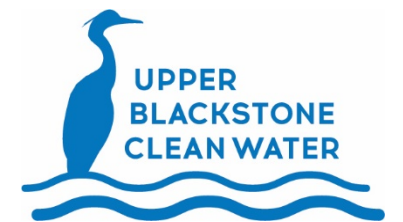


# A Multi-Sector Approach to Reduce Energy Consumption and Optimize Process Efficiency at the Upper Blackstone

Edris Taher, Karla Sangrey & Timothy Loftus



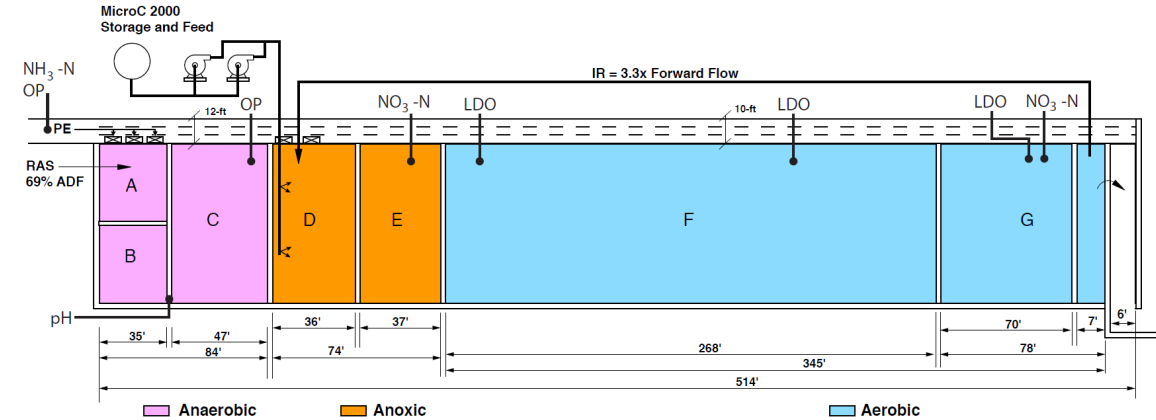
# Upper Blackstone in a Glance

- Plant Information:
  - Influent characterization:
    - Avg Flow: 30 MGD
    - Avg CBOD: 154mg COD/L
    - Avg TN: 28 mgN/L
  - Process configuration
    - A2O
    - 4 trains
  - Regulation/Permit
    - Seasonal permit
    - TN: 5 mg-N/L
    - TP: 0.1 mg-P/L

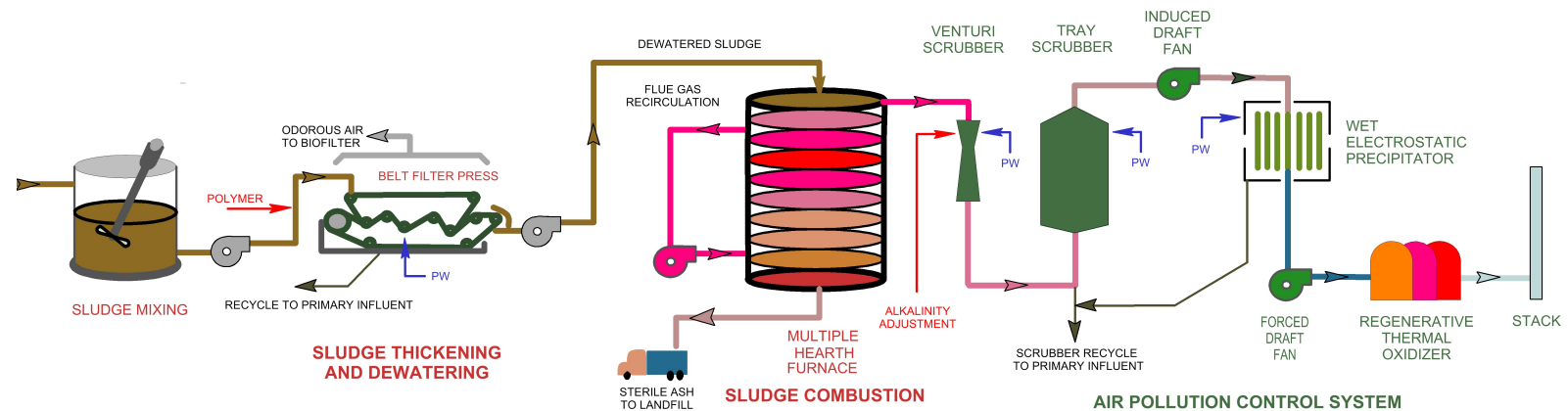


# Energy Reduction and Optimization

- Aeration Upgrade (Electricity)



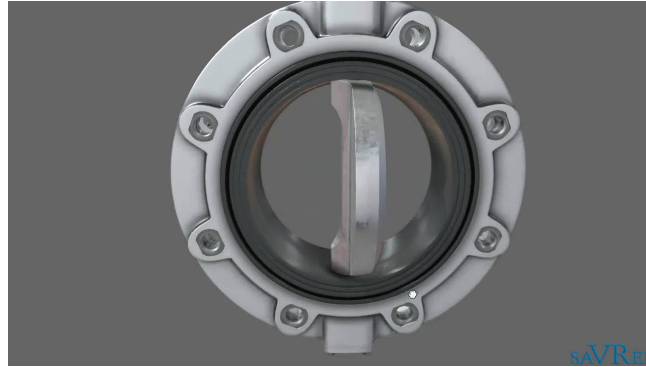
- RTO Upgrade (Gas)



# Aeration Upgrade

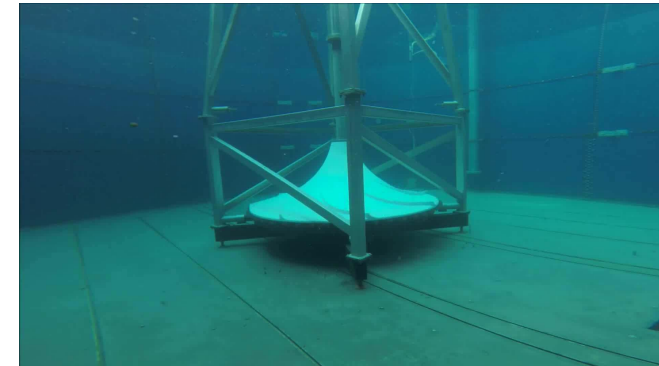
- **Most Open Valve Aeration Control**

Includes replacement of manual butterfly valves on aeration system with actuated IRIS valves to improve and provide more precise control of dissolved oxygen and reduce blower energy costs.



- **Modifications to Existing Aeration Tanks**

Includes mixer/aerators, platforms, and associated piping modifications necessary to decouple aeration from mixing in Zone G and achieve a better denitrification performance in the anoxic zone.







User **Logout**  
 Current User:  
**SCADA\ETAHER**

# Upper Blackstone Wastewater Facility

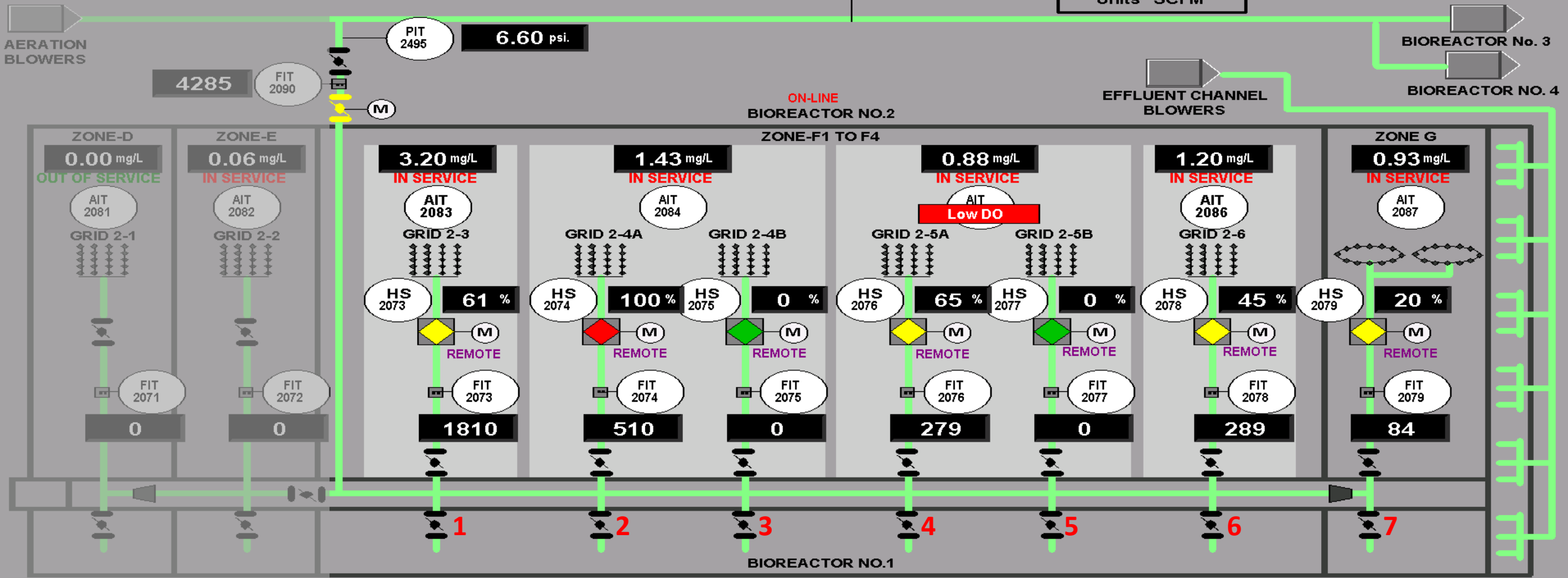
## Bioreactors No. 2 Air Distribution

**40.9 MGD**

**SETPOINTS**  
**TRENDS**

10:06:02 AM  
 5/17/2019

Mixer View Misc. Instruments Aeration View DO Control **PIT 2496 6.60 psi.** Note: Air Flow Engineering Units "SCFM" Alarm Summary



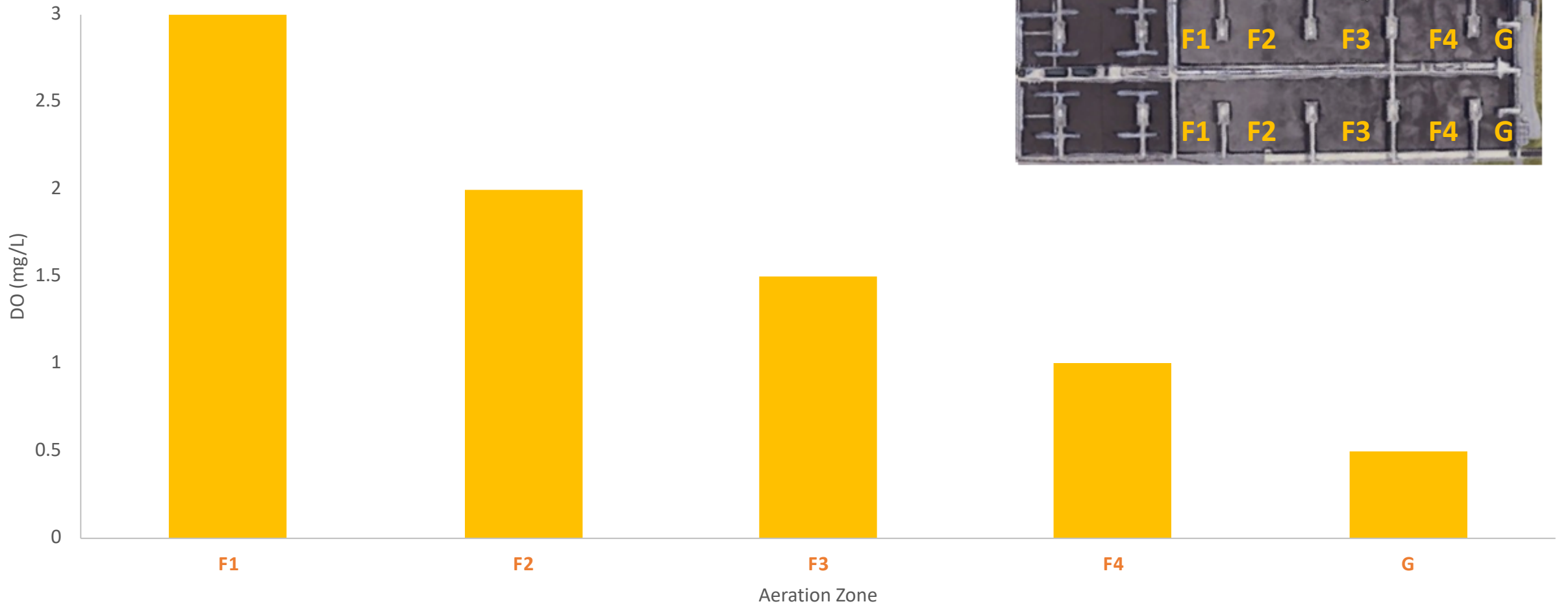
# Key Parameter on Electricity Usage

I. DO Set-points

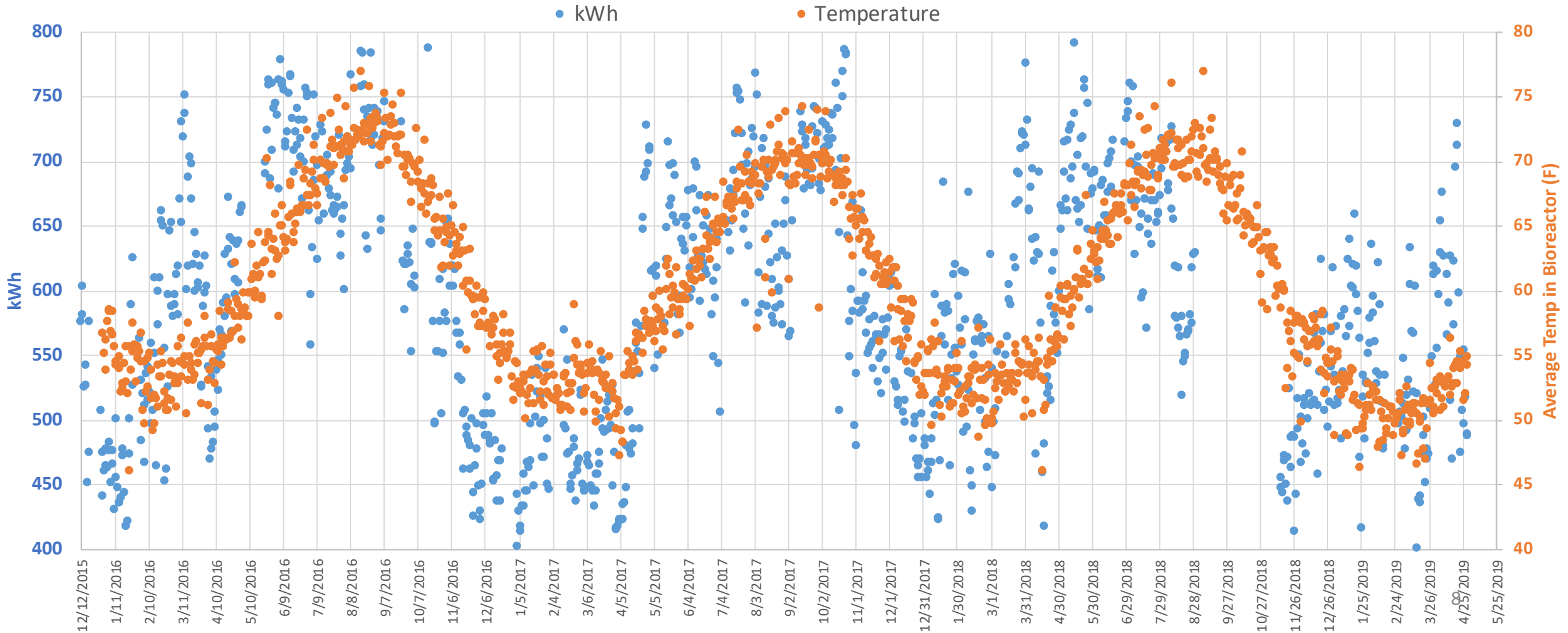
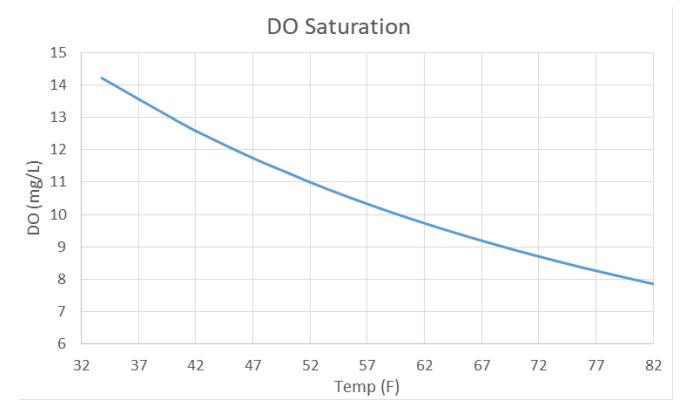
II. Temperature

III. Nutrient (CBOD & TKN)

# DO Set-point

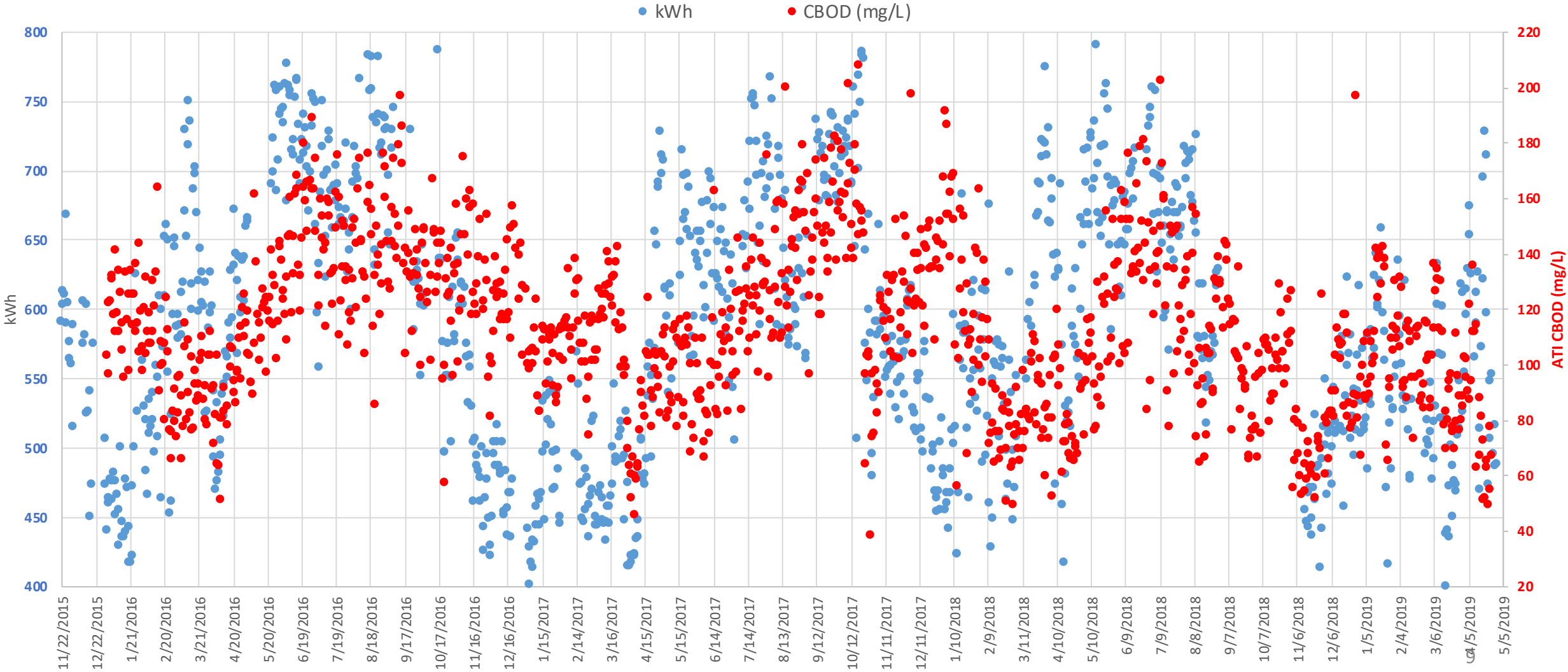


# Temperature

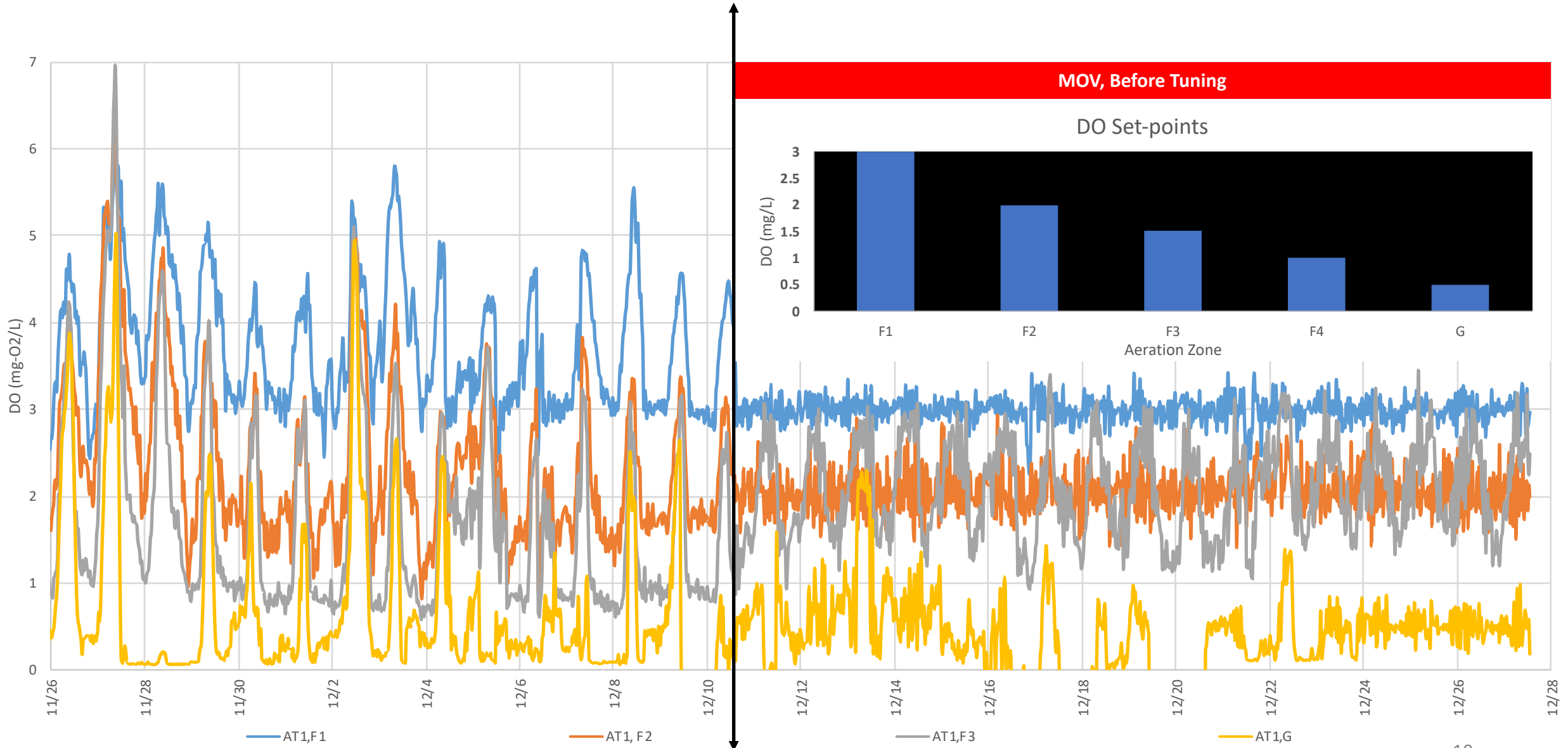




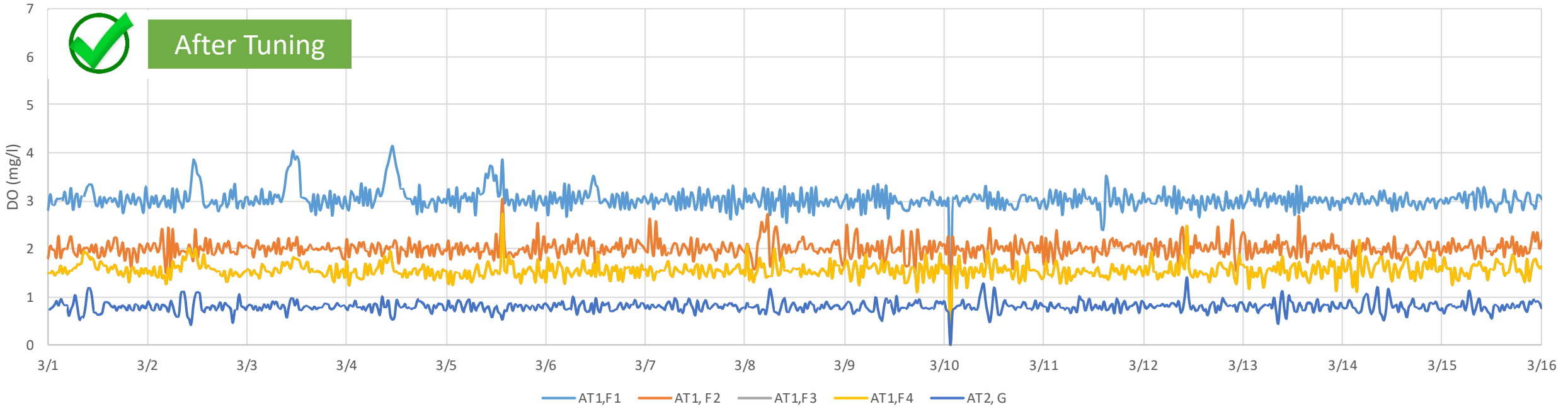
# Nutrient Concentration (CBOD & NH3)



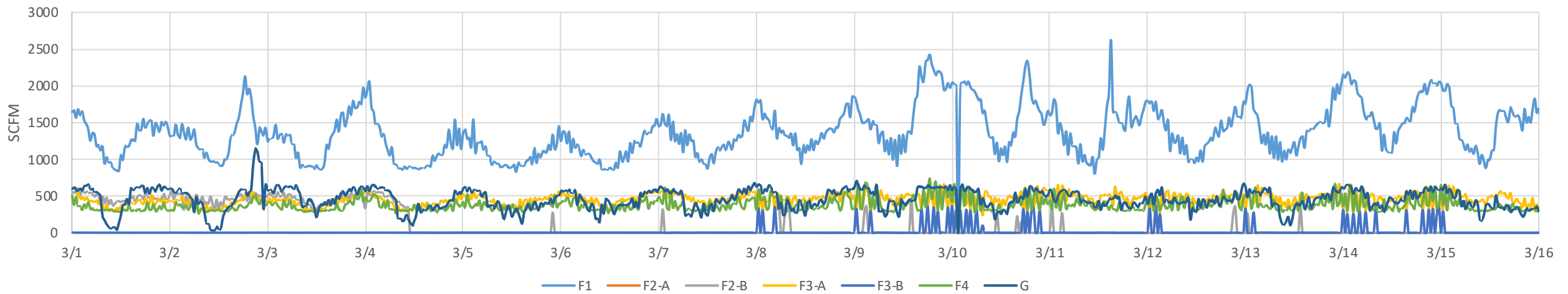
# Results & Achievement:



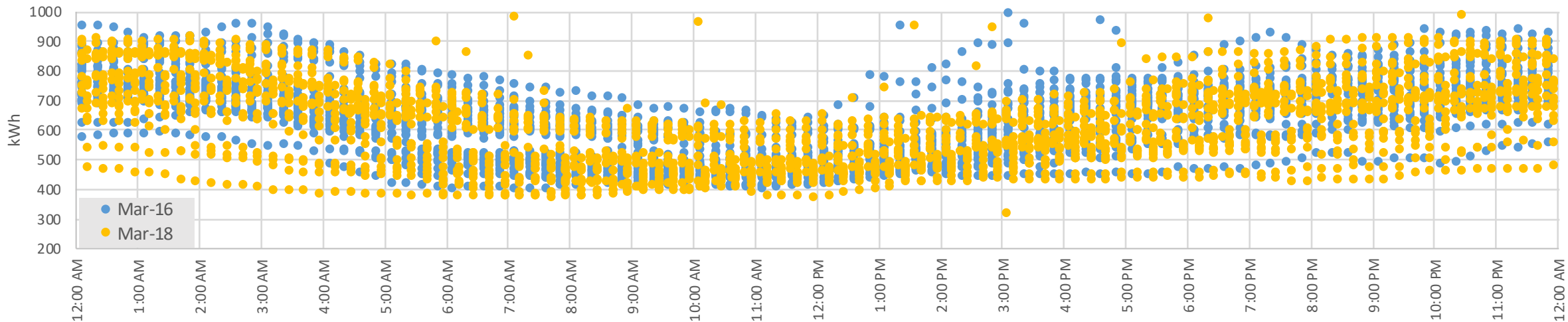
### DO AT-1



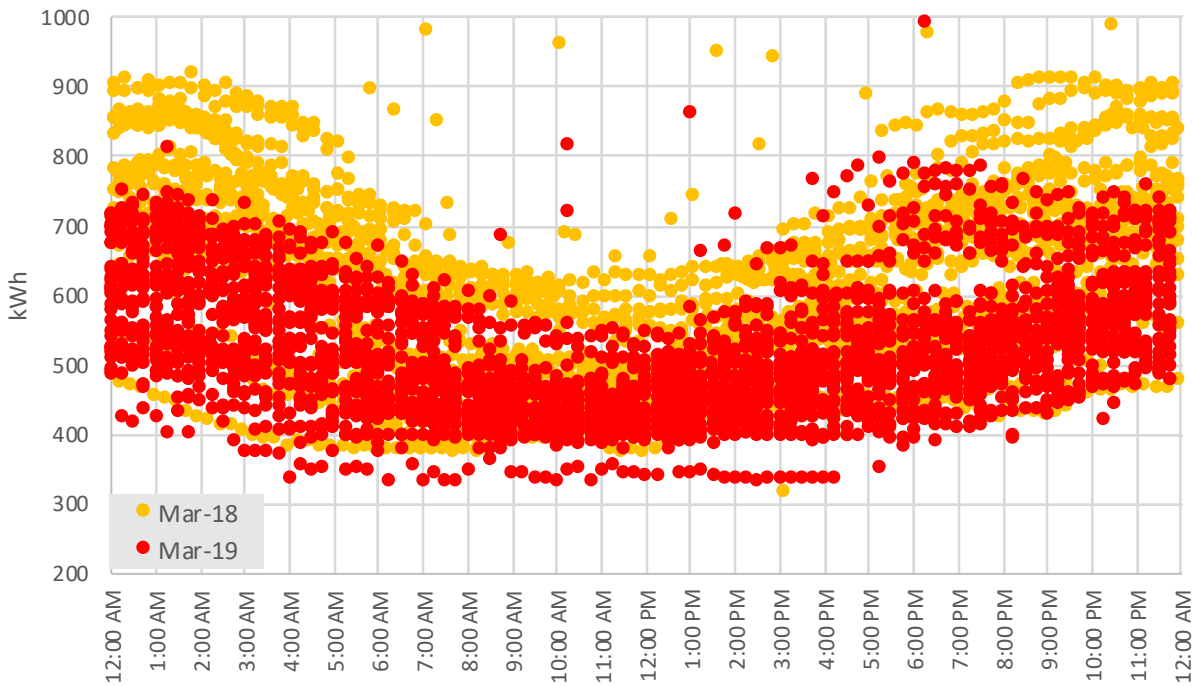
### AT-1 Air Flow



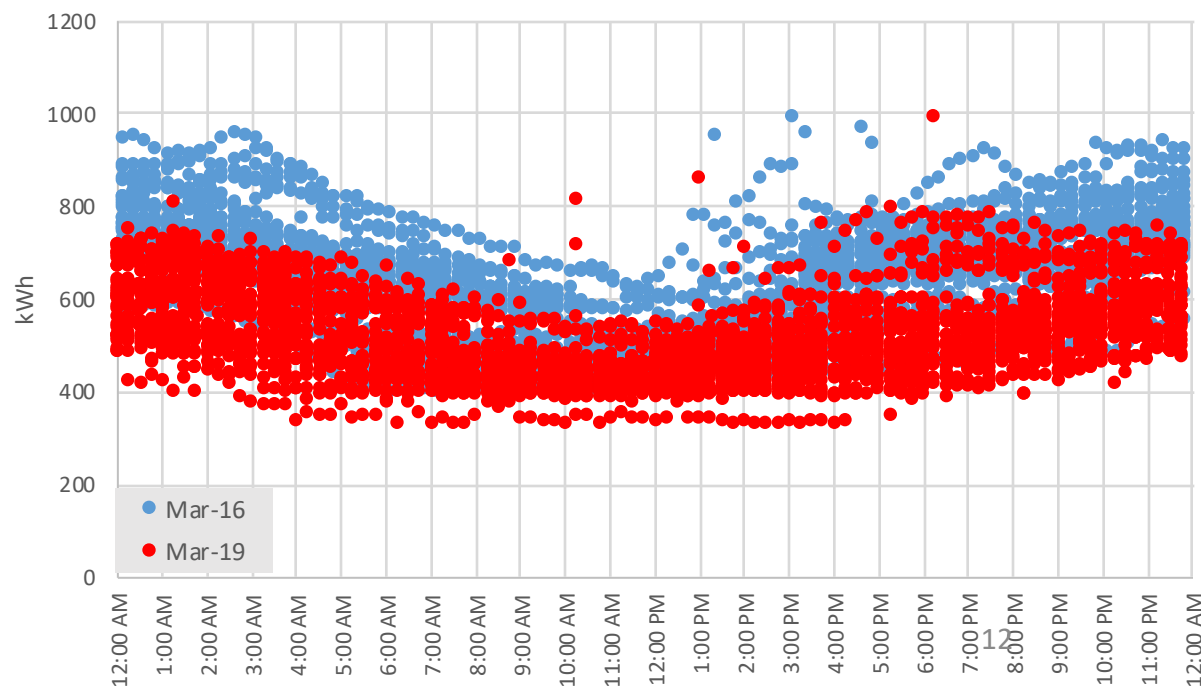
Hourly kWh 2016 vs 2018



Hourly kWh 2019 vs 2018

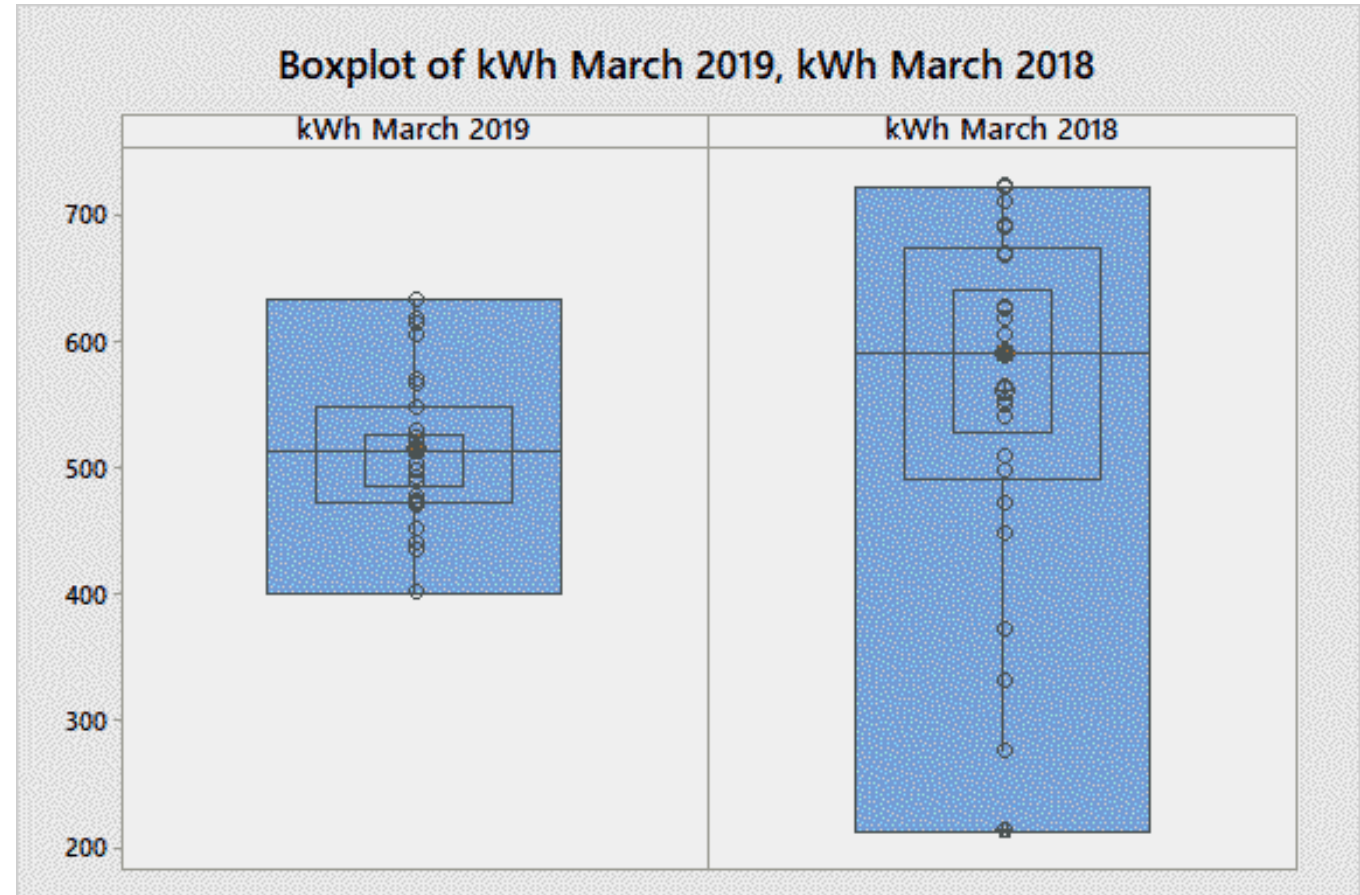


Hourly kWh 2019 vs 2016

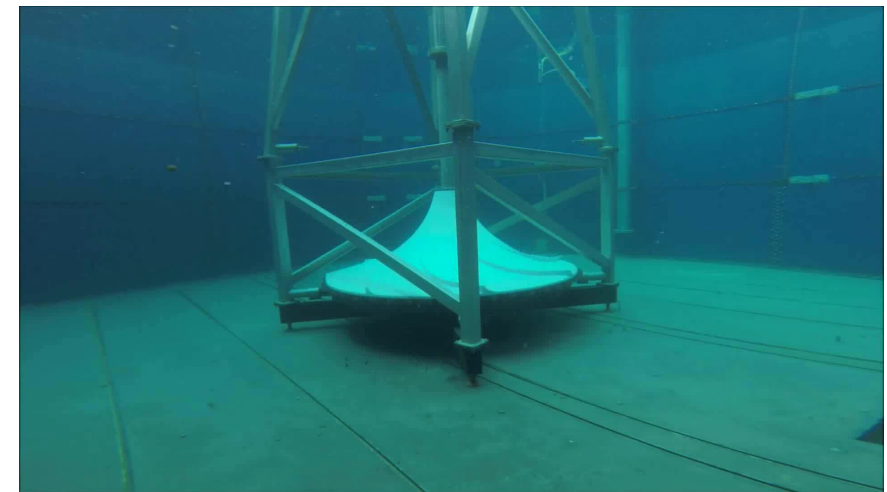
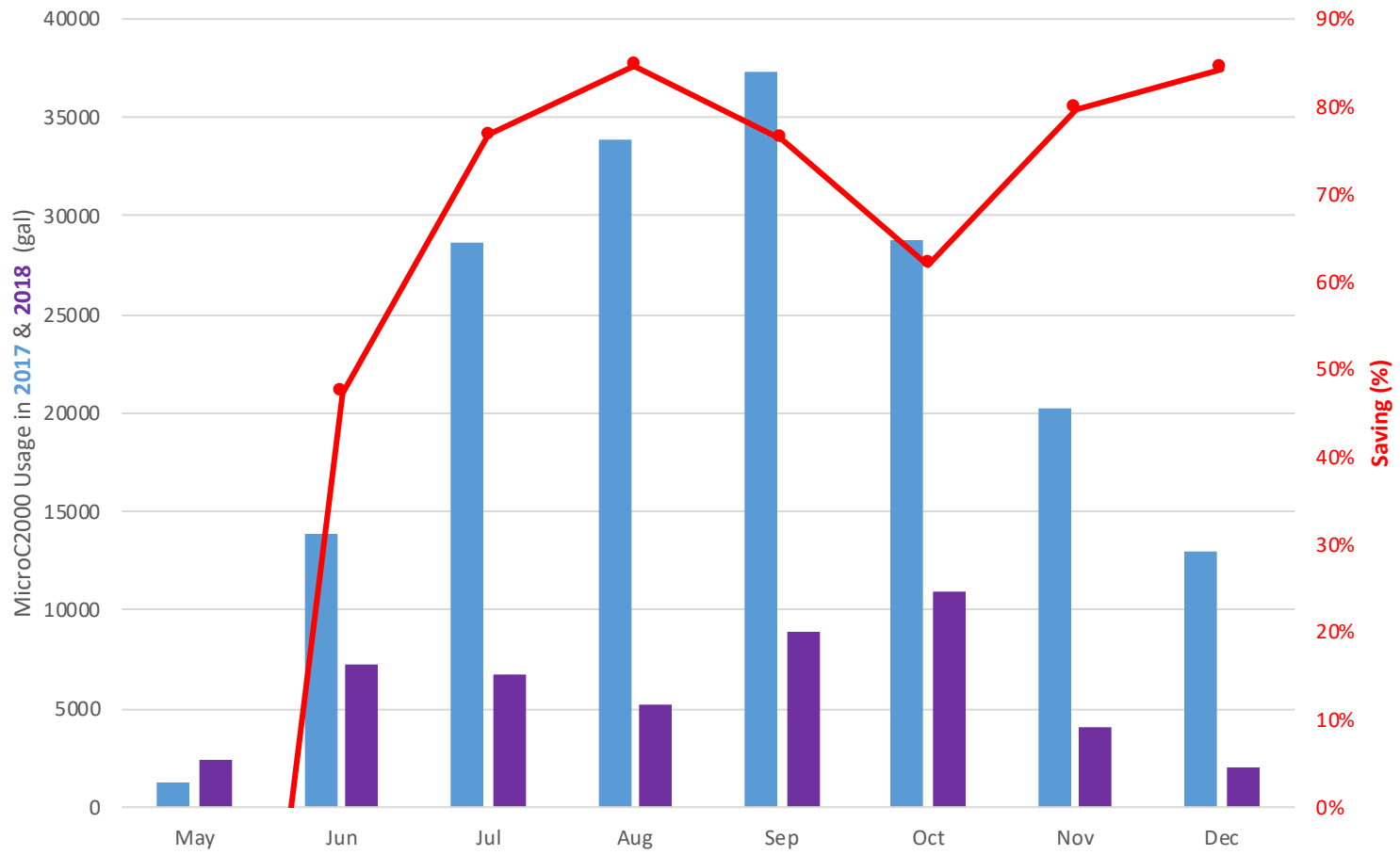




- The Electricity usage in March 2019 was 8 % less than 2018 and 2016.
- More Data is required to calculate the total saving.

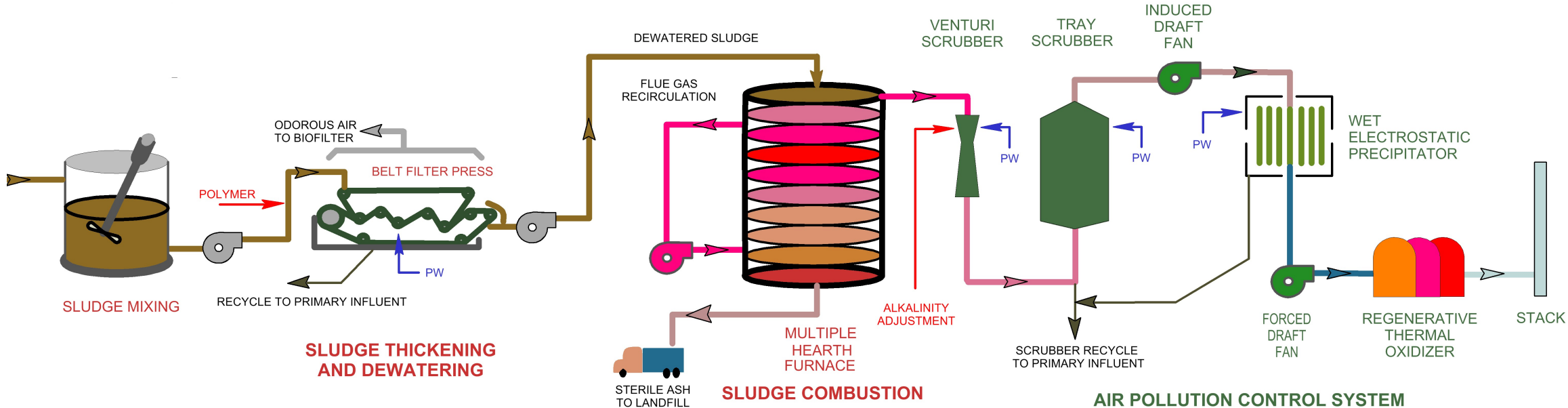


Supplemental Carbon Usage in 2017 vs 2018

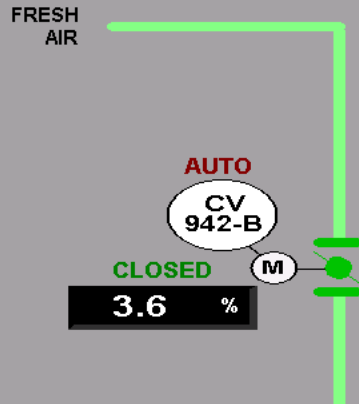


Replacing the disk diffuser in Zone G led to reduce MicroC usage from 177,000 to 48,000 gallon (73% reduction or \$258,000 saving).

# The Regenerative Thermal Oxidizer (RTO) Upgrade



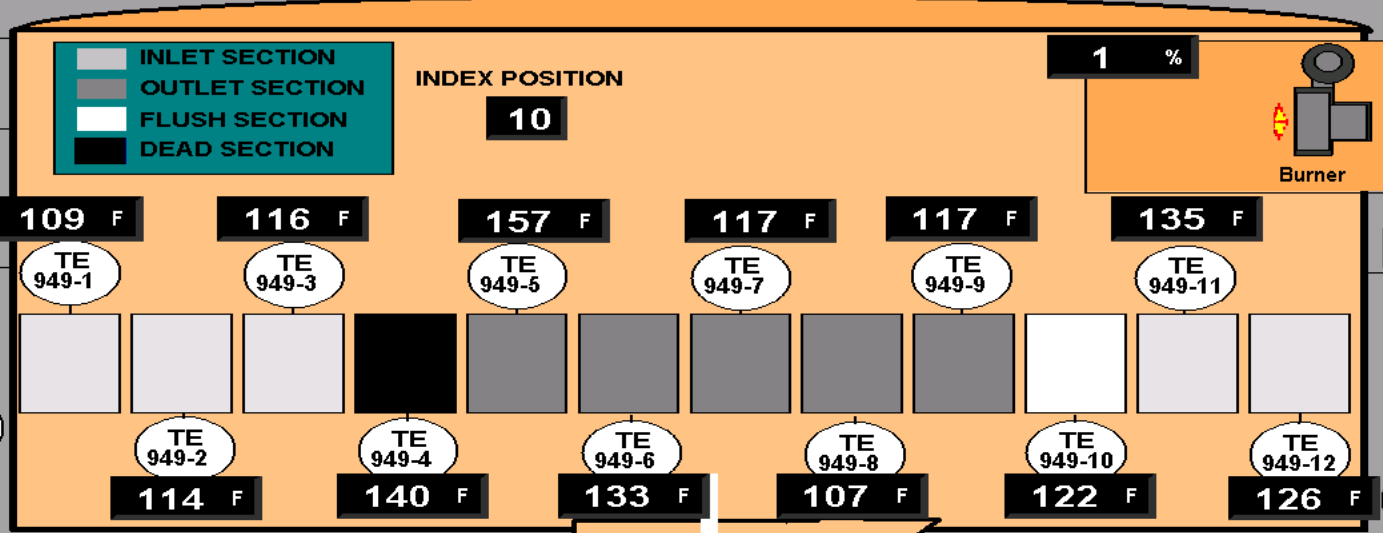
OPER ON-LINE



1499 F Avg.

1496 F TE 950-B

1502 F TE 954-B



COMBUSTION BLOWER  
RUNNING

BURNER  
RUNNING

BURNER GAS FLOW  
0.80 MCF/HR

RTO-B ROTARY VALVE DRIVE

ROTARY VALVE 960-B

COMMANDS

RUN COMMAND: STOP

CONTINUOUS ROTATION: NOT ACTIVE

REFERENCE COMMAND: NOT ACTIVE

STATUS

REFERENCED: REFERENCED

REFERENCE SWITCH (2608PRX): OFF

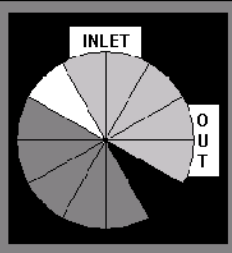
CURRENT POSITION (DEGREES): 90.1

CURRENT ENCODER VALUE: 239652

REFERENCE POSITION (DEGREES): 330.0

REF. PROX DETECTED (DEGREES): 329.4

INDEX POSITION: 4



INLET SECTION

OUTLET SECTION

FLUSH SECTION

DEAD SECTION

Temp. and Vibration Monitoring

TE 948-1B 88.3 F

AUTO  
CV 944-B  
OPENED

TE 962-B 109.8 F

2608PRX: OFF

ZSC 960-B ROTARY VALVE

TE 957-B 145.0 F

AUTO  
CV 970-B  
OPENED

PANEL TEMP.: 74.4 F

AIR SPRING PRESSURE PIT-963-B: 50.7 PSI

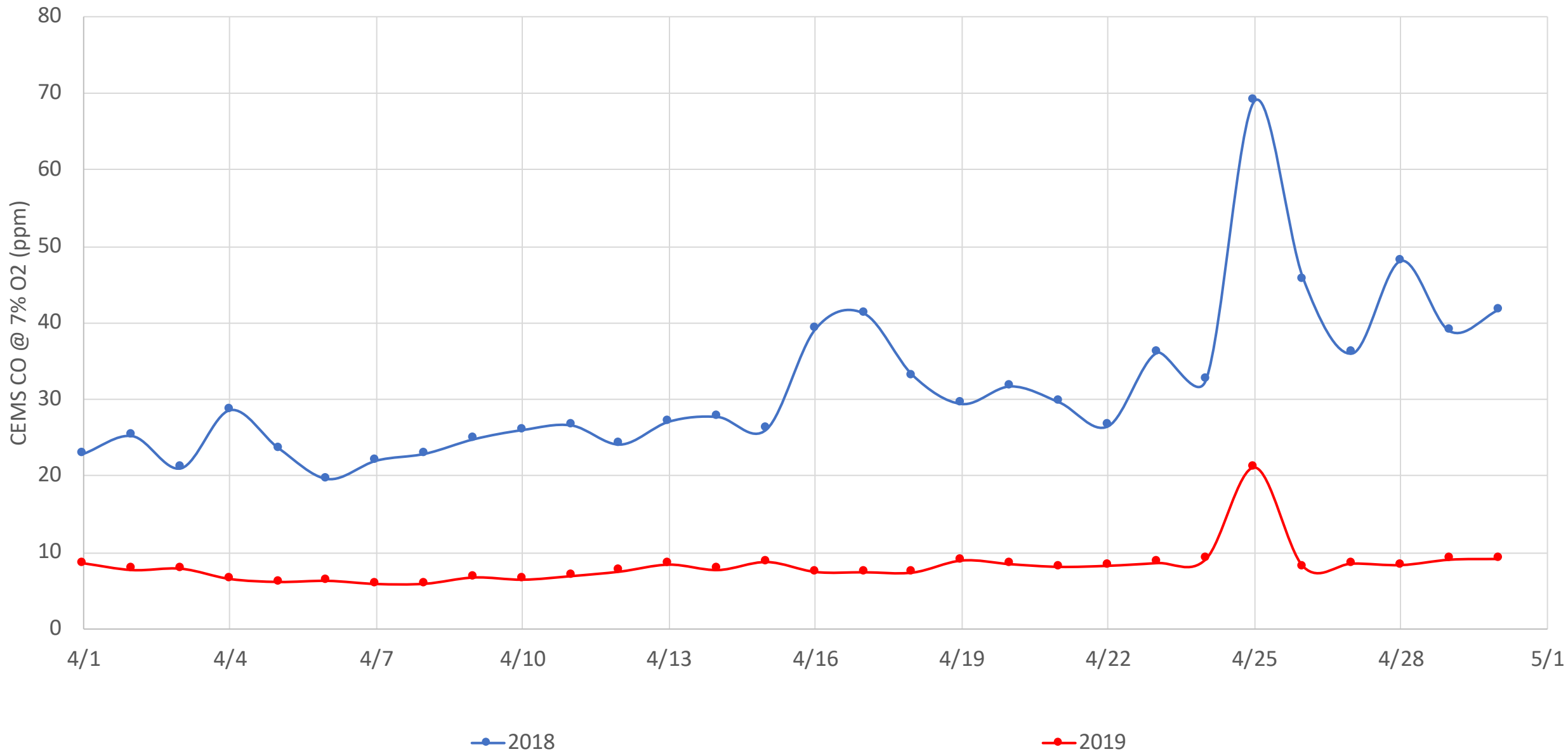


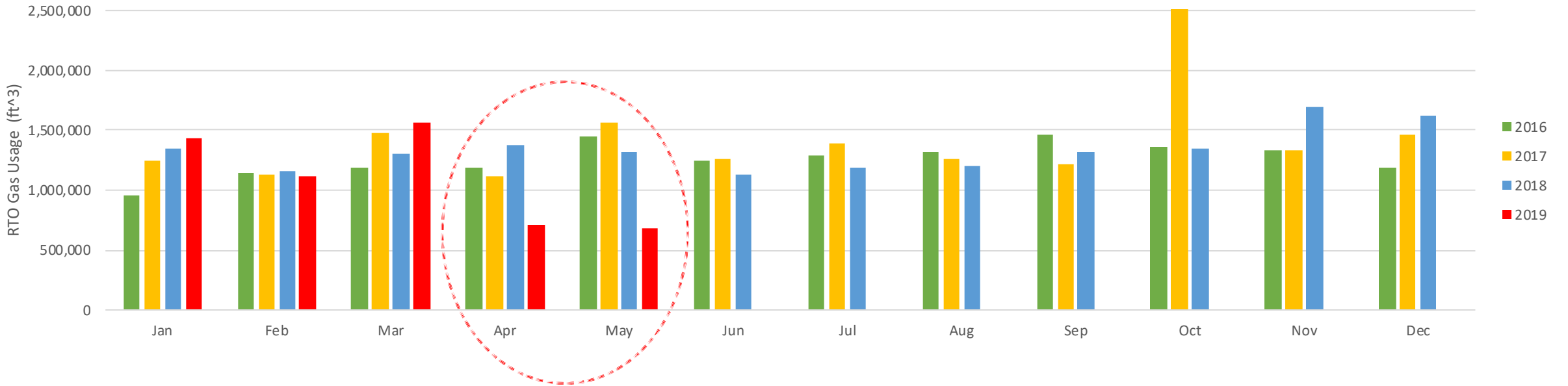
Process Overview

Alarm Summary

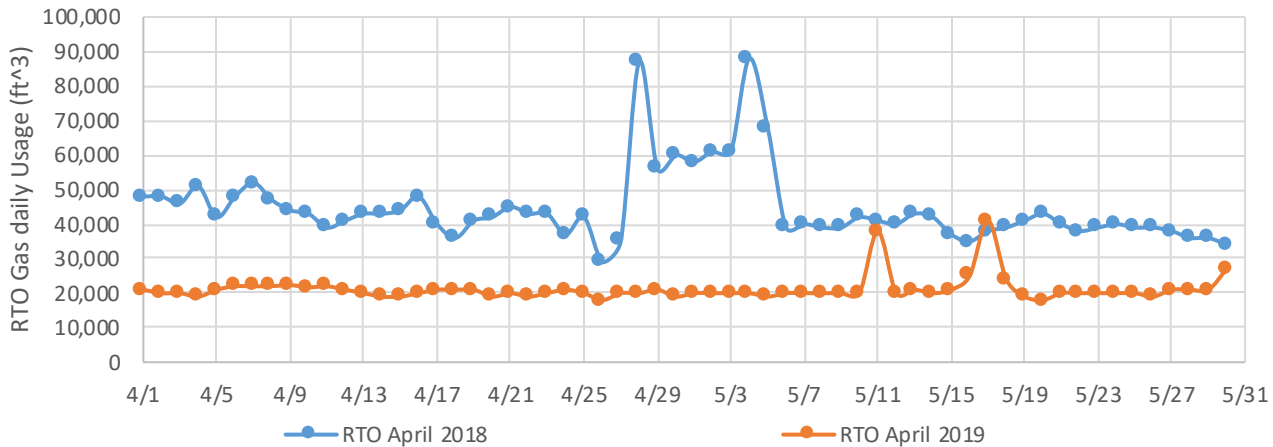


# April 2019 vs 2018

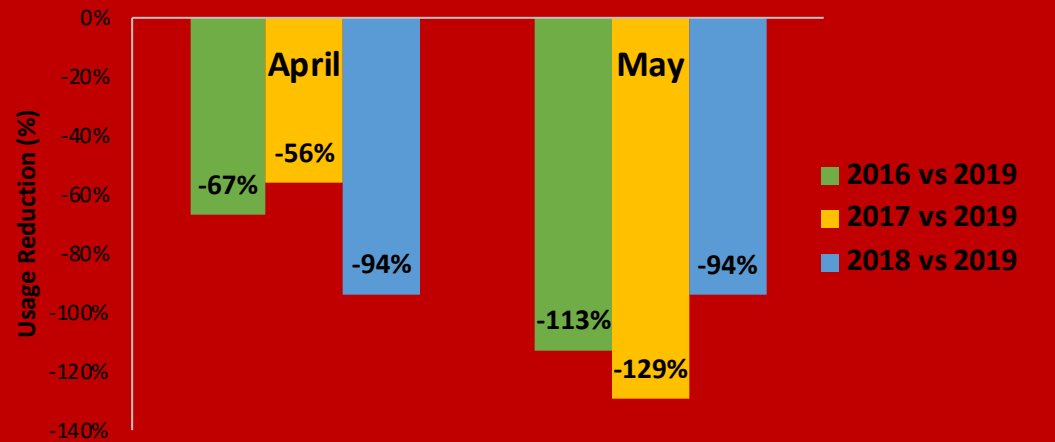




RTO Gas Daily Usage in April & May (2018 vs 2019)

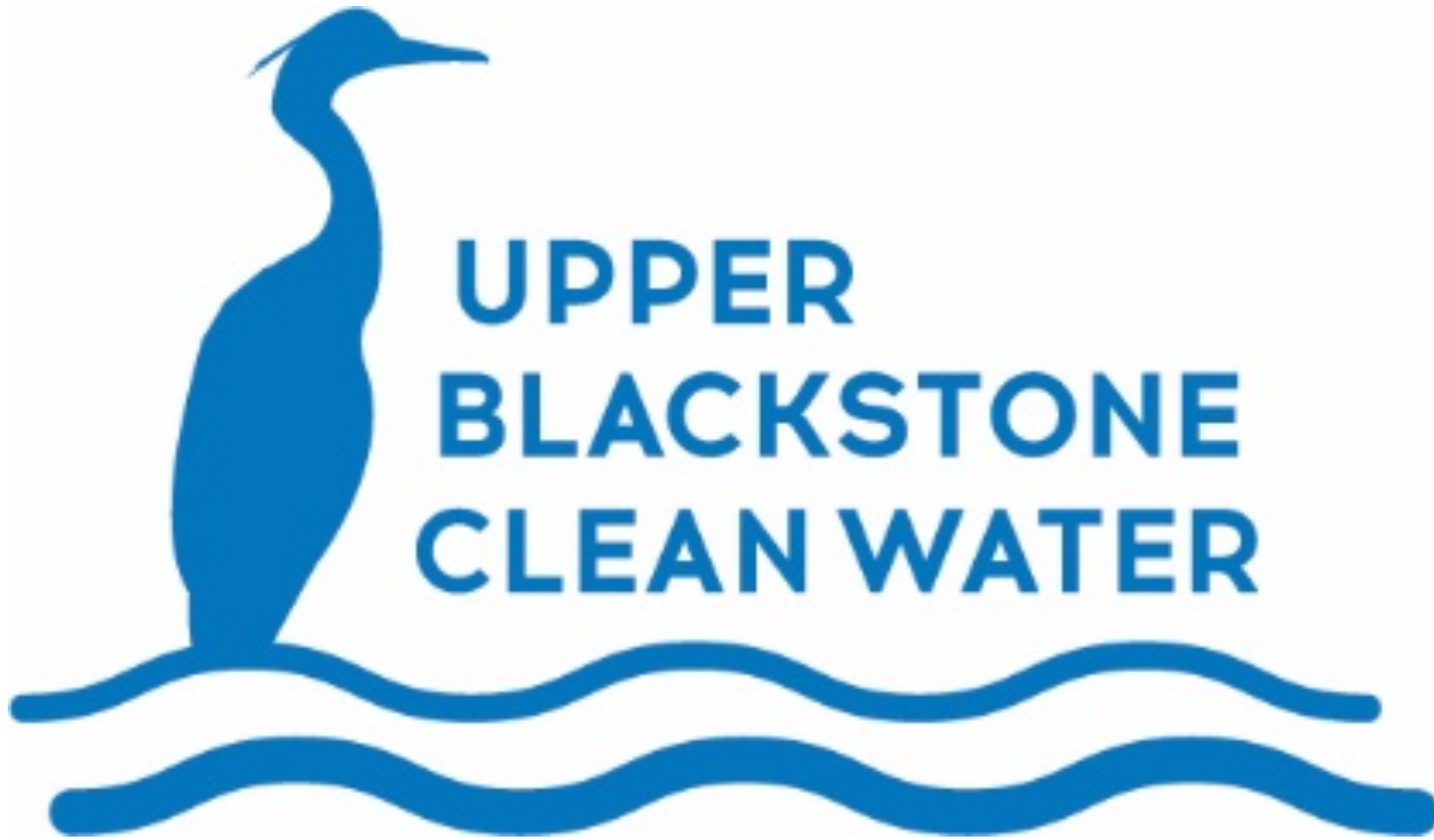


RTO Gas Usage Saving compare to 2019



# Achievements:

- ✓ Significant reduction on energy consumption
- ✓ 73 % reduction on Supplemental carbon usage  
(\$258,000 saving)



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Plant Operations Manager