COMPARISON OF CLASS A SYSTEMS FOR SMALL FACILITIES

Authors:

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Dan Leavitt - London, OH
Scott Lewis – Lakeland, FL
Sid Clark – Biogas
Jack Currie – CB&I
WHO?

- Franklin Township, PA
- Lakeland, FL
- London, OH
WHY?

- Upgrade Existing Facility
- Increase Solids Treatment Capacity
- Achieve Class A Biosolids
FRANKLIN TOWNSHIP - Murrysville, PA
Meadowbrook Road WPCF
MEADOWBROOK ROAD WPCF

Plant Overview

- Biological Advanced Treatment Facility
- 4.9 MGD Average Operating Flow
- 16 MGD Peak Instantaneous Capacity
- Screening & Aerated Grit Chamber
- Primary & Secondary Clarification
- Trickling Filters
- Nitrification Towers & Sand Filtration
- Ultraviolet Disinfection
PASTEURIZATION

2-Stage Digestion

Class A Biosolids
PROCESS FUNDAMENTALS

- Stage 1 - Pasteurization
- 3 Reactor Design
- 70° C Design Temperature
- 30 minutes (Time – Temperature)
- Fill and Draw Operation
- Heat Recovery
- Mesophilic Anaerobic Digestion
FACILITY UPGRADE

- (3) 2100 Gallon Reactors
- Heat Recovery System
- 750 MG ESD Vessel
- Dry Seal Gasholder
- Liquid/Gas Mix System
- Mech’l Equip’t in Gallery
- Startup 2004
ESD EQUIPMENT GALLERY

Pasteurization Process

Heat Recovery System
LAKELAND, FL
GLENDALE WTP

Plant Overview

- Activated Sludge Treatment
- 7 MGD Average Operating Flow
- 13.7 MGD Peak Instantaneous Capacity
- Headwork's Screening
- Primary and Secondary Clarification
2-PAD™ PROCESS

2-Stage Digestion
Class A Biosolids
PROCESS FUNDAMENTALS

- Stage 1 – Anaerobic Acid Reactor
- 2.1 Day HRT
- 55° C Design Temperature
- 3 hours (Time – Temperature)
- Batch Feed Process
- Heat Recovery
- Mesophilic Anaerobic Digestion
FACILITY UPGRADE

- 49,000 Gallon FST
- 268 MG ESD Reactor
- Jet Pump Mix System
- Mech’l Equip’t in Gallery
- Heat Recovery System
- Existing Digesters
- Startup 2007
LONDON, OH
LONDON, OH

Plant Overview

- Activated Sludge Treatment
- 2 MGD Average Operating Flow
- 5.8 MGD Peak Instantaneous Capacity
- New Headwork's Screening
- Primary and Secondary Clarification
- Ultraviolet Disinfection
AeroTherm (ATP) System

2-Stage Digestion
Class A Biosolids
Mr. John R. Currie, Product Manager
CBI Walker, Inc.
1245 Corporate Boulevard
Suite 102
Aurora, Illinois 60504

Dear Mr. Currie:

Your letter of August 17, 1992 to Mr. Vince Miller in our Region IV office, request for a PFRP equivalency determination on the ATP™ Two Stage Sludge Stabilization Process, and accompanying technical information were referred to our Pathogen Equivalency Committee (PEC) for review and a recommendation.

As we understand it, the CBI Walker ATP System involves a mesophilic anaerobic digestion process that is preceded by a pretreatment stage in which sludge is heated by both external heat exchange and by the bio-oxidation which results from vigorously mixing air with the sludge. There are approximately 30 of these systems now operating in Germany. In the United States, we have called this process anaerobic digestion with pre-pasteurization.

In the ATP System, sludge is preheated in a vessel with a nominal residence time of 18 to 24 hours. Sludge is introduced intermittently, amounting to 5 to 20 percent of the vessel volume. This means that the time between feedings of unprocessed sludge could range from 1.2 to 4.5 hours. Exiting sludge is heat-exchanged with incoming unprocessed sludge. This cools the exiting sludge before it is sent to the mesophilic digester and warms the unprocessed sludge. Thus, the digester is not shocked by receipt of material that is too hot, and the preheater is not cooled excessively by the charge of unprocessed sludge.

The PEC considers a process equivalent to a PFRP if it meets EPA’s time-temperature requirements and is satisfactorily reduced in vector attraction. The EPA’s time-temperature requirement for sludges of 7% solids content or less is given by the following equation:
ATP FUNDAMENTALS

- Stage 1 - Thermophilic Acid Reactor
- Anoxic - Minimal O₂ Input
- 60-65° C Operation
- 1 hour (Time – Temperature)
- 18~24 Hour HRT
- Semi-Continuous Feed
- Heat Recovery
- Mesophilic Anaerobic Digestion
HOW WELL ARE THESE PLANTS OPERATING?
SOLIDS OVERVIEW

- Primary & Secondary Sludge Screening
- Septage Receiving Station
- Sludge Thickening
- 2-Stage Digestion Facility
  - Pasteurization
  - Mesophilic Anaerobic Digester
- Dewatering (BFP)
- Methane Gas Utilization Facilities
SOLIDS OVERVIEW

- Blended Primary and Secondary Sludge
- Sludge Thickening
- 2-Stage Digestion Facility
  - Thermophilic Acid Reactor
  - Mesophilic Anaerobic Digester
- Liquid Land Application
- Methane Gas Utilization Facilities
SOLIDS OVERVIEW

- Blended Primary and Secondary Sludge
- Sludge Thickening
- 2-Stage Digestion Facility
  - Thermophilic Acid Reactor
  - Mesophilic Anaerobic Digester
- Dewatering – Existing Belt Filter Press
- Methane Gas Utilization Facilities
# Process Comparison

<table>
<thead>
<tr>
<th>Description</th>
<th>Franklin</th>
<th>Lakeland</th>
<th>London</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Stage Process</td>
<td>Pasteurization</td>
<td>Anaerobic</td>
<td>Anoxic</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Stage Detention (design)</td>
<td>NA</td>
<td>2.1 days</td>
<td>1 day</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Stage Temp (design)</td>
<td>62-68 °C</td>
<td>55 °C</td>
<td>65 °C</td>
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<tr>
<td>Time-Temp (design)</td>
<td>55 minutes</td>
<td>3 hours</td>
<td>1 hour</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Stage Process</td>
<td>Anaerobic</td>
<td>Anaerobic</td>
<td>Anaerobic</td>
</tr>
<tr>
<td></td>
<td>New</td>
<td>Exist’g</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td>ESD</td>
<td>Conv’l</td>
<td>ESD</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Stage Det’n (design)</td>
<td>13 days</td>
<td>12 days</td>
<td>13 days</td>
</tr>
<tr>
<td>Digester Temp</td>
<td>37 °C</td>
<td>37 °C</td>
<td>37 °C</td>
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</table>
### DESIGN PARAMETERS

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<tbody>
<tr>
<td>Plant Design Flow - MGD</td>
<td>16 Peak</td>
<td>13.7</td>
<td>5.8 Peak</td>
</tr>
<tr>
<td>Actual Plant Flow - MGD</td>
<td>4.9</td>
<td>7.0</td>
<td>2.0</td>
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<tr>
<td>Actual Sludge Feed - gpd</td>
<td>29,900</td>
<td>80,950</td>
<td>8,100</td>
</tr>
<tr>
<td>% Solids</td>
<td>2.95</td>
<td>*</td>
<td>5.7</td>
</tr>
<tr>
<td>Primary - gpd</td>
<td>*</td>
<td>58,673</td>
<td>5,500</td>
</tr>
<tr>
<td>% Solids</td>
<td>*</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Secondary - gpd</td>
<td>*</td>
<td>22,277</td>
<td>2,600</td>
</tr>
<tr>
<td>% Solids</td>
<td>*</td>
<td>4.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

* Franklin Township provided data as blended solids feed
* Lakeland does not sample the FST Vessel
* London Primary % solids prior to thickening
## PROCESS RESULTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Franklin</th>
<th>Lakeland</th>
<th>London</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Stage - Temp</strong></td>
<td>65°C</td>
<td>55°C</td>
<td>65°C</td>
</tr>
<tr>
<td><strong>Time-Temp actual</strong></td>
<td>3 ½ hours</td>
<td>3 hours</td>
<td>3 hours</td>
</tr>
<tr>
<td>Acids, mg/l</td>
<td>690</td>
<td>1012</td>
<td>4825</td>
</tr>
<tr>
<td>Alkalinity, mg/l</td>
<td>2200</td>
<td>2072</td>
<td>1669</td>
</tr>
<tr>
<td>VS Reduction</td>
<td>NA</td>
<td>28%</td>
<td>13%</td>
</tr>
<tr>
<td>Gas production, cfd</td>
<td>NA</td>
<td>28,557</td>
<td>NA</td>
</tr>
<tr>
<td><strong>2nd Stage – Detention</strong></td>
<td>29 days</td>
<td>19 days</td>
<td>56 days</td>
</tr>
<tr>
<td>Digester Temp</td>
<td>36°C</td>
<td>38°C</td>
<td>37°C</td>
</tr>
<tr>
<td>Acids, mg/l</td>
<td>156</td>
<td>146</td>
<td>960</td>
</tr>
<tr>
<td>Alkalinity, mg/l</td>
<td>2775</td>
<td>2908</td>
<td>4711</td>
</tr>
<tr>
<td>VS Reduction, Overall</td>
<td>53%</td>
<td>44%</td>
<td>52%</td>
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<tr>
<td>Gas production, cfd</td>
<td>26,010</td>
<td>66,423</td>
<td>6,722</td>
</tr>
<tr>
<td>Dewatered Cake</td>
<td>18.5%</td>
<td>NA</td>
<td>17%</td>
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</tbody>
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CONCLUSIONS

- Several Class A Options
- Process Results are Similar
- No one Best Solution
- Fit the Process to Your Plant
QUESTIONS?