Cambi THP at DC Water and Related Class A Digestion

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DC Water Biosolids Program
April 30, 2015 - VWEA Education Seminar
Review of DC Water’s Biosolids Program and Recent Startup

Other Class A Digestion Systems

Biosolids Use Plan/Development for DC Water

Q&A/Discussion
Blue Plains Advanced Wastewater Treatment Plant

- Operated by DC Water
- 370 mgd (ADWF capacity)
- ~160 acre site
- Largest Advanced WWTP in the world
Blue Plains AWTP Current Processing System

- NPDES Permit
  ~4.2 mg/l TN
  (Mass-based Limits)
- P-removal
  NPDES limit < 0.18 mg/l
- Develop a program that has long term sustainability
- Greatly reduce biosolids volumes
- Produce a low-odor, well-dewatered biosolids product with potential for “beyond-ag” uses
- Produce renewable power to offset plant energy needs
- Achieve Class A biosolids
Class B vs. Class A Product
Lab-Scale testing of Digestion Process Options for DC Water – Major Effort

- Tested over 50 process options at lab-scale (Wilson/Novak)
- Feedstock for all tests was Blue Plains solids (primary and WAS)
- Included Thermal Hydrolysis + MAD

TH + MAD was Eventually Selected
R & D Work was Essential for Program Success

- Extensive product odor testing on digestion and dewatering processes.
- Confirmed that with THP prior to digestion, chances for fecal regrowth/resuscitation were essentially eliminated.
- Major work on dewatering combined with each digestion process tested.
THP/Digestion cake – Ag use and Beyond

- Granular, well-dewatered, Class A, low-odor cake
- Easily stored and land-applied
- DC Water believes greater value products are possible

Bottom line: Working with an end product that can access more markets can stabilize product costs long-term
Visits and evaluations by DC Water/team to TH facilities (ten plants) over the past decade

TH projects have progressed successfully to large size/capacity from 1995 to 2014

DC Water conducted research and field testing at TH/digestion plants to confirm performance and suitability at Blue Plains

Anglian Water’s Cotton Valley Plant, UK
Cambi THP was Sole-Sourced by DC Water in 2009

- The only TH system proven at the scale required
- Cambi helped define the interfaces and impacts for Blue Plains project in 2009/2010 period
- Cambi’s Mark I system is used at DC Water (Mark II was not developed yet).
- THP/Digestion has 450 dry tons/day capacity at Blue Plains

Cambi THP – 4 Train System for DC Water (6 reactors per train)
Delivery Method is Specific for Each Project

Gravity Thickeners → DAFTs → Blend Tank → Screening and Pre-Dewatering → Dewatering → Lime → Mix → Store & Loadout

Power → Emissions

Steam → Biogas

Biogas Treatment and CHP → Mesophilic Anaerobic Digestion

Final Dewatering → Recycle Processing

DB

DBB

DB

Site Preparation

Loadout

Class A

Class B

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Process Flow of THP Before Anaerobic Digestion – Cambi™ Batch Class A

- **Sludge cake (P+WAS)**: ~15 to 18% DS
- **PULPER**: Pre-heat tank
- **Flash Tank**: Disintegration
- **Reactors** - Batch pressure cooking
- **Homogenized and preheated sludge**
- **Hydrolyzed sludge**
- **Recycled steam for energy recovery**
- **Steam 150 psi**
- **Hydrolyzed sludge to digestion at 8-12% DS. Dilution and cooling required.**
- **Process gases (to digester)**
Turbines with HRSGs Provided Best Fit at DC Water

- Maximize power and meet steam needs of Cambi THP
- 12 bar (175 psi) steam
- 73% overall power/heat efficiency
- Low-NOₓ emissions from Solar Mercury 50 gas turbine
- Flexible operation to meet peak steam needs
Key Performance Parameters - Startup Period

- Pre-Dewatering Centrifuges are consistently producing the 15 to 18 % solids “sloppy cake”
- Cambi THP is operating reliably, at capacity, with all trains in service
- Volatile Solids Reduction in the THP/Digestion system is about 65 %, with commensurate gas production
- Final dewatering cake typically at 30 to 32 % solids, low-odor product, and meeting Class A fecal coliform density
Biosolids Fecal Coliform in Final Cake

Blue Plains Belt Filter Press Cake
Fecal Coliform 7 day geomean

Class B = < 2,000,000/g
Class A = < 1000/g
New Facilities – as of May 2014
Class A Anaerobic Digestion Systems in North America

- Thermal Hydrolysis/Digestion (THP using batch process):
  - DC Water Blue Plains AWTP, Washington DC
  - (Several in design: HRSD, SFPUC, Raleigh, TRA, Franklin, TN)

- Pre-Pasteurization/Digestion (Batch):
  - Alexandria Renew, Alexandria, VA
  - Carmel Utilities, Carmel, Indiana
  - Franklin Township, Murrysville, PA
Thermophilic Digestion with Batch (or plug flow):
- Hyperion Treatment Plant, City of LA, California
- Terminal Island Plant, City of LA, Calif
- Orange County Water and Sewer Auth (OWASA), Chapel Hill, NC
- Dual Digestion, Tacoma, Washington
- Columbus Water works, Columbus, Ga (in startup)
Class A Anaerobic Digestion Systems in North America (Con't)

- **Other:**
  - Inland Empire, Ontario, California (Acid, Thermo, Meso – Alt 3 EPA)
  - Metro Vancouver, Canada (4-stage thermophilic digestion system)
  - Lakeland, Florida (2-PAD™ staged digestion)
  - London, Ohio (thermophilic acid, plus mesophilic digestion)
CLASS A BIOSOLIDS USE: PLAN AND DEVELOPMENT AT DC WATER
Historical Economics of DC Water’s Biosolids Recycling Program

- Pay a third party ~$43/wt for full service contract (transport, land app, reporting) of Class B biosolids
- $19M/yr program cost = 21% of the Blue Plains operating budget
- Delivered free to farmers
- Farmers value product at $300/acre (nutrients, lime, etc.), approximately $15/wt
- Value to farmers @ $15/wt, 1200 wtpd = $6,570,000/yr
- We do not extract this value
Blue Plains Garden & Compost Giveaway
Connecting with DC Gardening Community

First Annual
HOME GROWN DC FAIR
A Celebration of DC Farms and Gardens
SATURDAY, SEPTEMBER 7TH
4PM - 7PM
Old City Farm & Guild: 925 Rhode Island Ave. NW
THE FIRST DC ONLY FARMERS MARKET
DC STATE FAIR VEGETABLE JUDGING CONTESTS
LIVE MUSIC, COMMUNITY AND FOOD

homegrownDC@gmail.com
www.facebook.com/homegrownDCFair
organized by:

Neighborhood Farm Initiative
Common Good City Farm
Old City Farm & Guild
Glens Garden Market
dc water is life
FreshFarm Marktes
Community Gardens
Future Plans for Class A Biosolids

- Continue DC Water’s land application program – using Class A biosolids
- Develop blended soil products (similar to compost). Move into demonstration scale.
- Expand product use in the metropolitan service area for tree planting, restoration, green infrastructure, etc.
Value of Class A Biosolids

- Digested, Class A biosolids blended with sand and sawdust
- Tagro mix sells for $8/yard for residents, $10/yard for non-residents and commercial customers
- Tagro potting soil sells for $30/cy
# Biosolids Blending Trials

## Ingredients:
1. Biosolids
2. Soil (DC soil from Clean River project)
3. Sand – from Harvest Garden Pro
4. Sawdust – River End Sawmill
5. Hardwood bark fines (composted) - from Harvest Garden Pro
6. Pine bark fines - from Harvest Garden Pro
7. Ground money

## Blends:
1. TM hardwood – 2 biosolids : 1 hardwood bark fines : 1 sand (TAGRO Mix)
2. TM sawdust - 2 biosolids : 1 sawdust : 1 sand (TAGRO Mix)
3. TPS hardwood – 1 biosolids : 1 sawdust : 3 hardwood bark fines (TAGRO potting soil)
4. TPS pine bark – 1 biosolids : 1 sawdust : 3 pine bark fines (TAGRO potting soil)
5. AC – 1 biosolids : 1.5 sand : 1 hardwood bark fines (Abbottsford Classic)
6. AC Topsoil - 1 biosolids : 1.5 soil : 1 hardwood bark fines (Abbottsford Classic)
7. 3TP : 1B – 3 soil : 1 biosolids
8. 2TP : 1B - 2 soil : 1 biosolids
9. 2TP/S/B – 2 soil : 1 sawdust : 1 biosolids
10. Money 1 – 1 biosolids : 1 soil : 1 money
11. Money 2 - 2 biosolids : 1 sand : 1 money : 1 hardwood bark
Working with local soil blenders

- VA blender interested in developing commercial products
  - Spent a day with their marketing team
  - Coordinating with Va Tech on research
  - Willing to participate in a yr-1 blending pilot
  - Have 12-compartment computerized blending equipment

- MD blender closer by, but a smaller operation
  - Interested in highly specialized soil blends
  - Have 8-compartment computerized blending equipment
  - Interested in serving the DC Metro land development community with a top quality soil product.

- Working with DC Water Fleet to determine the best trucking scenario
Blending of up to 12 feedstocks
Designing a small onsite mixing facility
Implementation schedule

- Research contracts to develop product mixes (2014-15)
- Pilot digester for product testing (2013)
- Complete Class A/EQ certification, obtain Virginia distribution and marketing permit (2015)
- Pilot blending/marketing project (2015)
- Full scale, 10 – 20% to blenders (2016)
There is no such thing as waste, only wasted resources.

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Q&A AND DISCUSSION
Program Benefits

**Reduce biosolids** quantities by more than 50%

**Improve product quality** (Class A and more)

**Generate 10 MW** of clean, renewable power

**Cut GHG emissions** dramatically
NUTRIENTS and CARBON RECYCLING

FARMING
- Provides carbon and nutrients valued at $300.00 per acre.

SILVICULTURE
- Reduces soil erosion and improves wildlife habitat.

RECLAMATION
- Restoring mined areas to their natural state and providing wildlife habitat.

URBAN RESTORATION
- Grow trees and reduce runoff.

BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT: A RESOURCE RECOVERY FACILITY

- WATER: Recovery of 1 billion gallons of water that would otherwise be lost.
- NUTRIENTS: Recovery of 125 million pounds of phosphorus and 670 million pounds of nitrogen.
- CARBON: Reduction of 1.8 million metric tons of carbon emissions.
- ENERGY: Production of 13 MW of electricity.

GREEN ENERGY BIORENEWABLES

POWER FROM THE PEOPLE

THERMAL HYDROLYSIS PROCESS (THP) AND DIGESTION FACILITY

DC Water will be the first in North America to use thermal hydrolysis for wastewater treatment. When completed, this facility will be the largest plant of its kind in the world.

GREEN BENEFITS:
- Produce combined heat and power, generating 13 MW of electricity.
- Save DC Water $10 million annually cutting grid demand by a third (DC Water is the largest consumer of electricity in the District).
- Reduce carbon emissions by approximately 50,000 metric tons of CO2e per year.
- Reduce trucking by 1.7 million miles per year.
- Save $10 million in biosolids trucking costs.
- Produce Class A biosolids to grow trees, sequester carbon and reduce runoff.
Washington, DC, and Land Applied from Plant and Storage

April 2012 Biosolids Land Applied

Legend (Wet Tons)

- County, tons to storage (applicable), tons applied, agriculture $
Major On-Site Projects

- BP Tunnel Dewatering Pump Station & Enhanced Clarification Facility: $300 million
- New Filtrate Treatment Process: $84 million
- New Biosolids Management Program: $470 million
- Dual Purpose Sed Basins Upgrade: $18 million
- Upgrade & expansion of the Nit/ Denit system: $340 million
- Enhanced Nutrient Removal Facilities: $340 million
- Upgrade of the Secondary High Rate System: $26 million