Transitioning to a Thermal Drying Program at DWSD

March 3, 2015
Presentation Outline

- Background
- Project Drivers
- Thermal Drying Process at DWSD
- Product Quality Considerations
- Product Distribution & Marketing
- Markets Identified for DWSD product
- Regulatory Considerations
- Project Update
Background - DWSD’s Wastewater System

- Serves 40% of MI population in 127 communities.
- Service area: 1,079 square miles.
- One WWTP in the system.
- Wastewater plant capacity:
  - 1,700 MGD Primary
  - 930 MGD Secondary
  - Approx. 750 MGD Average
Existing Solids Processes at the WWTP

Primary Sludge

Gravity Thickening

Secondary Sludge

Gravity Thickening

Thickened Sludge

Storage

Dewatering

Centrifuges/BFPs

Incineration

Ash Disposal

- MHI Complex I
- MHI Complex II

Off-Load Facility

Lime Stabilization

- Land Application
- Landfill

Land Application

Landfill
Total Solids Generation: 450 dtpd

Multiple Hearth Incineration: 301 dtpd
Class B Land Application: 50 dtpd
Landfill: 99 dtpd

Approx. 51% of the WWTP O&M costs for solids processing & disposal.
Drivers for the Biosolids Drying Project

- ACO required peak biosolids capacity = 850 dtpd.
- Little sludge storage at the plant.
- Limited landfill space and offloading capacity.
- Compliance with MACT 129 emission limits by March 2016 required upgrades to MHIs.
- Complex I MHIs from 1940s – at the end of their useful life.
- Desire for a sustainable product.
Decision to Thermally Dry Biosolids

- Decision process through consultation and consensus.

- Biosolids symposium in March 2012.
  - Comprised of industry experts.
  - Evaluated several technologies.
  - Recommended drying and beneficial use of product.

- PC-792 RFP advertised in August 2012 for Design-Build-Operate of biosolids drying.
Selected Technology Option – Thermal Drying

- Incineration Complex I (1940s units) to be retired.
- PC-791 separate contract to bring C-II Incinerators into Air Quality Compliance.
- DWSD to continue incineration, land application/landfilling of remaining solids.
- DWSD to cancel capital projects for Complex I refurbishment, centrifuge replacement, and biosolids storage.
Contract Operations of Biosolids Dryer Facility

- Design-Build with 20-year Operation/Maintenance by contractor.
- Fixed monthly price up to 73,000 DTPY with incremental unit costs per excess dry ton beneficially reused up to 140,000 DTPY (escalated at CPI).
- DWSD owns the facility and pays utilities to guaranteed caps. 
  - Allows contractor to manage energy cost risk, while holding it responsible for excess consumption.
- Approximately 21% reduction in solids processing and disposal O&M for DWSD.
- NEFCO responsible for marketing and disposal of biosolids.
**Contract Operations of Biosolids Dryer Facility**

- Brings specialized expertise to the complex operating environment.
- Shifts risk of meeting environmental standards to the private sector.
- Long-term cost certainty - Offers predictable operations budgeting process.
  - **Commodities** – electricity, fuel chemicals
    - Escalation tied to indices
    - Pass-throughs with guarantees
- Mutual trust between NEFCO and DWSD
Environmental Benefits

- **Class A Product**
  - Protective of public health.
  - **DWSD** - largest sludge nutrient recycler in the nation.

- **Truck Traffic**
  - 4 Truckloads of cake = 1 Truckload of dried product.
  - *Reduced noise impacts on the community.*
  - *Reduced emissions from trucking.*
ENVIRONMENTAL BENEFITS

- **Odor Potential**
  - Contained, odor-controlled facility.
  - Product has negligible odor, reducing odors during trucking.

- **Fugitive Dust**
  - Pellet oiling system to minimize product dust.
  - Fabric filters to reduce dust at the facility.

- Nuisance-free technology, low impact on neighbors.
**Environmental Benefits - Air Emissions**

- Emissions aggregated from all DWSD facilities.
- Start-up of BDF requires permanent shut-down of incinerators in Incineration Complex I.
- Reduction in emissions with thermal drying.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Reduction in Emissions Compared to Complex I MHIs</th>
<th>BDF Emissions as a % of Total&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>90.4%</td>
<td>11.9%</td>
</tr>
<tr>
<td>CO</td>
<td>95.9%</td>
<td>4.7%</td>
</tr>
<tr>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>--</td>
<td>84.4%</td>
</tr>
<tr>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
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<td>79.2%</td>
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</table>

<sup>1</sup> Includes Complex II MHIs with pollution control upgrades
Located across the street from the WWTP.

Four dryer trains 316 dtpd firm capacity (440 dtpd peak).

Dewatering included in the facility.
Selected Technology Option – Thermal Drying

- Primary Sludge
  - Gravity Thickening
  - Thickened Sludge Storage
  - Dewatering (Centrifuges/BFPs)
    - Complex II MHIs
      - Incineration
      - MHI Complex I
      - MHI Complex II
    - Off-Load Facility
      - Lime Stabilization
      - Land Application
      - Landfill
  - New Biosolids Drying Facility
  - Dewatering + Thermal Drying
- Secondary Sludge
  - Gravity Thickening
Thermal Drying Technology

- Class A Product with multiple outlets.
- Volume Reduction (4 to 1).
- Nutrients in biosolids remain available after drying – product suitable for beneficial use.
- Thermal value enhancement by evaporating water – better suited for use as a fuel.
Drying Process

Solids System Components

Air Handling & Emission Controls
Cost savings – no separate thickening/digestion.

Class A product.

Less nutrient recycle.
Dewatered cake characteristics affect mixing.

- Pellets shaped during the mixing step.
- Eliminates “plastic” or “sticky” phase during drying.
- Easy drying of surface moisture.
- Dewatered cake characteristics affect mixing.
## Feed Characteristics Affect Product Quality

<table>
<thead>
<tr>
<th>Sludge Type</th>
<th>Characteristics</th>
</tr>
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<tbody>
<tr>
<td>Primary Sludge</td>
<td>- Highly variable</td>
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<tr>
<td></td>
<td>- Good dewaterability</td>
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<tr>
<td></td>
<td>- Can contain extraneous materials</td>
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<tr>
<td>Waste Activated Sludge</td>
<td>- More homogenous than PS</td>
</tr>
<tr>
<td></td>
<td>- Better binding properties</td>
</tr>
<tr>
<td></td>
<td>- Unstabilized WAS can be prone to odors</td>
</tr>
<tr>
<td>Digested Sludge</td>
<td>- Low volatility</td>
</tr>
<tr>
<td></td>
<td>- Homogenous, but poor binding properties</td>
</tr>
<tr>
<td></td>
<td>- Better product quality</td>
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<tr>
<td></td>
<td>- Low odors from dried product</td>
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</tbody>
</table>
Product Quality Considerations

- Establish product quality standards based on market requirements.
- Ensure upstream solids processing facilities are operational for consistent feed to drying.
- Determine optimum dewatered cake characteristics for good pellet quality.
- Optimize operating parameters to determine acceptable operating ranges.
Dried Product Distribution & Marketing

*Biosolids are not a waste to be managed but a product we make with intent.*

- Public perception & acceptance
- Developing relationships

Public Perception: Biosolids = Sludge!?

Perception = Reality

“The way in which something is regarded, understood, or interpreted” - Oxford Dictionary

Different perceptions:

- Generators – waste management, diversity
- Users – benefits, recycling, cost savings
- Public – odor, health, environment

What is your perception?

- Defend safe use
- Advertise benefits
Developing Relationships

- Understand customer needs
- Strive for synergy
- Address and acknowledge concerns
- Educate and involve
End Uses for Dried Biosolids

- Bulk land application
- Fertilizer blending
- Land Reclamation
- Alternative Fuels
  - Cement kilns
  - Power generation
  - Renewable fuel
Dried Biosolids for Bulk Land Application

- Food crops
- Feed crops
- Turf farms
- Tree farms
- Golf courses
- Landscaping
- Soil blending

**Benefits of Land Application**
- High organic content
- Increased soil carbon storage
- Slow release nutrients
- Natural micronutrients
- Faster plant establishment
- Increased water retention
Dried Biosolids in Fertilizer Blends

- Turf formulas
  - High value-add.
  - Nutrient-rich filler.
  - Slow-release N.
  - Particle size needs.
  - Minimal contamination.

- Specialty agricultural formulas

- Engineered soils
Dried Biosolids as Fuel

- Lower cost alternative to coal.
- BTU value 6,300 – 7,600 BTU/lb.
- Chemistry similar to coal.
- Steady volumes for generator and customer.
- Helps users achieve “Green Energy” initiatives.
- Class A EQ biosolids safe and acceptable to workers and public.
Dried Product Quality Requirements

Chemical Characteristics

- **Nutrients**
- **Metals**

<table>
<thead>
<tr>
<th>ANALYSIS</th>
<th>AVERAGE</th>
<th>GUARANTEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen</td>
<td>4.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>3.7% Water Insoluble Nitrogen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3% Water Soluble Nitrogen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available Phosphorus (as P$_2$O$_5$)</td>
<td>3.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Potassium (as K$_2$O)</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Iron</td>
<td>3.0%</td>
<td>2.0%</td>
</tr>
</tbody>
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Nutrients Derived from Treated Municipal Biosolids

Quincy, MA Product Analysis
Dried Product Quality Requirements

Physical Characteristics - Particle Size

- Granular product: Free flowing, suitable for traditional spreading.
- Larger pellets with undigested solids.
Dried Product Quality Requirements

Physical Characteristics - Dust

- Friability.
- Dust suppressants
  - Asphalt/hydrocarbon mix
  - Crude glycerin
  - Vegetable fats
Dried Product Quality Requirements

Hot Product
Dried Product from DWSD

- Available in September 2015 ~ 100,000 dry tons/year

- **Potential MI Customers:**
  - Anticipate high agricultural demand – corn, wheat, soy, hay
  - Potential for fertilizer blending depending on product quality
  - Cement kilns located favorably

- Geographic diversification
  - Export to OH, and IN.
  - Exploring ON, Canada market.
Product Marketing Approach

- Issued RFP for land application marketing brokers.
- Importing MA product to establish demand.
- Maintain product availability for innovative uses.
  - Bulk agriculture blending
  - Bagged fertilizer blending – turf and horticultural
  - Engineered topsoil products
  - Compost blending
  - Alternative fuels
Blender Market Approach

- Need product to market product
- Provide samples of MA product (digested)
- Processing plan (high value-add):

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Primary Sludge

Blend Ratio

Secondary Sludge

Storage

Dryer Train #1

Dryer Train #2

Dryer Train #3

Dryer Train #4

6-12 mesh screening
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Regulatory Considerations

- DWSD permit
- Wintertime land application
  - Land slope
  - Frozen ground
  - Precipitation forecast
- Storage
  - Only as needed
  - Covered if longer term
  - MDEQ approved if constructed
  - Contingency plans
Spring of 2014…
Project Update

Operations to commence in August 2015 (6 months ahead of schedule).
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