DIGESTER FOAMING
CASE STUDIES:
Marquette, MI
Sun Prairie, WI

Presentation Outline

• Background Info on Plants
• Marquette Experiences
• Sun Prairie Experiences
• Concluding Thoughts
Plant Commonalities

- RBC Plants Converted to Enhanced Biological Phosphorus Removal Activated Sludge
  - Sun Prairie 2007
  - Marquette 2008
- Primary Clarification
- Gravity Belt Thickening of WAS
- Existing Anaerobic Digesters With Upgraded Mixing Systems
  - Pumped Nozzle Mixing Systems
# Mixing System Comparison

<table>
<thead>
<tr>
<th>Item</th>
<th>Marquette</th>
<th>Sun Prairie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Rotamix</td>
<td>JetMix</td>
</tr>
<tr>
<td>Digester Volume</td>
<td>2 @ 397,000 gal</td>
<td>2 @ 362,000 gal</td>
</tr>
<tr>
<td>Mixing HP</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Mixing Flow</td>
<td>1,500 gpm</td>
<td>1,200 gpm</td>
</tr>
<tr>
<td>HP/1,000 gal</td>
<td>0.076</td>
<td>0.069</td>
</tr>
<tr>
<td>Turnover Time</td>
<td>264 min</td>
<td>302 min</td>
</tr>
</tbody>
</table>
# 2011 Digestion Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Marquette</th>
<th>Sun Prairie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Sludge Mix</td>
<td>60% PSD/40% TWAS</td>
<td>50% PSD/50% TWAS</td>
</tr>
<tr>
<td>Detention Time</td>
<td>65 days</td>
<td>60 days</td>
</tr>
<tr>
<td>Temperature</td>
<td>92-102 Deg F</td>
<td>95 Deg F</td>
</tr>
<tr>
<td>Temp Variability</td>
<td>&lt; 1 Deg F/day</td>
<td>&lt; 1 Deg F/day</td>
</tr>
<tr>
<td>VS Reduction</td>
<td>54%</td>
<td>58%</td>
</tr>
<tr>
<td>VA/Alkalinity</td>
<td>0.25</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Marquette, MI
Marquette Has Had Digester Foaming Challenges
Marquette Digester Foaming History

• No foaming as RBC plant
  – Foaming began ~ 2-3 months after startup of activated sludge system and has been persistent much of the time

• Factors thought to contribute to foaming episodes
  – Activated sludge foaming
  – Inconsistent digester temperature control
  – Mixing system operation
    • Periods with little/no mixing had less foaming problems
Marquette Solution(s)

- Improved digester temperature control
- Continual feed of raw sludge to digestion
  - TWAS fed 24 hours/day rather than in slugs as produced
- Installed foam/scum buster nozzles in summer 2010
  - Tied into discharge of mixing pumps
  - Have kept foam under control but require continual operation of mixing pumps
  - Installing dedicated pumps for foam suppression summer 2011
Marquette Solution
Sun Prairie Has Had Digester Foaming Challenges
Sun Prairie Digester Foaming History

• No foaming as RBC plant
• Foaming started shortly after startup in 2007
  – No activated sludge foaming episodes
• Initially foaming was relatively constant, managed by hosing down on cover
• Incremental changes have reduced problem to currently an infrequent minor event
  – 18 months +/- without significant foaming
Sun Prairie Solution(s)

- Continual feed of raw sludge to digestion
  - TWAS fed 24 hours/day rather than in slugs 3 days/week
- Reduced mixing system operation from 4 hours on / 4 hours off to 30 minutes on / 4 hours off
- Reduced mixing intensity by significantly throttling mixing pump discharge valves
  - ~85% closed
- Lowered primary clarifier sludge blanket level to reduce fermentation in primaries
  - Slight impairment of Bio-P performance
Mixing System Primary Contributor?

• Conference call with JetMix in spring 2009
  – Mixing systems designed to resuspend grit deposits in biosolids storage tanks after sitting 9 months
  – Energy overkill for continuous mixing of digesters?
Concluding Thoughts

Standard mitigating efforts have helped:
• Continuous feeding rather than slug loading
• Consistent temperature control
• Prevent activated sludge foaming
• Provide scum/foam busting at digester liquid surface

New mitigating effort concepts:
• Minimize primary sludge fermentation
• Decrease energy of pumped mixing systems
  – Throttling discharge valves/VFDs
  – Intermittent operation of mixing systems
Concluding Thoughts

Donohue designs of four pumped nozzle mixing systems in last 5 years

• Sun Prairie: Bio-P Nitrifying Activated Sludge => Digester Foaming
• Marquette: Bio-P Nitrifying Activated Sludge => Digester Foaming
• Evansville, IN: Nitrifying Activated Sludge => Digester Foaming
• Rantoul, IL: Two Stage Trickling Filter => NO Digester Foaming
Acknowledgements

• Marquette
  – Curt Goodman & Tom Asmus

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  – John Krug & Lee Graves

• Donohue
  – Ken Sedmak & Ed Nevers