



Massachusetts Water Resources Authority

## Wastewater Advisory Committee February 1, 2013

### Co-Digestion at Deer Island: A Feasibility Study On A Major Green Energy Initiative

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### Presentation Agenda

- Brief Industry Overview
- Current Residuals Operation
- Special Study – Co-Digestion
  - What materials are we considering
  - Regulatory
  - How?
  - Known issues to be addressed
  - Next Steps
  - Other WWTPs currently performing co-digestion
- Questions/Answers



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### Basic Statistics for US WWTP (EPA, NACWA & NEBRA)

- 16,583 wastewater treatment facilities in US
- Only 41 (0.25%) are over 100 MGD capacity
- Deer Island Flow – 365 MGD avg, 1,310 MGD max.
  - Detroit largest on max daily flow basis (DI - 2<sup>nd</sup>)
  - Chicago largest based on avg. daily basis (DI - 4<sup>th</sup>)
- 2,000 centralized sludge processing facilities
- 544 have anaerobic digestion
  - only 106 use the methane gas
  - 34 AD plant in NE, 6 AD plant in Massachusetts
- Ultimate disposal approaches:
  - 45% of facilities use land application
  - 29% of facilities use landfills
  - 17% of facilities use incineration
  - 9% of facilities practice beneficial use (including MWRA)

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### Deer Island Treatment Facility





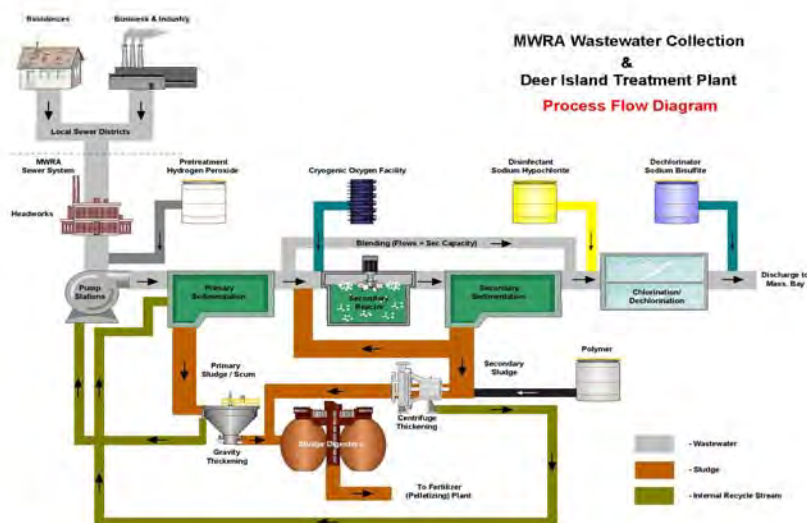
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## Deer Island Treatment Facility



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## MWRA Wastewater Collection & Deer Island Treatment Plant Process Flow Diagram





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### Residuals Processing Statistics for Deer Island

- Sludge to Digestion – 246 dry TPD
  - 70% as Primary sludge – from gravity thickening
  - 30% as Waste Secondary sludge – from centrifuge thickening
    - Typical sludge makeup of other plants: 50:50
  - Time in Anaerobic Digestion:
    - 18 days avg.
  - 62% Volatile Solids destruction
    - (industry avg. is 45-55%)



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### Overview of Current Residuals Processing

- Sludge to Pellet Plant – 106 dry TPD
  - On DITP, Digested sludge is stored, then pumped 7 miles to Pellet Plant
    - Methane gas captured, stored, then used in boilers on site
  - NEFCO dewater, dries, & pelletizes all digested sludge
  - All pellets go to beneficial re-use:
    - turf farms
    - golf courses
    - fertilizer blenders
    - cement kiln



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### Residuals Processing Statistics for Deer Island

- FY12 Annual Avg digester gas production – 189.5 kscfh
  - 97.3% of gas is beneficially used in boilers
  - 76% of days that digester gas met all DI heating requirements
  - 98.4% of total boiler heat attributable to Digas
- FY12 value of gas utilization - \$15-20M (heat) & \$2.8M (power)



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### Co-Digestion Feasibility Study

#### Part of MWRA's Long-Range Residuals Planning

- **Goals:**
  - Extend useful life of existing facilities
  - Improve process efficiency, optimize existing facility
  - Recommend long-term residual processes
  - Increase Digas volumes and increase green energy production,
  - Reduce sludge volumes
- **Facilities Technology Options Assessment (2012-2013)**
- **Evaluate Residuals Facilities & Processes**
  - Deer Island & Fore River
  - Assess and Rank Technology Options
  - Develop "Short-List" of Most Viable Options
  - **Perform Co-Digestion Feasibility Special Study**

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### Co-Digestion Feasibility Study

- **Co-Digestion: the introduction of non-wastewater derived organic waste material into the wastewater anaerobic digestion process**
- **Organic waste material:**
  - Source Separate Organic Food Wastes (“SSO”)
  - Fats, Oils & Grease
  - Other materials –
    - airport deicing fluids,
    - off-spec beverages (dairy, brewery, soda bottling)

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### Co-Digestion Feasibility Study

- **MaDEP – estimates 950,000 wet tons organic waste**
  - **only 100,000 wet tons annually are currently diverted.**
  - 2020 State Goal: Divert additional 350,000 wet tons per year to AD units
- **Current destinations for organic wastes in state:**
  - Edible food goes to food banks
  - Animal Feed Stock
  - Commodity Processing (FOG to biodiesel)
  - AD (Jordan Dairy Farm)
  - Composting
  - **Landfill & Incinerators – proposed ban imminent**

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### Co-Digestion Feasibility Study

- **MaDEP Regulation:**
  - Promulgated newly reformed regulations in late 2012 to pave way to turn organic wastes to green fuel
    - 310 CMR 16.00, Regulations for Solid Waste Management Facility Site Assignment and Recycling, Composting & Conversion Permits
    - 310 CMR 19.00, Solid Waste Management
    - 314 CMR 12.00, Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharges
  - Summer 2014 ban on source separated organics to landfill for commercial/industrial sources > 1 wet ton per week
    - Ban encourages diversion to AD units with digas recovery
  - **MWRA under no regulatory obligation to accept this waste**

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### Co-Digestion Feasibility Study

- **MWRA Benefits:**
  - Increased Digester Gas for increased Green Energy Production
  - Decrease purchase of electricity
- **MWRA Impacts:**
  - Need facilities on DITP to receive, store & feed material to digester
  - Increase sludge to NEFCo, \$ (digestion is never 100% destruction)
  - Additional CHP facilities to handle increased gas production if significant volumes are accepted

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### Co-Digestion Feasibility Study

- **How?**
  - DITP would receive the material to a new storage facility
  - Material could then be blended with normal thickened WW sludges at varying addition rates into the existing digesters
    - current planning - up to 20% of normal sludge volume (~50 dtpd TS)\*
  - Digas could be used in either the existing boilers/co-gen units up to trial volumes or newly constructed CHP facilities might be needed (for volumes greater than trial volumes) to overcome existing digas utilization restrictions and improve electrical generation efficiencies.

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### Co-Digestion Feasibility Study

- **Issues to be Addressed:**
  - Logistics – how is the material going to get to DITP?
  - Will co-digestion create the potential for odors and/or pests
  - Will this new waste stream negatively impact the current operation (digesters, sludge quality or effluent quality)? **MWRA operates a very successful residuals management program, we will not do anything to compromise that program.**
  - Costs need to be identified, cost mitigation established

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### Co-Digestion Feasibility Study

- **How are these issues being addressed? Next Steps...**
  - **Digas System Capacity Analysis** (complete)
    - MWRA Contract 7274A Task Order #6 with FST
    - Determine bottlenecks in existing Digas Utilization Processes
  - **Co-Digestion Bench Scale Study** (expect completion Summer 2013)
    - MWRA Contract 7274A Task Order #7 with FST/UMass
    - **Refine performance parameters to improve cost analysis**
  - **Co-Digestion Feasibility Study** (draft report complete, under review)
    - MWRA Contract 7147A Subtask 7, CDM-Smith
    - Evaluate overall Co-Digestion Feasibility & Costs
  - **Co-Digestion 1 Digester Scale Pilot** (future, dependent on bench scale)
    - Further refine performance parameters and operational impacts
    - RFP to solicit vendors for small-scale pilot at Deer Island
  - **Learn from others**

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### Co-Digestion Feasibility Study

- **National Experience with Co-Digestion**
  - **East Bay MUD, Oakland, CA (55 mgd plant )**
    - 2008 started taking in waste
    - Pre-processes all SSO on-site themselves,
    - Accept 10% by wt of their normal sludge production
  - **Gloversville-Johnstown, NY (15 mgd)**
    - Receive some material by pipeline (adjacent property),some by truck
    - 2:1 outside material to normal WW sludges (designed to handle this material)
  - **Des Moines, Iowa (40 mgd)**
    - 45% of material to digesters is from outside sources
- **Local Experience with Co-Digestion**
  - 34 NE TPs with AD, only 1 WWTP takes in food waste currently
    - **Essex Junction, VT (2 mgd)**
  - **Jordan Dairy Farm, MA (private digester)**

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### Summary To Date

- **Digester gas is a high-value green energy source at DITP**
- **Co-Digestion could substantially increase digas production & electricity generation on DITP**
- **Costs need to be clearly identified to plan cost mitigation**
- **Co-Digestion could be a viable future treatment enhancement**