Lessons Learned from the First Year of Operation of an ANITA™ Mox System at Little Patuxent WRP

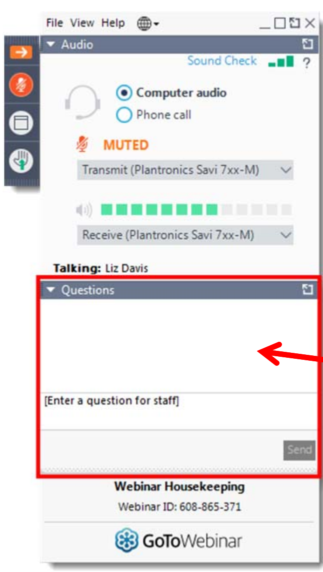
Tuesday August 18th, 2020
1:00pm – 2:00pm EST

Presenters
Larry Li
Chris Moline
Robert Hindt

WATER TECHNOLOGIES

1

How to Participate Today



- **Audio Modes**
  - Listen using Mic & Speakers
  - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- **Submit your questions using the Questions pane.**
- **A recording will be available for replay shortly after this webcast.**

2

VEOLIA

SPEAKER INTRODUCTION

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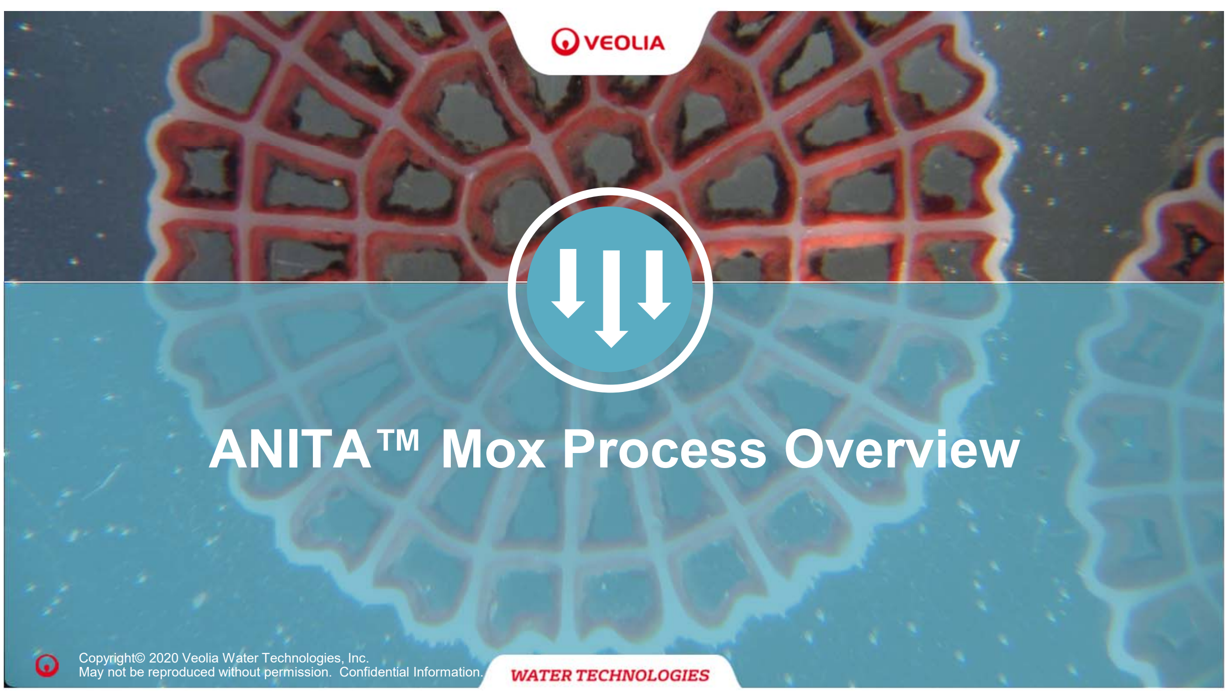
Veolia Water Technologies

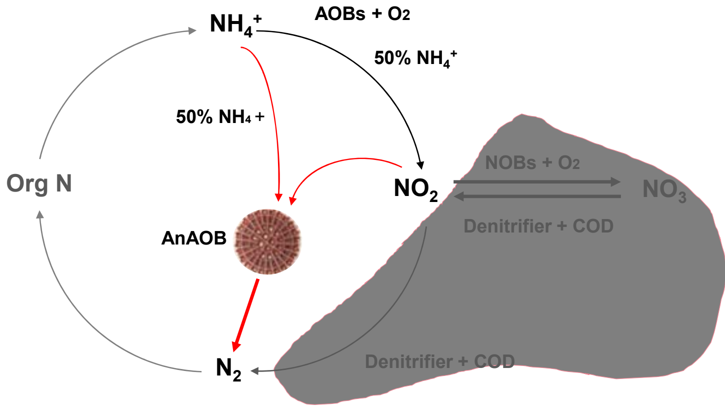
WATER TECHNOLOGIES

3



4

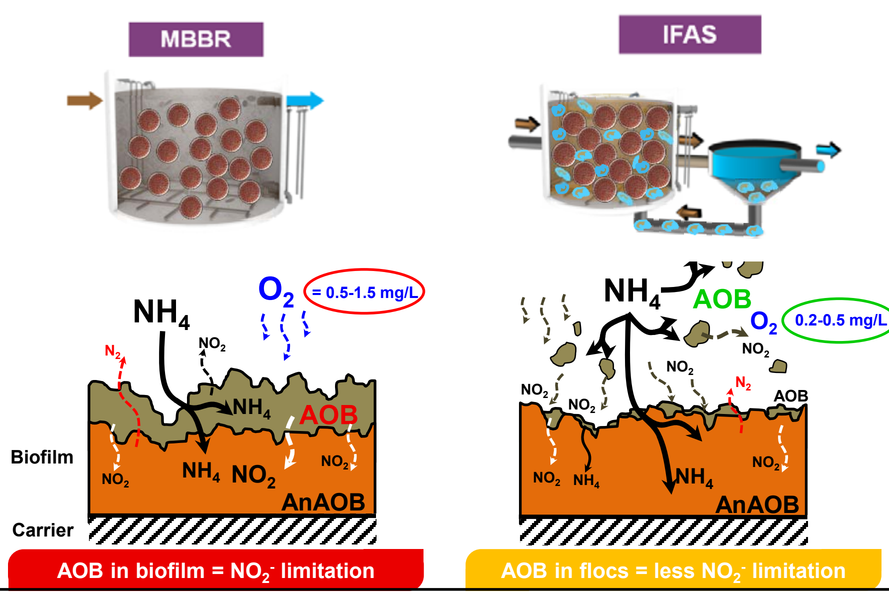
Alternate Nitrogen/Ammonia Strategies: Principle and Benefits



Parameter	ANITA™ Mox	Conv. NDN	Savings
Oxygen Requirement (lb O_2 / lb N)	1.9	4.6	60%
External Carbon (lb / lb N)	0	3.0	100%
Sludge Production (lb VSS / lb N)	0.1	0.5 – 1.0	50 – 90%

5

MBBR for Simplicity; IFAS for THP or More Capacity



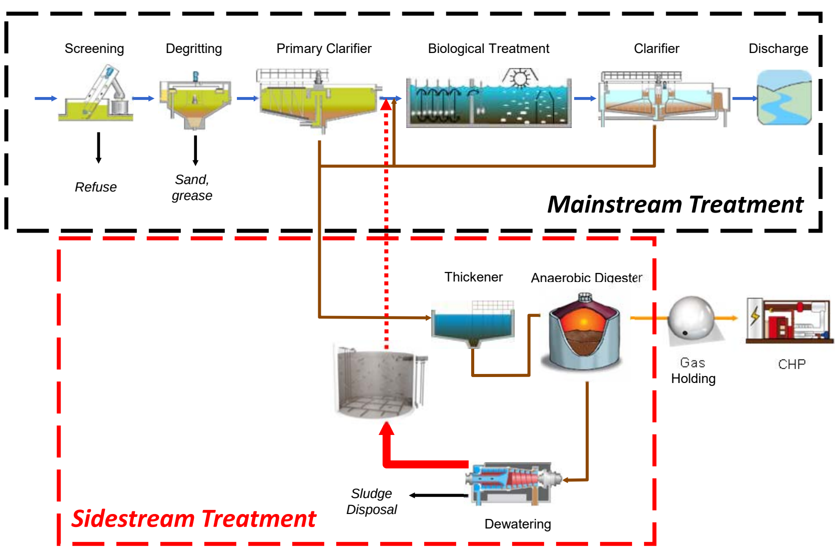
6

Maintenance-Free Components (Media, Air Grids, Sieves)

- AnoxKaldnes™ K5 Media
  - 800 m2/m3 SSA
  - Longevity
- Media Retention Sieves
  - 304L Stainless Steel
  - Cylindrical Perforated Plate
- AnoxKaldnes™ Aeration Grid
  - 304L Stainless Steel
  - Medium Bubble
- I/C Instrument and Controls
- Mixers
- Blowers (if necessary)

7

Mature for Sidestream, Ready for Mainstream



8

Dare to Compare

- Simplest, most stable and robust process in the Market
- Works well with existing tanks, any water depth (10-30ft) and geometry
- Compact design with minimal maintenance
- No anammox washout, Greater protection from shocks/toxicity
- Tolerate high range of TSS, polymer, DO, pH, NO2 residue etc.
  No need for media replacement
- Resilient, works with flexible dewatering schedules

9

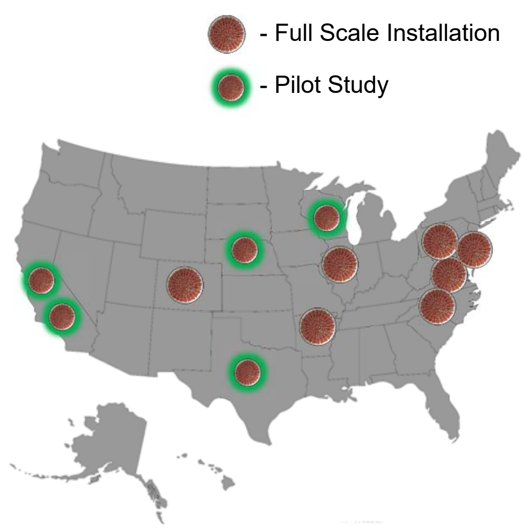
Every Project Is a Success (30 + projects in 10 years)

U.S. Installations – Sidestream

James River TP, VA (HRSD) (2014)
South Durham WRF, NC (2015)
Egan WRP, Chicago, IL (MWRDGC) (2016)
Denver Metro, CO (2017)
Howard County MD (2018)
Tomahawk Creek, KS (2019)
WSSC (2020)
Central Valley (2021)

ROW Installations – Sidestream

Malmo, Sweden (2010)
Växjö, Sweden (2011)
Holbæk, Denmark (2012)
Grindsted, Denmark (2012)
Industrial Client (F&B), Poland (2015)
Locarno, Switzerland (2015)
Arla Foods (Dairy), United Kingdom (2015)
Viikinmäki (near Helsinki), Finland (Large Scale Pilot) (2015)
Borås, Sweden (2016)
Stockholm Vatten-Bromma, Sweden (2016-17)



10

11

1 Project Background

2 System Performance

3 Chemical Feed Requirements

4 Struvite Management

5 Temperature Management

6 Foam Management

12

Project Background

13

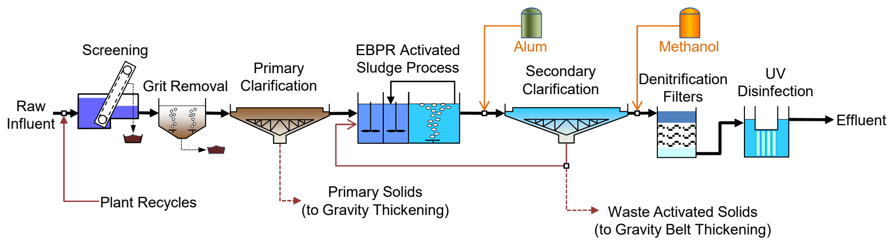
Little Patuxent WRP

- Average influent flow ~20 MGD
  - Influent screening + pumping + grit removal
  - Primary clarification
  - BNR activated sludge and clarification
  - Denitrification filters
  - UV disinfection
- Average solids production
  - 23 dry tons/day before anaerobic digestion
  - 12 dry tons/day after anaerobic digestion

14

Little Patuxent WRP – Liquid Treatment Process

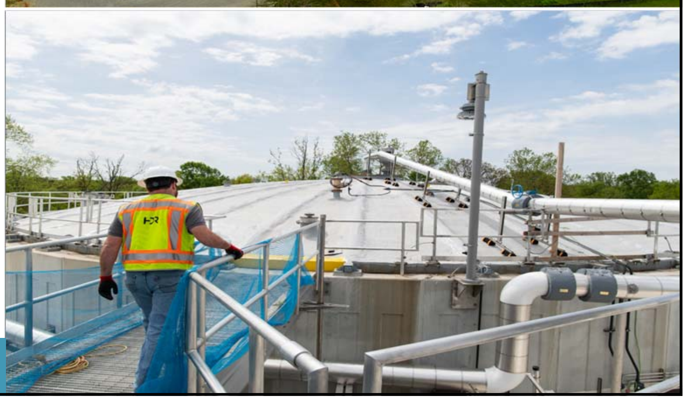
- High influent BOD (industrial component)
- Effluent Limits: 4 mg/L TN, 0.3 mg/L TP, seasonal ammonia



15

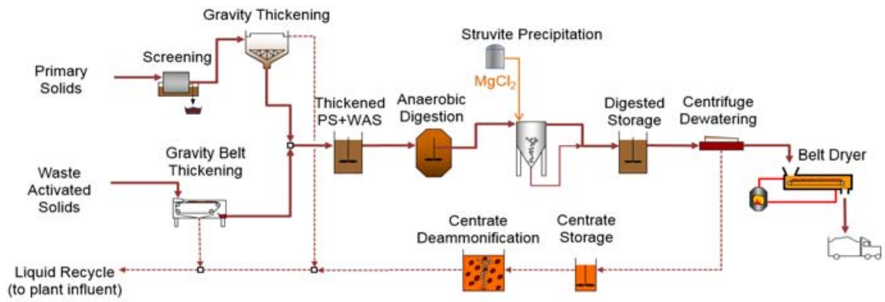
LPWRP Biosolids Improvements

- Solids Handling
  - Gravity thickening for PS (upgraded)
  - Gravity belt thickeners for WAS (new)
  - Anaerobic digestion (new)
  - Centrifuge dewatering
  - Belt dryers (new)
- Nutrient Recycle Improvements
  - New, concentrated centrate (N & P)
  - Phosphorus precipitation (AirPrex)
  - Ammonia removal (ANITA Mox)



16

Little Patuxent WRP – Solids Handling Processes



17

LPWRP Effluent Discharge Limits

- Permit compliance is the first consideration for managing nutrient recycles

	Annual Average Limit (mg/L)	Monthly Average Limit (mg/L)	Weekly Average Limit (mg/L)
Total Nitrogen	4.0 (3.0 goal)	-	-
Ammonia Nitrogen, April 1 – Oct 31	-	0.75	1.1
Ammonia Nitrogen, Nov 1 – March 31	-	7.0	-
Total Phosphorus	0.30		

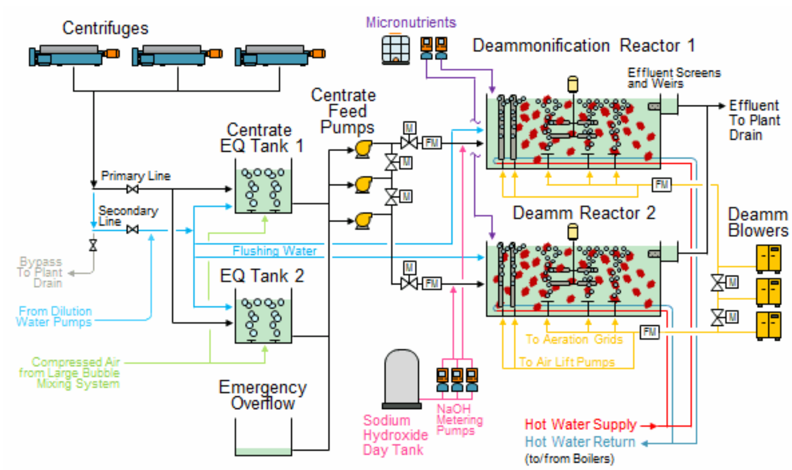
18

ANITA Mox System Design

- Design Load
  - 1,600 lb/d Ammonia, 1,100 mg/L typical
- Treatment Specifications
  - ≥80% Ammonia Removal
  - ≥70% TN Removal
- Reactors and Equalization
  - Existing aerobic treatment basins
  - (2) EQ tanks @ 200,000 gal/each
  - (2) reactors @ 141,000 gal/each
- Major Equipment
  - Existing solids gallery
  - (3) Centrate feed pumps
  - (3) 50 hp blowers, 850 SCFM each
  - Reactor mixers, air lift pumps
  - Sodium Hydroxide and Micronutrient Feed Systems

19

ANITA Mox System Process Flow



20

System Performance

21

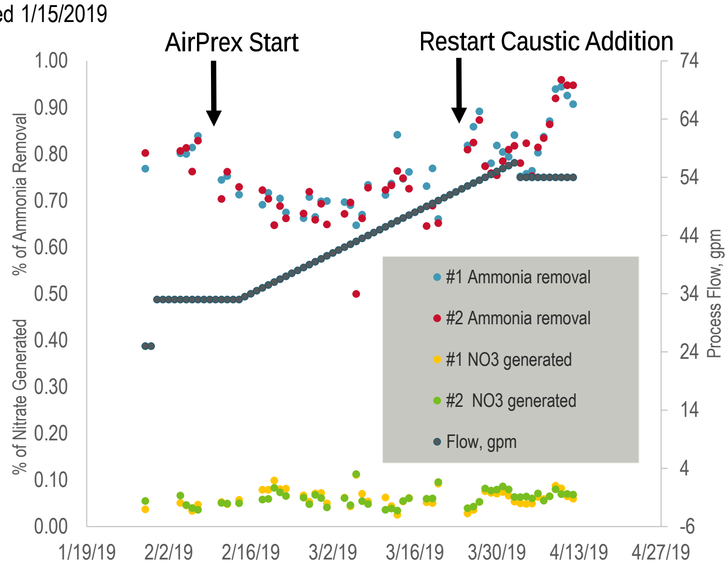
Typical Performance

- Centrate Feed
  - 140,000 gal/d total
  - 1,080 mg/L NH_3-N (1,260 lb/d)
  - 1,100 mg/L TSS
- Effluent
  - 230 mg/L NH_3-N (79% removal)
  - 55 mg/L NO_3-N
  - 10 mg/L NO_2-N
  - 750 mg/L TSS
  - pH 6.6
- Chemical Feed
  - 150 gal/day 25% NaOH

22

ANITA Mox System Startup

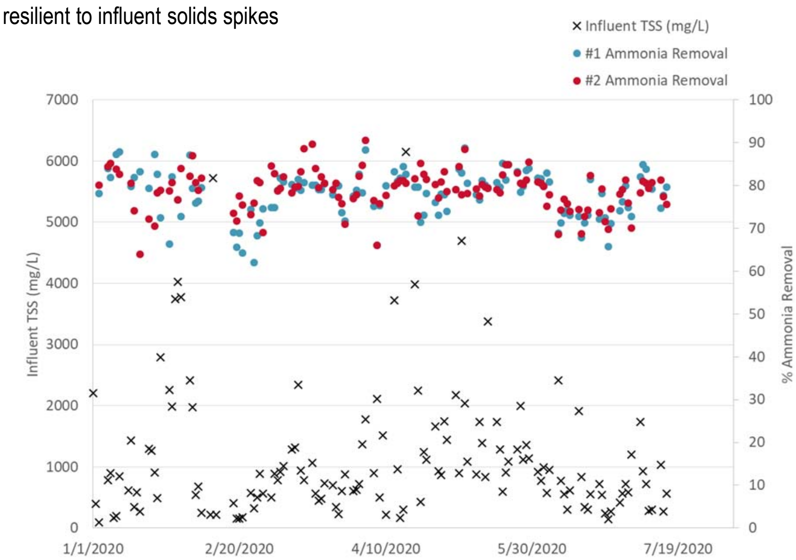
- 5% seed media added 1/15/2019



23

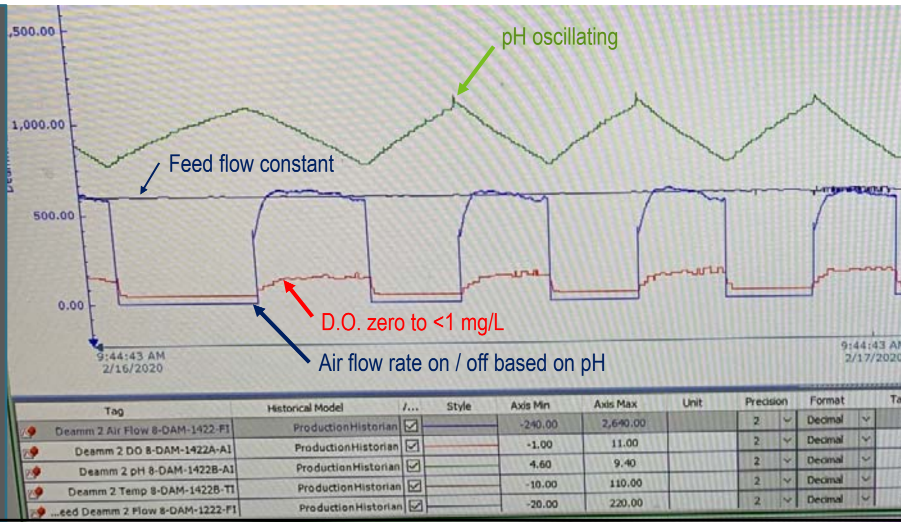
Ammonia Removal & Influent TSS

- System has been resilient to influent solids spikes



24

Example Operation over 24 Hours



25

System Monitoring and Control

- Adjust feed rate slowly (max 5% per day)
- Nitrogen species monitored daily, and 2x/day if there's a process concern
  - NH_3-N: Target between 150 and 250 mg/L. *Increase D.O. if higher.*
  - NO_2-N: Target <15 mg/L. *Reduce D.O. if higher.*
  - NO_3-N: Target between 10-15% of NH_3-N removed
- pH, Alkalinity, and Sodium Hydroxide Feed
  - Air shuts off at pH 6.3-6.5 (adjustable) to allow pH to increase before aerating again
  - Sodium hydroxide feed set to provide sufficient alkalinity for ammonia removal
- Temperature
  - Add dilution water to centrate drain if reactor >95°F
  - Can also heat if temperature is low

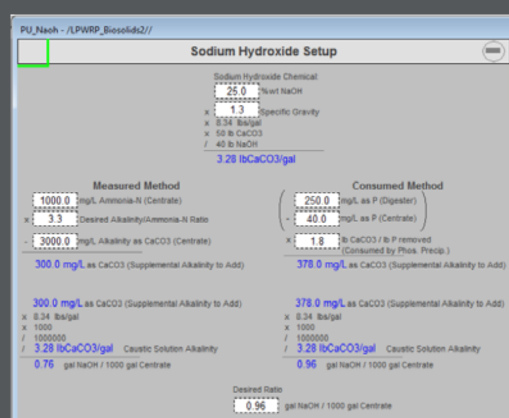
26

Chemical Feed Requirements

27

Supplemental Alkalinity

- Alkalinity consumed by AirPrex process upstream, due to struvite formation
- Calculate alkalinity dose based on either
  - Phosphorus removed at AirPrex
  - Target alkalinity-to-ammonia ratio in centrate
- 25% sodium hydroxide added directly to reactors



28

Micronutrients

- System includes micronutrients feed pumps and tote
- Micronutrient has not been needed during operation at LPWRP

29

Struvite Management

30

Struvite Management

- LPWRP has enhanced biological phosphorus removal process → struvite potential in centrate
- Upstream AirPrex process removes >85% of phosphorus but some struvite can still form in centrate
- Struvite forms when pH rises due to turbulence or exposure to air

AirPrex Process, Upstream of ANITA Mox

31

Pumping Considerations

- Struvite formed on centrifugal impeller and downstream
- Hair/ragging and foam also an issue
- Rotary lobe pump provides more consistent performance

Rotary Lobe Pump for Centrate Feed

32

Piping Considerations

- Struvite buildup has occurred in centrate feed lines
- Has been removed with jetting or citric acid recirculation
- Provide flushing connections for citric acid circulation and access for pipe jetting

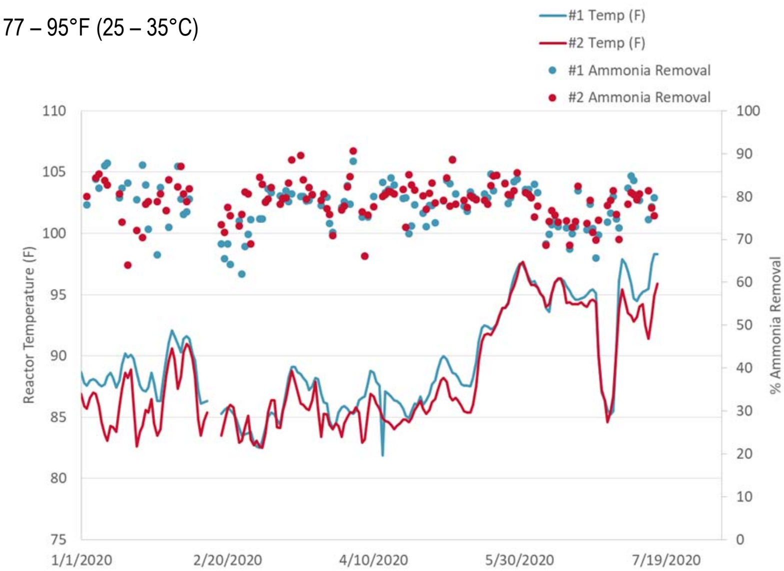
33

Temperature Management

34

Reactor Temperature

- Optimal temperature 77 – 95°F (25 – 35°C)



35

High reactor temperature can cause inhibition

- While low temperatures reduce reaction rate, temperatures >98°F can also be problematic
- Reactor temperature > feed temperature
  - Exothermic reactions
  - ~8°F temperature rise calculated from biological activity
- Dilution is simplest method to address elevated temperature
  - Reduces feed temperature
  - Reduces energy content of feed

36

Foam Management

37

Foam Management

- Reactors each include two airlift pumps each for foam control
- Portion of reactor surface separated by existing walkway beam, leading to foam build-up
  - Temporary spray nozzles
  - Additional airlift pump to be added

38

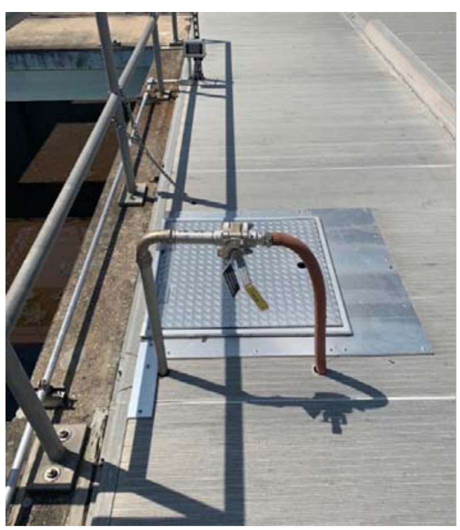
Foam Photos

Centrate Equalization Tank

Reactor surface without airlift pump

39

Airlift Pump Installation



40

Questions?

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41