Trends in Dewatering
WEAT Webinar 2012

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Overview

- General drivers and trends
- Technologies/case studies
- Comprehensive pilot case study
Drivers for Change

Dewatering Technology Drivers

Workforce Challenges
- Reduced operational requirements
- Maintenance simplicity

Economics
- Increasing disposal/use costs
- Labor costs
- Energy costs

Odor Concerns
- Enclosed dewatering
- Low shear processes
**Dewatering Technology Evolution**

- **Established**: refinements, not wholesale change
- **Innovative**: increasing success in marketplace
- **Emerging**: slow movement

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- Test Failure
- Poor Performance
- Obsolescence
Belt Filter Press Trends: 3-belt BFPs

- Manufacturers:
  - Vertical: BDP, Charter Machine, Ashbrook
  - Horizontal: Ashbrook, Andritz, Komline
- Designed for thin sludges (<1.5% solids)
- Offer separate belts for drainage, pressure zones
Vertical 3-belt BFP

Schematic Courtesy BDP
Horizontal 3-belt BFP

INDEPENDENT GRAVITY ZONE

HIGH PRESSURE ZONE

BELT WASH STATION

WEDGE ZONE

DEWATERED SLUDGE

Schematic Courtesy Ashbrook
Reasons for 3-belt BFP Applications

• Vertical units
  – Ease of access for ops/maintenance
  – Elimination of catwalks

• Eliminate need for additional BFP or thickening to accommodate hydraulic load

• Potential 2-3% increase in cake solids compared to 2-belts
  – Increase not limited to thin sludges
Case Study: Albany County Sewer District, NY

North Plant
LIQUIDS STREAM
• Conventional activated sludge
• Design/ADF flows = 35/25 mgd

SOLIDS HANDLING
• 2.0m belt filter presses
• Multiple hearth incinerators (10 hearths)
• Operating 100 hrs/wk
• Solids throughput = 1.5 DT/hr
• Cake solids = 22%

South Plant
LIQUIDS STREAM
• Conventional activated sludge
• Design/ADF flows = 29/25 mgd

SOLIDS HANDLING
• 1.5m belt filter presses
• Multiple hearth incinerators (7 hearths)
• Operating 65 hrs/wk
• Solids throughput = 1.2 DT/hr
• Cake solids = 19.8

OBJECTIVE: INCREASE CAKE SOLIDS CONTENT
3- belt Press Installation at North Plant
North Plant

North WWTP (2-m)  South WWTP (1.5 m)
## BFP Performance: Design vs Actual

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>North Plant</th>
<th>South Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Design</td>
<td>Actual</td>
</tr>
<tr>
<td>Size</td>
<td>meter</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Throughput</td>
<td>gpm</td>
<td>100 to 200</td>
<td>152</td>
</tr>
<tr>
<td>Discharged Dry Solids</td>
<td>lbs/hr</td>
<td>2,500 to 3,000</td>
<td>2,980</td>
</tr>
<tr>
<td>Dewatered Cake Solids</td>
<td>MIN %</td>
<td>24</td>
<td>25.6</td>
</tr>
<tr>
<td>Solids Recovery</td>
<td>%</td>
<td>95</td>
<td>98.9</td>
</tr>
<tr>
<td>Polymer usage</td>
<td>lb active polymer/DT solids</td>
<td>10</td>
<td>6.4</td>
</tr>
</tbody>
</table>
New BFPs Have Less Payback < 4 Years

Higher cake solids provides $276,000/yr savings.
Potential Future BFP Trends

- Continue to see 3-belts
- Enclosed units for odor control
- Evolution to address "smooth sludges"
  - Larger roller(s) for gentle pressure

Courtesy: Ashbrook
Centrifuge Dewatering

- Commonly used technology, especially at larger facilities
  - High throughput machine
  - Typically highest cake solids other than pressure filter
- Uses centrifugal force to separate solids from liquids
- Manufacturers: Alfa Laval, Andritz, Centrisys, Flotweg, Westfalia
A scroll scrapes continuously the centrifuged sediments. The clear effluent is evacuated on the opposite side.
Centrifuge Advantages and Disadvantages

• Advantages
  – Small footprint, low staffing requirements
  – Small, contained odor source, facilitating odor control
  – Major maintenance items easily removed/replaced

• Disadvantages
  – High power consumption and polymer use
  – Relatively noisy, higher vibration
    • Vibration is a structural concern
  – High shear operation, resulting in higher odor potential and possible indicator regrowth
  – Expensive spare parts
  – Repair work performed by manufacturer
Centrifuges in Texas

• Historically not dominant choice
  – Low disposal/use costs
  – Historic preference for BFPs
  – Historic maintenance requirements
• Drivers moving in favorable direction
  – Disposal/use costs increasing
  – O&M somewhat simplified
    • Easy start up/shut down
  – Enclosed process (odors)
• Concerns
  – Product odor
  – Regrowth/reactivation (AnD biosolids)
Centrifuge Trends

- Focus on energy reduction (varies by manufacturer)

- Other
  - Controls – focus on “set it and forget it”
  - Interchangeable parts for major maintenance (scrolls)
    - 4 hr vs multi-week effort

Source: Alfa Laval (Islander), 2012
Screw Press Dewatering

- Relatively new technology with growing interest
  - From pulp/paper industry
  - Strong focus on west coast
- Simple, low maintenance system
- Free draining dewatering device
- Screw applies pressure against basket
- Potential cake solids expected slightly less than centrifuge
- Manufacturers: FKC (horizontal), Huber (inclined), PWTech (inclined), BDP (inclined)
Horizontal Screw Press

Screw Press Cross Section

Courtesy: FKC
Inclined Screw Press

Courtesy: Huber
Screw Press Basket and Cake
Screw Press Advantages and Disadvantages

**Advantages**
- Enclosed system provides good odor containment
- Easy start up and shut down, can run automated
- Low power consumption
- Low maintenance requirements

**Disadvantages**
- Low throughput = more units and larger footprint
- Typically, cake solids expected to be lower than centrifuge
- Typically, polymer dose expected to be slightly higher
- Testing recommended
Rotary Press Features

- Relatively “new” technology (to Texas)
- Simple, best suited for raw sludges
- Solids rotated between two parallel revolving filter elements; filtrate flows through these elements
  - Friction of plates and backpressure at outlet produces cake
- Cake solids:
  - 25-28% P+WAS
  - 14-27% WAS
- Manufacturers: Fournier, Prime Solutions
Rotary Press- 6 Channel Unit
Rotary Press Advantages/Disadvantages

• Advantages
  – Enclosed, low odor, noise levels
  – Easily expanded
  – Small footprint
  – Easy start up, shut down
  – Ease of operation/maintenance
  – Low power consumption

• Disadvantages
  – Works better with sludges that are more fibrous
  – Relatively small throughput; capital costs can be high
Case Study: Gloucester, MA (5 mgd Primary Plant)

- Drivers
  - Labor requirements
  - Dewatering room odors
  - Washwater requirements
- 2, 6-channel presses

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>2,000 dry lb/hr (per 6-channel press)</td>
</tr>
<tr>
<td>Cake solids</td>
<td>35-42%</td>
</tr>
<tr>
<td>Dewatering time</td>
<td>6-12 hrs/week</td>
</tr>
<tr>
<td>Washwater use</td>
<td>5 minutes per day</td>
</tr>
</tbody>
</table>
Electrodewatering

- Suppliers: Ovivio Cinetek, Siemens?
- Add cathodes, anodes to pressure zone
- Combination of electro-osmosis and application of controlled mechanical pressure to sludge
  - 500 to 1500 kwh/DT
- Cake solids of 25-50%
- Reported pathogen reduction
- Canadian installations
  - Victoriaville: from ~15-18% to 35%
  - Valleyfield: from 14% to 25%
Electrodewatering Advantages/Disadvantages

**Advantages**
- 40 to 50% reduction in sludge volume, increased solids
- Small footprint
- Reported pathogen and odor reduction
- Self-contained

**Disadvantages**
- Few US vendors
- Emerging technology
- Relatively high power consumption
- Needs high feed solids (10-20%)
- Low throughput/high capital ($1M+/meter)
Technology Comparison Case Study: Orange County Utilities, FL

• Three facilities
  – Northwest WRF: 7.5 mgd
  – South WRF: 43 mgd, AnD
  – Eastern WRF: 24 mgd

• General
  – No primary clarifiers
  – Different biological processes
  – Different biosolids processing
  – Belt Filter Press Dewatering
## Feed Sludge Characteristics

<table>
<thead>
<tr>
<th>OCU Facility</th>
<th>Solids Content</th>
<th>Volatile Solids</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest WRF</td>
<td>1.0-1.5%</td>
<td>82-84%</td>
<td>7.0</td>
</tr>
<tr>
<td>South WRF</td>
<td>3.0%</td>
<td>70-74%</td>
<td>7.5</td>
</tr>
<tr>
<td>Eastern WRF</td>
<td>0.9-1.0%</td>
<td>88-90%</td>
<td>6.8</td>
</tr>
</tbody>
</table>
## Pilot Test Results: Cake Solids Content

<table>
<thead>
<tr>
<th></th>
<th>Belt Filter Press</th>
<th>Centrifuge</th>
<th>Screw Press</th>
<th>Rotary Fan Press</th>
<th>Electro-Dewatering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northwest WRF</strong></td>
<td>14%</td>
<td>23%</td>
<td>21%</td>
<td>----</td>
<td>39%</td>
</tr>
<tr>
<td><strong>South WRF</strong></td>
<td>13%</td>
<td>20%</td>
<td>17%</td>
<td>14%</td>
<td>37%</td>
</tr>
<tr>
<td><strong>Eastern WRF</strong></td>
<td>15%</td>
<td>21%</td>
<td>20%</td>
<td>17%</td>
<td>43%</td>
</tr>
</tbody>
</table>
## Polymer Consumption

<table>
<thead>
<tr>
<th>North Activation Polymer per Ton</th>
<th>Centrifuge</th>
<th>Screw Press</th>
<th>Rotary Fan Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest WRF</td>
<td>20-24</td>
<td>18-20</td>
<td>----</td>
</tr>
<tr>
<td>South WRF</td>
<td>33-37</td>
<td>30-35</td>
<td>12-16</td>
</tr>
<tr>
<td>Eastern WRF</td>
<td>19-23</td>
<td>18-24</td>
<td>12-16</td>
</tr>
</tbody>
</table>
## Solids Capture

<table>
<thead>
<tr>
<th>Percent Capture</th>
<th>Centrifuge</th>
<th>Screw Press</th>
<th>Electro-Dewatering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest WRF</td>
<td>97%</td>
<td>94%</td>
<td>92%</td>
</tr>
<tr>
<td>South WRF</td>
<td>96%</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>Eastern WRF</td>
<td>92%</td>
<td>97%</td>
<td>93%</td>
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# Energy Consumption

<table>
<thead>
<tr>
<th>kWh per Ton</th>
<th>Centrifuge</th>
<th>Screw Press</th>
<th>Electro-Dewatering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest WRF</td>
<td>98</td>
<td>14</td>
<td>225</td>
</tr>
<tr>
<td>South WRF</td>
<td>53</td>
<td>6</td>
<td>265</td>
</tr>
<tr>
<td>Eastern WRF</td>
<td>92</td>
<td>14</td>
<td>163</td>
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</table>
## Implications for Orange County Utilities

<table>
<thead>
<tr>
<th></th>
<th>Dry Tons per Day</th>
<th>Belt Filter Press (WTPD)</th>
<th>Centrifuge (WTPD)</th>
<th>Screw Press (WTPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest WRF</td>
<td>4.7</td>
<td>34</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>South WRF</td>
<td>16.4</td>
<td>126</td>
<td>81</td>
<td>96</td>
</tr>
<tr>
<td>Eastern WRF</td>
<td>19.7</td>
<td>131</td>
<td>96</td>
<td>97</td>
</tr>
<tr>
<td>Total</td>
<td>40.8</td>
<td>291</td>
<td>198</td>
<td>215</td>
</tr>
</tbody>
</table>
Conclusions

- Dewatering alternatives outperformed OCU’s BFPs
- Screw press offers cake solids content comparable to centrifuge
- Linear electro-dewatering, rotary press throughput too small for this application (multiple units needed)
- Centrifuge selected due to high throughput and dewatered cake solids
  - Screw press preferred at one facility, but standardization was a concern
Word of warning....

Your results may vary....

When in doubt, pilot!!
Questions?