Energy Efficiency Collaboration with Danish Utility at AlexRenew

Presented by

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Outline

- AlexRenew Introduction
- Energy Minimization Approach
- Collaboration History with VCS Denmark
- Collaboration Area Identification
• Original 18 MGD trickling filter plant and interceptor system placed in service in 1956

• Late 1970s and ‘80s plant upgrades included tertiary treatment and expansion to 54 MGD

• Comprehensive facility upgrade from 1999 to 2005 provided biological nitrogen removal

• Under construction on SANUP to meet even lower Total Nitrogen permit limits (3 mg/L)
Solids Process Schematic

Waste Activated Sludge

Blending Tanks

Thickening Centrifuges

Thickened Sludge Equalization Tanks

Primary Sludge
Tertiary Sludge

Gravity Thickeners

Blending Tanks

Thickening Centrifuges

Pre-Pasteurization Process

Anaerobic Digesters

Digested Sludge Equalization Tanks

Dewatering Centrifuges

Dewatering Centrate to Centrate Pre-Treatment

Lime

Class A Biosolids to Land Application

Polymer
Energy Use

- Electricity
- Natural gas
- Biogas
Opportunities and Challenges

• Increasing loads to the plant
• Building HVAC and lighting demand
• Multiple plant internal pump stations
• Site constraints to implement certain renewable energy technologies
• Relatively low unit electricity cost - certain energy efficient technologies may not be attractive
Energy Activities

2009
• First E-Zero Team Meeting

2011-2012
• Implemented the absorption chiller
• Installed motion sensors
• Upgraded energy efficient ballast
• Lowered hot water set points on water heaters
• Scheduled HVAC units turned off at night
• Adjusted thermostat based on temperature
• Installed energy star products (light bulbs, ballast) on primary tank lighting

2013
• Collaboration with VCS Denmark

2014
• Energy Minimization Program
Energy Minimization Program

Energy Management
- Energy Audit
- Energy Monitoring
- Peak Shaving
- Rate Structure

Process Optimizations
- Buildings
- Pumps and Motors
- Thickening
- Digestion and Pasteurization
- Dewatering
- Fleet

Green Energy
- On-site generation
- Off-site generation

Best Practices
- Engineering Design
- Maintenance Program
- Training
- Public Outreach

Partnerships

Impact Ranking (high to low)
Collaboration

- Letter of Intent – July 2013
  - Wastewater technology and operations
  - Climate change
  - Energy reduction
  - SCADA system
  - and other areas

- Mainstream Anammox Kick-Off Workshop – October 2013
- Collaboration Meeting – April 2014
- Collaboration Meeting – October 2014
- Denmark Visit – December 2014
VCS Denmark Overview

- **3rd largest water and wastewater utility**

- **Water Supply (Groundwater) and Distribution**
  - 5 water treatment plants, 6.6 mgd
  - 27 gpd per capita
  - 5.2% leakage
  - ~ 50 people total

- **Wastewater Collection and Treatment**
  - 8 advanced treatment plants, 22 mgd total
  - 1400 miles sewers and 300 pump stations
  - ~ 70 people total
    - 35 in treatment plants
    - 35 in sewer collection
Ejby Molle WWTP

- Largest wastewater plant in VCS
- Rated capacity at 28.5 MGD

**Effluent Limits (average/permit)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average/Permit</th>
<th>Typical Discharge</th>
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<tbody>
<tr>
<td>BOD</td>
<td>8 mg/l</td>
<td>1-3 mg/L</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>8 mg/l</td>
<td>2-5 mg/L</td>
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<tr>
<td>Total Phosphorous</td>
<td>0.5 mg/l</td>
<td>0.05-0.15 mg/L</td>
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**Process Units**

- Screenings/Grit
- Chemically Enhanced Primary Treatment
- Trickling Filters/Oxidation Ditch
- Secondary Clarifiers
- Effluent Filters
- Thickening Centrifuges and Dewatering Centrifuges
- Anaerobic Digestion/Cogeneration
- Composting/Land Application
2013 Energy Uses, M kwh

- Activated Sludge Aeration, 2.6
- Pumping to Trickling Filters and Return Sludge, 1.2
- Effluent Filter, 0.8
- Thickening and Dewatering, 0.7
- Other, 0.5
- Sludge Storage, 0.2
- Activated Sludge Oxidation Mixing, 0.2
- Primary Treatment, 0.3
- Screen, Grit and Grease, 0.3
- Pumping to Activated Sludge, 0.5
- Activated Sludge Anaerobic Zone Mixers, 0.4
- Anaerobic Digestion, 0.3
- Other, 0.5
High Automation

- All plant processes operate with little intervention
  - Instruments for process control, instead of lab samples
- No centralized control room
  - One person assigned to monitor SCADA daily during weekdays
- Not manned on nights and weekends
  - Four lead operators designated to emergency calls on a person per week rotation
High Automation

- No Sludge Storage
- Sludge Trucks
  Loaded on Scales
  - When full, discharged to a local waste management facility producing compost
Energy Efficient Operation

Low DO - Ammonia Based Control
No Chemical Addition
Energy Efficient Operation

- Sludge pumps operated based on blanket level
- Thickened Sludge Operation
Efficient Design and Maintenance Program

- Select energy efficient process
- DO NOT Overdesign
Energy Production

- Two Engine Generators
- Exhaust gas to heat digesters, building and sold back to District central heating system
- Provide 100% of average electrical demand, 150% energy demand including electricity and heat
Energy Production
Industrial Feed Stock – 8%-10% of Energy Demand
Sidestream Anammox

Started in December 2014
Mainstream Anammox

Hydrocyclone installed in February 2014
Major Collaboration Area

- Process Automation
- Biological Reactor Basin Operation
- Thickened Sludge Operation
- Cogeneration
- Mainstream Anammox
- Sidestream Anammox
Questions?