Biosolids Composting at the Borough of Mechanicsburg, PA WWTP

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Borough of Mechanicsburg
Presentation Overview

- Problem
- Proposed solution
- Feasibility
- Pilot study
- Plant upgrade
- Design
- Construction
- Equipment
- Data collection
- Data management
- Startup
- Operation
- Product development
- Market development
- Take-home points
Take-Home Points

• Operational Challenges:
  – Wintertime chimney effect / pile temperature loss
    • Air restrictor – doesn’t help with side-infiltration
    • Tarp piles in extreme cold
    • Wetter / denser mixes
    • Ambient temperature sensor
  – Input-response lag

• Planning / Design
  – Hoop building + snow = hazardous conditions ("avalanches")
    • Plan for more open space around hoop building

• Sales Logistics
  – Public wanted volumes <1 cu yd; however, WWTP labor must be considered
The Problem
circa 2005

- Increased distance to liquid biosolids land application sites (farms) (1/3 solids production)
- Landfill (2/3 production) used for dewatered biosolids (when fields unavailable) ... very costly ($60/WT)

...“Coincidentally” in 2005, Mechanicsburg was making plans for a major upgrade to the WWTP, to meet Chesapeake Bay loading/concentration limits
The Proposed Solution

- As part of the plant upgrade, develop an alternative option for biosolids management
- Biosolids composting was selected as likely candidate
- A joint-municipal leaf composting and woody waste processing facility was planned and installed in early 2007.
- This could serve as a source for shredded woody waste bulking material for biosolids composting

Mechanicsburg Projected Costs
Comparison of Composting and Landfill

<table>
<thead>
<tr>
<th></th>
<th>Composting*</th>
<th>Landfill</th>
</tr>
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<tbody>
<tr>
<td>Total</td>
<td>$3,006,966</td>
<td>$3,908,776</td>
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<tr>
<td>$/WT</td>
<td>$79.26</td>
<td>$103.02</td>
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<tr>
<td>Revenues</td>
<td>$(465,704)</td>
<td>$-</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>$508,171</td>
<td>$3,908,776</td>
</tr>
<tr>
<td>Capital</td>
<td>$2,964,500</td>
<td>$-</td>
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*Includes the cost of the addons to the garage, containing an office, conference room, and a record storage facility, which are not directly part of the composting operation.

WEF/IWA Residuals and Biosolids 2015
Joint Composting Facility
finished early 2007
Pilot Study

- Setup Aug 2007
- Constructed Oct 2007
- Deconstructed Jan 2008

WEF/IWA Residuals and Biosolids 2015
Refurbish existing:
- Primary trickling filter 1-4
- Chlorine contact tanks
- Secondary clarifier 1-2

New:
- Denitrification filters (x2)
- Methanol pump and filter control bldg
- Pumping station
- Final clarifier #3
- Aeration tanks #3 and #4
- Blower bldg and sodium hydroxide storage
- Anoxic flow splitter box
- Filter control building
Design

• Sizing
  – Building: 120 x 180'
  – Biosolids: ~1000 WT/yr
  – Compost: ~1500 cu-yd/yr

• Air handling
  – 6” piping flush to concrete, with ¾” holes spaced for even air distribution
  – 21 1.5hp blowers

• Equipment selection

• Operational layout
Construction
- Completed in 2013
- Loading dock simplifies screen operation
- Conveyor feeds screen fines into storage building
- Screen overs stored outside
Equipment

- Loader 4 cu-yd bucket
- Roto-Mix truck
- Doppstadt screen
- Conveyor
Data Collection

- Temperature measurement
  - Annual calibration verification
- Software
- Limited software ability to manage composting

- Ecoprobe
  - Radio-transmitted wireless data
  - Problems reprogramming data frequency
  - Firmware update to hard-code new rate
  - Battery consumption higher than expected
  - Good data quality
Data Management

Spreadsheet system created to track each pile:

• Track analytical data of ingredients
• Calculate a recipe (selecting ingredients/analyticals and amounts to meet C:N and moisture goals)
• Log ingredients going into each mix-truck load of the pile
• Directly interface with MySQL db of probe/time/temperature data
• Plot temperatures of selected probes, against minimum limits
• Calculate daily minimum for regulatory report in a ready-for-use table
• Record and plot air-flow settings over time
• Keep operator notes associated with the pile
• Serve as an archival record once the pile is completed
Recipe

- **Plenum:**
  - Overs from screened compost, or
  - Overs from screened woody waste
- **Mix:** (by weight / volume)
  - Biosolids (1 / 1)
  - Woody waste (1 / 1.6)
  - Overs from screened compost (0.6 / 1.4)
- **Cover:**
  - Woody waste
  - Unscreened finished compost

*WEF/IWA Residuals and Biosolids 2015*
Startup – Building piles

- 7-9 mix-truck loads per windrow cell
Startup – Pile 1 (Dec 2012)

Mechanicsburg WWTP
Compost Startup Trial - Pile #1

Temperature (°C)

Time

1/8/2013 to 1/26/2013
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Startup – Pile 2A/B (Aug 2013)

* 3-day PR met, with the exception of “2b Northwest - Mid_Avg”
* “2b Northwest - Mid_Avg” is currently below the VAR Min temperature
* general decline in temperature is happening pretty quickly
* duration at 45 seconds on, 30 minutes off

WEF/IWA Residuals and Biosolids 2015
Startup – Piles 3A/B (Nov/Dec 2013)

WEF/IWA Residuals and Biosolids 2015
Startup
Pile 3A smoke testing

- Results: good airflow, with most smoke in the top 1/3 of the pill
Too much air?

• On-cycle was down to seconds per 20-30 minutes. Findings were that still too much air was getting into the piles, cooling and drying them prematurely.

• An inlet baffle was tested to see if it would allow longer “on” cycles without over-aerating (over-cooling/drying)
REOTEMP
OxyTemp
Startup – Pile 4 A/B (Mar/Apr 2014)
Startup – Pile 5 (Apr/May 2014)

WEF/IWA Residuals and Biosolids 2015
Startup – Permitting

• Once two full compost cycles were completed and separately screened, samples were tested to support operation under the PADEP PAG-07 (Class A EQ) biosolids General Permit.

• Permit issued September 2014
How much does black gold cost?

- **Alchemy**
  - the medieval forerunner of chemistry, based on the supposed transformation of matter. It was concerned particularly with attempts to convert base metals into gold or to find a universal elixir.

- **Capital Costs**
  - Composting Facility (with Garage and Office Building)

<table>
<thead>
<tr>
<th>Type of Bid</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Preliminary Estimate</td>
<td>$2,765,000</td>
</tr>
<tr>
<td>Low Bid</td>
<td>$2,964,500</td>
</tr>
<tr>
<td>Actual Cost</td>
<td>$3,000,000</td>
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</tbody>
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Product Development

• Branding
  – Options considered in-house
  – Naming contest selected to encourage community buy-in

• Registered fertilizer via PA Department of Agriculture (PDA)

• License to sell fertilizer via PDA
PLANT ELIXER

A wonderful blend of sewer bio-solids and composted tree clippings.

Essence of Mechanicsburg for flowers & vegetables.

By combining these two precious ingredients, one pulls with nutrient and the other pushes moisture back into the soil. Yes, one pulls and the other pushes.

Wash Jar Before Using for Food

Processed by the Mechanicsburg WWTP
Roe Adams, Supervisor
Market Development

• Target market
  – Primary: bulk direct sales
  – Secondary: sales to local residents

• Market development strategy
  – Surveys to local compost wholesalers and retailers
  – Direct contact: on phone and in person, with follow-up
  – Anticipated demand by market
  – Anticipated price point by market
    • $15-$30/cu-yd for other compost products
    • Initially distributed to build customer base
      – $5/cu-yd (bulk); $10/cu-yd (residents)
  – Earth Day product “roll-out” – free bag with tree
Publicity

Turf, Garden, & Landscaping Utilization
Information Sheet

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Benefits of WASTEFLOW include:
- High organic matter content
- Advanced oxidation process
- Superior filtration system
- Reduced need for land disposal
- Rainwater harvesting and irrigation

Recommendations for Use
-適用於新建或老化的農田、園林、景觀設計
-適用於當地的環境
-適用於改善土壤結構

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WEF/IWA Residuals and Biosolids 2015
• For locals, Joint-Facility access is now access-controlled.
Take-Home Points

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Questions?

Thanks for your attendance and attention.

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