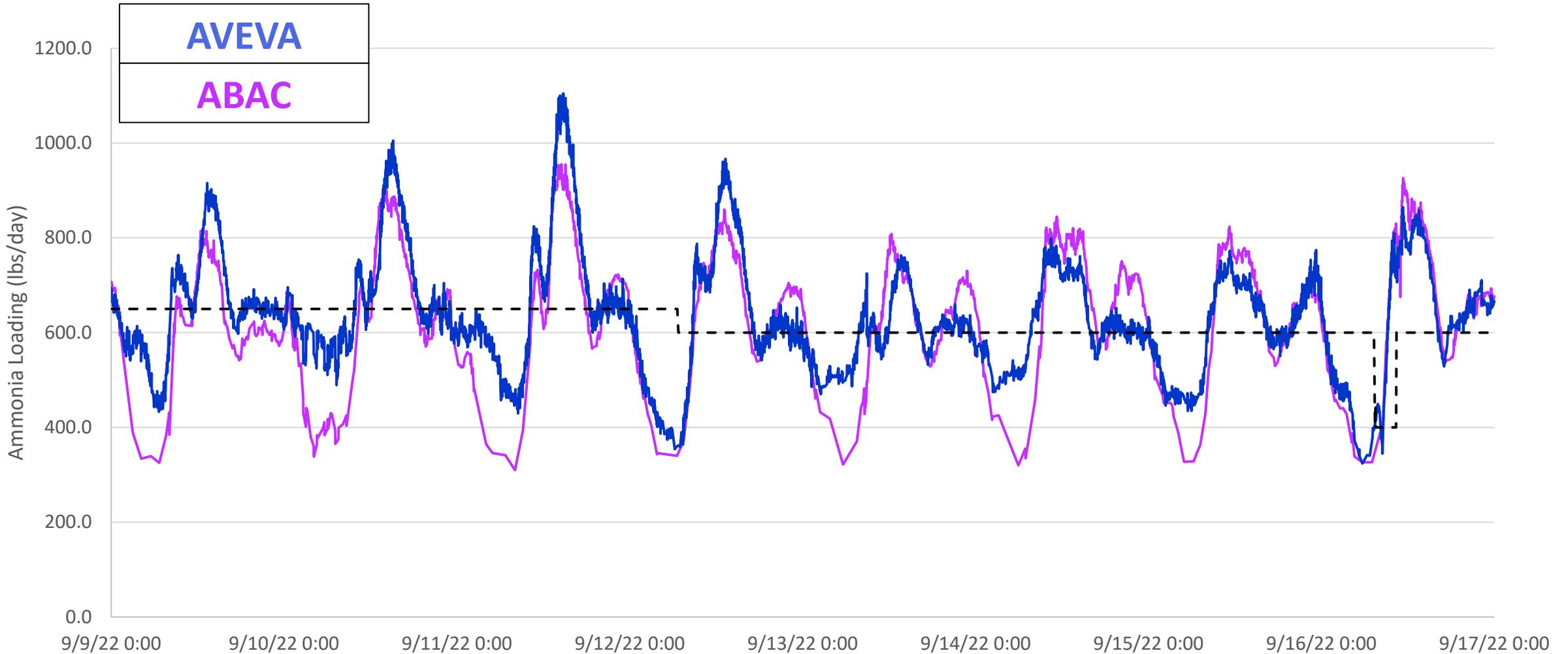


AVEVA – Advanced Predictive Control

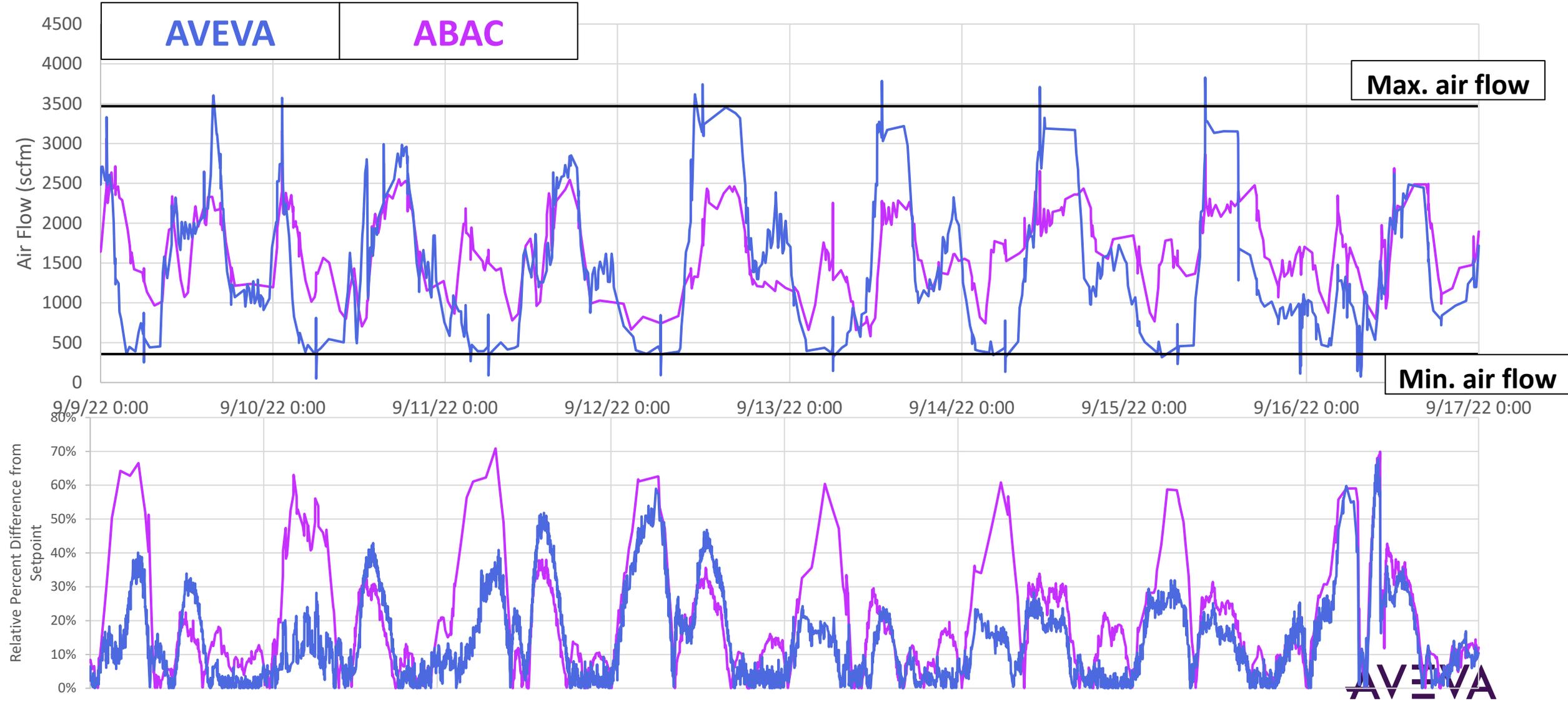
- Ammonia loading based setpoint
- Uses historical data to predict conditions 140 minutes into the future
- Air flow is adjusted based on historical data and influent data to hit setpoint



Effluent Ammonia Loading – ABAC vs AVEVA

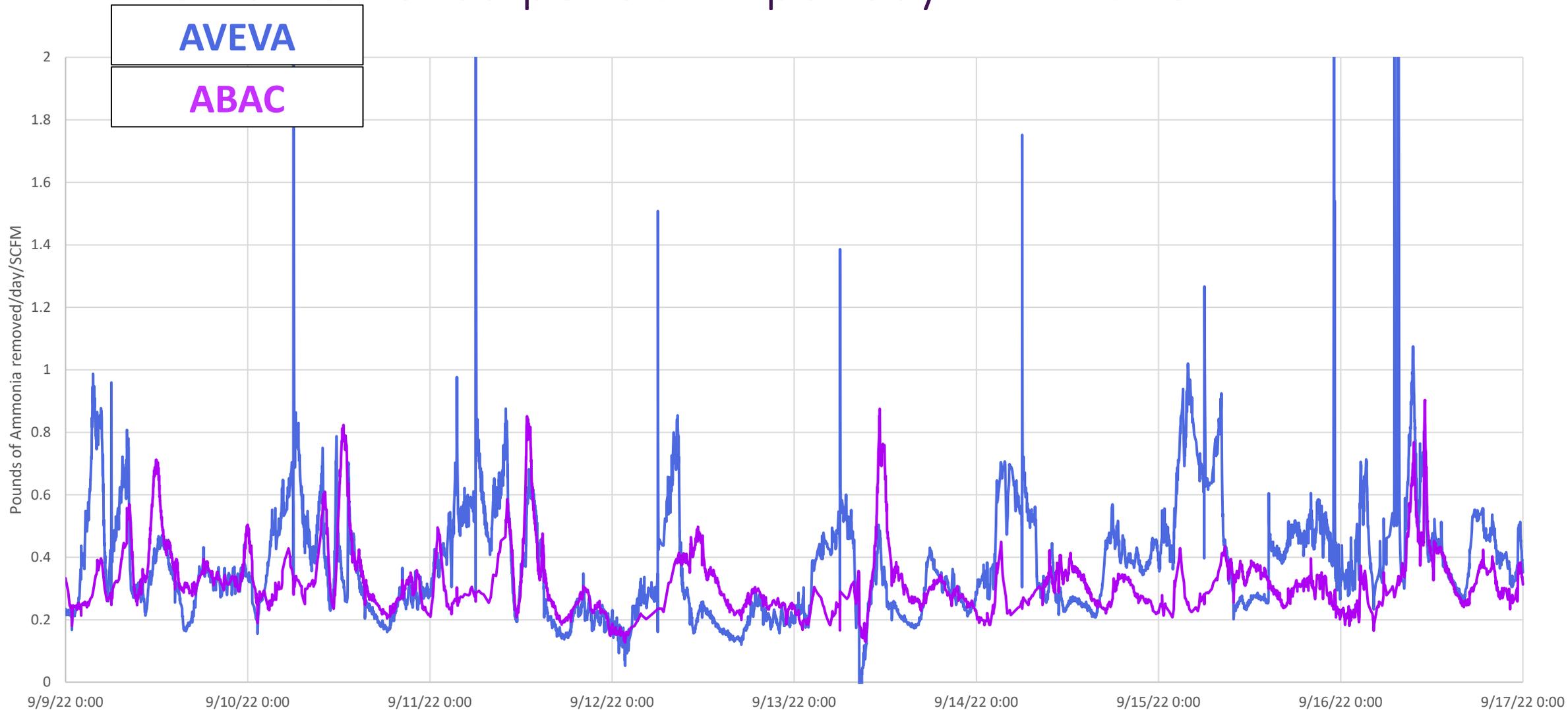


Air Flow and Relative Percent Difference – ABAC vs AVEVA



AVEVA

Ammonia Removed per SCFM per day – ABAC vs AVEVA



“AVEVA APC was surprisingly easy to operate. I wasn't expecting it to perform better than the existing process control.”

Operations Supervisor

Results and Next Steps

Parameter	ABAC	AVEVA APC
SCT NH4 Effluent Load, ppd Setpoint 625 ppd	590 ppd,	629 ppd
Air Flow, SCFM	1576 scfm	1431 scfm
Ammonia Removed per SCFM per day	0.31 ppd/SCFM	0.39 ppd/SCFM

- Improved process stability and ammonia removal
- Decrease in air flow
- Additional savings possible through optimized ammonia effluent load setpoints throughout year
- Possible expansion of APC logic to other areas of plant operation



Anna Schroeder, P.E.

Engineering Supervisor

- South Platte Renew
- aschroeder@englewoodco.gov

Questions?

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