GLWA - Biosolids Dryer Facility

Designed, Built, Operated & Maintained By

NEFCO

Majid Khan, PhD, MSIS
Director – Wastewater Operations
GLWA Wastewater System

- Serves 35% of State population (~3.5 million people) in 77 communities over a 946 sq. miles service area
- Only one GLWA WWTP in system
- Treatment Capacity: 1700 MGD primary / 930 MGD secondary / 686 MGD average
- Solids Disposal Requirements
  - Average day - 450 dry tons
  - Peak day – 850 dry tons
- Prior Biosolids Disposal
  - 67% Multiple Hearth Incinerators
  - 11% Land applied
  - 22% Landfilled
Background

Biosolids Management Challenges

- New air emissions regulations require modification of existing incinerators for continued use after March 2016
- Complex I incinerators from 1940’s are at the end of their useful life
- GLWA experienced high costs to dewater and incinerate biosolids
  - Solids processing & disposal was $66M/year – 51% of WWTP O&M costs
- Limitations on available landfill space and offloading capacity require on-site incineration or processing for majority of biosolids
- Dewatering and incineration has presented significant challenges with previous permit violations
Maximizing Consultation and Consensus

- **Biosolids Alternatives Study – June 2010**
- **Flexible and inclusive biosolids services procurement (PC-781)**
  - 12 proposers and 22 proposals offered a wide range of technologies but procurement cancelled.
- **Biosolids symposium**
  - Panel: 4 from Wastewater Utilities (MWRA, MWRD, NEORSD, MSD), 2 academia, 1 WEF, 1 A/E
Basis for Technology Decision

Biosolids Symposium Considered Numerous Factors

- Proven or novel technology at GLWA’s scale? What is the feasible capacity? Is the technology currently offered commercially and operating in U.S.?
- Reliability? 24x7x365? What redundancies and/or back-up methods are feasible?
- Relative cost and complexity?
- Ability to handle variability in sludge quantities and content?
- Operability and maintainability issues?
- Does the technology affect ultimate disposal of biosolids?
- Does the technology support beneficial reuse?
- Affected by Michigan climate?
- Regulatory issues (current or future potential issues)?
- Is commercial feasibility sensitive to market conditions?
- Risks?
- Effect on WWTP and GLWA’s operations?
- Potential impacts (e.g., community, customers, or others)?
- Technology advantages?
- Technology limitations?
- What are the keys to successful implementation of the technology?
- Other Issues?
### Basis for Technology Decision

#### Technologies Considered By Symposium

<table>
<thead>
<tr>
<th>Biosolids Processing Options</th>
<th>GLWA Study</th>
<th>PC-781 Proposers</th>
<th>Experts Recommend For Further Consideration?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Thermal Options</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Multiple-hearth Incineration (Existing)</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>B. Fluid Bed Incineration</td>
<td>✓</td>
<td>2</td>
<td>✓</td>
</tr>
<tr>
<td>C. Thermal Drying</td>
<td>✓</td>
<td>2</td>
<td>✓</td>
</tr>
<tr>
<td>D. Pyrolysis</td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Gasification</td>
<td>✗</td>
<td>2</td>
<td></td>
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<tr>
<td><strong>2. Beneficial Reuse And Land Disposal Options</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Land Application of Stabilized Solids</td>
<td>✓</td>
<td>3</td>
<td>✓</td>
</tr>
<tr>
<td>B. Landfilling of Stabilized Solids</td>
<td>✓</td>
<td>7</td>
<td>✓ (backup only)</td>
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<tr>
<td>C. Other Beneficial Reuse (by Private Firm)</td>
<td></td>
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</tr>
</tbody>
</table>

1 Number of proposers offering each technology. Several proposers offered more than one processing technology.
### Basis for Technology Decision

#### Other Technologies Considered By Symposium

<table>
<thead>
<tr>
<th>Biosolids Processing Options</th>
<th>GLWA Study</th>
<th>PC-781 Proposers&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Experts Recommend For Further Consideration?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Digestion Options</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A. Anaerobic Digestion</td>
<td>✓</td>
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<tr>
<td>B. Advanced Anaerobic Digestion</td>
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<tr>
<td>C. Aerobic Digestion</td>
<td>X</td>
<td></td>
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<tr>
<td>D. Autothermal Thermophilic Aerobic Digestion (ATAD)</td>
<td>X</td>
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<tr>
<td><strong>4. Alkaline Stabilization Options</strong></td>
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<td></td>
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<tr>
<td><strong>5. Composting Option</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>6. Sludge Minimization Options</strong></td>
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</tr>
<tr>
<td>A. Ozonation</td>
<td></td>
<td></td>
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<tr>
<td>B. Cannibal™ Process</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>C. Mechanical Shredding (KADY Bio-Lysis)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>D. Thermal Hydrolysis</td>
<td>✓</td>
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</tr>
<tr>
<td>E. Ultrasound</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>F. MicroSludge™</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Pulsed Electric Field</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>7. Deep well injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>8. Enhanced Nutrient/Fertilizer Production</strong></td>
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<td></td>
<td></td>
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<tr>
<td><strong>9. Electrocoagulation</strong></td>
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<tr>
<td><strong>10. Others suggested by Symposium panel</strong></td>
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</tbody>
</table>

<sup>1</sup> Number of proposers offering each technology. Several proposers offered more than one processing technology.
Basis for Technology Decision

Other Issues Addressed By Symposium

- Self-perform some or all Biosolids Management
- Minimum Level of Redundancy
- Minimum Specified Capacity
- Handle Peaks Separately
- Multiple Contracts
- Facility Turn-over at Contract End
- Restrictive Biosolids Specifications
- Reimburse Utilities
- Suggested Minimum Contractor Qualifications
- Risks and Risk Mitigation Strategies
Decision Process

Maximizing Consultation and Consensus

- Technology decision – Add dryers and make Complex II M.H. Incinerators compliant
- RFP development, advertised solicitation, round-table meetings, addenda, proposals
- Proposal evaluation committee:
  - 3 customer representatives brought valuable wastewater experience and perspective;
  - 4 GLWA (management, wastewater operations, engineering, finance).
  - Board member and Board consultants monitored process
- Selection, scope adjustment and negotiation
- Review by Board Operations, Regulatory, Compliance and Procurement committee
- Water Board presentation and approval
- Public meeting
- City Council presentation and approval
- Public pre-construction meeting
- Air permit hearing
- Wholesale customer updates
Basis for Technology Decision

Drying Effectively Manages Biosolids

- Drying identified by industry experts as a viable option for GLWA during the March 2012 Biosolids Symposium
  - Proven and reliable
  - Economical
  - Environmentally beneficial
    - Beneficial reuse of biosolids as fertilizer or fuel with less trucking
    - Produces Class A biosolids – lower odors and stable
    - Uses less energy than existing incinerators
    - Future feedstock for biosolids gasification if desired
    - Lower emissions and less community impact
- Well established technology used in:
  - Boston, MA
  - Milwaukee, WI
  - Philadelphia, PA
  - South Bronx, NY
  - Chicago, IL
  - Windsor, ON
  - Sacramento, CA
  - St. Petersburg, FL
  - Stamford, CT
  - Winston-Salem, NC
  - Honolulu, HI
  - Irvine, CA
  - Green Bay, WI
  - Blue Lake (Shakopee, MN)
  - GLSD (N. Andover, MA)
  - West Palm Beach, FL
  - Cumberland MD
Basis for Technology Decision

Dried Biosolids – Fertilizer or Fuel
Basis for Technology Decision

GLWA Thermal Drying Decision

- Biosolids drying
  - Increased from 3 trains to 4 in negotiation
  - 316 DTPD firm, 440 DTPD peak (largest in North America)

- Dewatering included in facility (alternate offered by all proposers)
- Separate site across from WWTP
Basis for Technology Decision

GLWA Thermal Drying Decision

- Design/Build with 20 years Operation/Maintenance by Contractor
  - Contractor markets and disposes of biosolids
  - Operation Firm Leads D/B Team
  - D/B very motivated to provide a quality facility to minimize maintenance and operation costs.
  - Scope fixed in contract reducing Owner input during design
  - Very rapid completion. Award in May 2013. Design complete May 2014. Scheduled construction completion August 2015 (7 mo. Early)
  - Change orders to date are minimal (0.14% including site environmental mitigation).

- GLWA continues to incinerate, land apply or landfill remainder
- Incineration Complex I (1940’s era) to be retired
- Cancel capital projects for C-I refurbishment & AQC, centrifuge replacement, biosolids storage
Triple Pass 110 DTPD Dryer
<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Design</td>
<td>23-May-13</td>
<td>0</td>
</tr>
<tr>
<td>Receive Air Permit to Install</td>
<td>1-Nov-13</td>
<td>5.3</td>
</tr>
<tr>
<td>Construction Started</td>
<td>21-Nov-13</td>
<td>6.0</td>
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<tr>
<td>First Sludge to Facility (Centrifuge Tuning)</td>
<td>7-Jul-15</td>
<td>25.5</td>
</tr>
<tr>
<td>Start System Test</td>
<td>5-Aug-15</td>
<td>26.4</td>
</tr>
<tr>
<td>Start 5-day Demonstration Test</td>
<td>28-Sep-15</td>
<td>28.2</td>
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<tr>
<td>In-service</td>
<td>16-Feb-16</td>
<td>32.8</td>
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</tbody>
</table>
Product Silo

Cyclone Separator

Odor Scrubbers

Hypochlorite and Caustic Tanks for Odor Control

Dry Polymer Silo

Polymer Mix Tanks
Dryer Challenges and Solutions

- **Public Impact**
  - Contract requires no noticeable odors on site or in surrounding community
    - Alkaline Hypochlorite Scrubbers – remove odors
    - Regenerative thermal oxidizers – remove odor-causing compounds and organic vapors
    - Only dried biosolids will be trucked – low odor
    - Sealed building
    - Best available emissions control (BACT)
  - Contract requires no noticeable increase in ambient sound at 500 feet from facility
    - 90 Decibels or less aggregate at 3 feet from equipment specified
  - **Truck Traffic**
    - Trucking of dried biosolids will reduce the number of truckloads by 75% as compared with sludge cake

✓ Results: Low public impact
  - No noticeable noise
  - Little truck traffic
  - Air emissions significantly less than incineration
  - Little visible stack plume
Dryer Challenges and Solutions

- Fire and Explosion Risk Mitigated by:
  - Dryer inert atmosphere via exhaust circulation.
  - Water quench is provided.
  - Dry product storage and recycle bins are blanketed with nitrogen.
  - Deflagration relief vents are provided in silos and the dryer cyclone.
  - Sprinklers and fire suppression are provided.
  - The fuel train meets the most stringent requirements of IRI, FM or the Michigan state code.
  - Silo and recycle bin temperature monitoring
  - Non-combustible construction materials
  - Employee safety training
  - Contractor required to provide insurance

✓ Results: Safeguards work as planned for deflagration events
  » Further refinements are in progress
Dryer Challenges and Solutions

Train 1 Product 29-Jul-15

Train 3 Product 3-Oct-15
21.2-23.2 lb/cf

Milorganite
Dryer Challenges and Solutions

- Undigested Unscreened Primary Biosolids Contain Fiber Mitigated by:
  - Design modifications have been made to ensure that fiber can be handled.
  - Grinders are installed before the centrifuge feed pumps.
  - The system is immune to fiber before drying.
  - Drag conveyors are used because they are less subject to fouling.
  - Three scalper decks are used to remove trash from the dried product.
  - Pellet coolers are provided with larger gaps.
  - Contractor operational expertise and rapid operating adjustments
  - Dried product typically 24 to 28 pcf versus 40 pcf anticipated by Contractor based on experience at other facilities
  - Most other facilities dry screened digested biosolids.

✓ Results: Processing Successfully
  - Contractor operational expertise has proven critical for success
  - Significant de-bottlenecking has been completed with more ongoing
Biosolids Dryer Facility
Lessons Learned

- Significant benefits from engaging industry expertise and experience in a biosolids symposium
- Inclusive and collaborative decision process expedited contract procurement and approval
- Equitable allocation of risks allows very competitive pricing
- A reliable Contractor partner is critical
- Contractor team led by experienced dryer operator provides significant expertise
- Contract based on performance requirements and warranties
Lessons Learned

- Long term operation contract motivates design and construction of high-quality operable facility and fast-paced design and construction
- Complete Contractor responsibility for operation and maintenance is key for project success
- Test sludge early in the design process
- Very rapid design and construction possible but allow an extended period for shake-down and testing
- Contractor experience in marketing dried biosolids product allows GLWA to focus on its core services
Questions?