Massachusetts Water Resources Authority

MWRA Wastewater Advisory Committee

Long-Range Residuals Planning

October 14, 2011

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Presentation Outline

- Overview of U.S. Residuals Practices
- Existing MWRA Operation
- Future Planning Goals & Steps
- Progress to Date
- Examples of Emerging Technology

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

- 16,583 wastewater treatment facilities in US
- Only 41 (2.5%) are over 100 MGD capacity
- Deer Island at 1270 MGD is 2nd largest in the US (Detroit is 1st)
- 2,000 centralized sludge processing facilities
- 544 have anaerobic digestion; but only 106 use the methane gas
- 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 Plant

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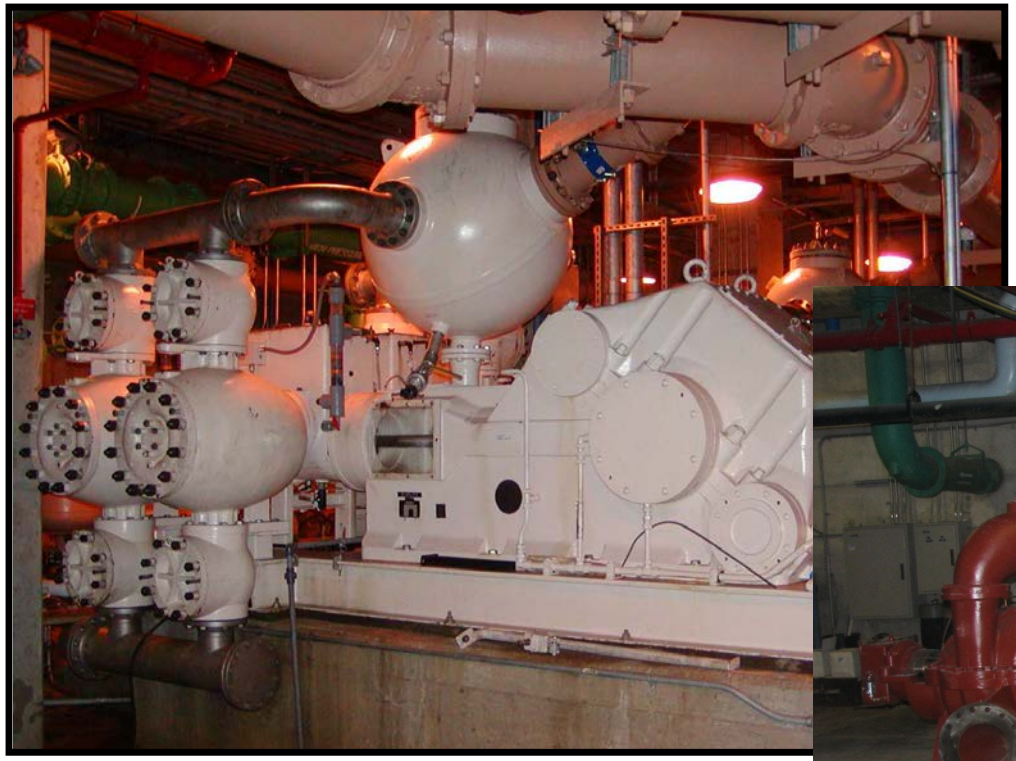
Anaerobic Digestion



Sludge Pumping to NEFCO – Existing and Proposed

Basic Residuals Processing Statistics for Deer Island

- Annual average sludge to digestion – 240 dry TPD
- Annual average sludge to NEFCO – 106 dry TPD (or 742 TPW)
- Typical pumping schedule – 4.5 days/week; 163 dry TPD
- Annual digester gas production – approximately185 kscfh
- % of gas beneficially used in boilers – 97-98%
- % of days that digester gas meets all our heating demand – 70%
- Annual value of gas utilization - $15M (heat) & $2.5M (power)

Overview of Current Residuals Processing

- Primary sludge – gravity thickening (2/3 of quantity)
- Secondary sludge – centrifuge thickening (1/3 of quantity)
- Combined sludge to anaerobic digestion for 15-18 days
- Volatile solids destruction – 65% (industry ave. is 40-50%)
- Digested sludge stored, then pumped to NEFCO
- Methane gas captured, stored, used in boilers
- NEFCO dewaters, dries, pelletizes all digested sludge
- All pellets go to beneficial re-use such as:
  - Turf farms, golf courses, fertilizer blenders, cement kiln

Overview of Contract S345 – NEFCO

- Term – March 1, 2001-December 31, 2015
- NEFCO responsible for all O&M including utilities & capital repairs
- NEFCO "owns" the sludge once it arrives at their facility
- NEFCO responsible for marketing and disposal
- "Fixed" price for annual sludge quantities up to 90 dry tons per day
- "Variable" price for incremental sludge quantities over 90 tons
- FY11 Costs - $362.90/ton ($378 Fixed; $276 Variable)
- Labor and Capital are only major costs not in variable rate
- Monthly billing is uniform; "true-up" in January
- Escalation indices applied to base bid for all major costs

NEFCO – Piping Layouts

NEFCO – Dryer Trains and Centrifuges

CY10 NEFCO Distribution

- Maryland - Renewable Fuel/Cement Kiln (MD)- 7,484
- Connecticut - Agricultural – 10,112
- Rhode Island – Agricultural/Turf – 2,398
- Ohio - Blender – 5,346
- Florida - Agricultural – 3,566
- Virginia – Blender/Turf – 1,372
- Pennsylvania - Blender – 1,189
- Massachusetts- Agricultural/Blender – 2,284
- New York – Agricultural/Blender/Turf – 1,354
- Vermont – Agricultural - 170
- New Jersey - Blender - 464

CY10 Bay State Fertilizer "Public Giveaway" (121 tons)

- Presidents Golf (Quincy) – 64
- Needham DPW – 22
- Bedford DPW – 20
- Belmont DPW - 4
- DCR – Castle Island - 3
- Westboro State Hospital - 3
- Massachusetts Horticultural - 2
- Nut Island – 2
- Deer Island – 1

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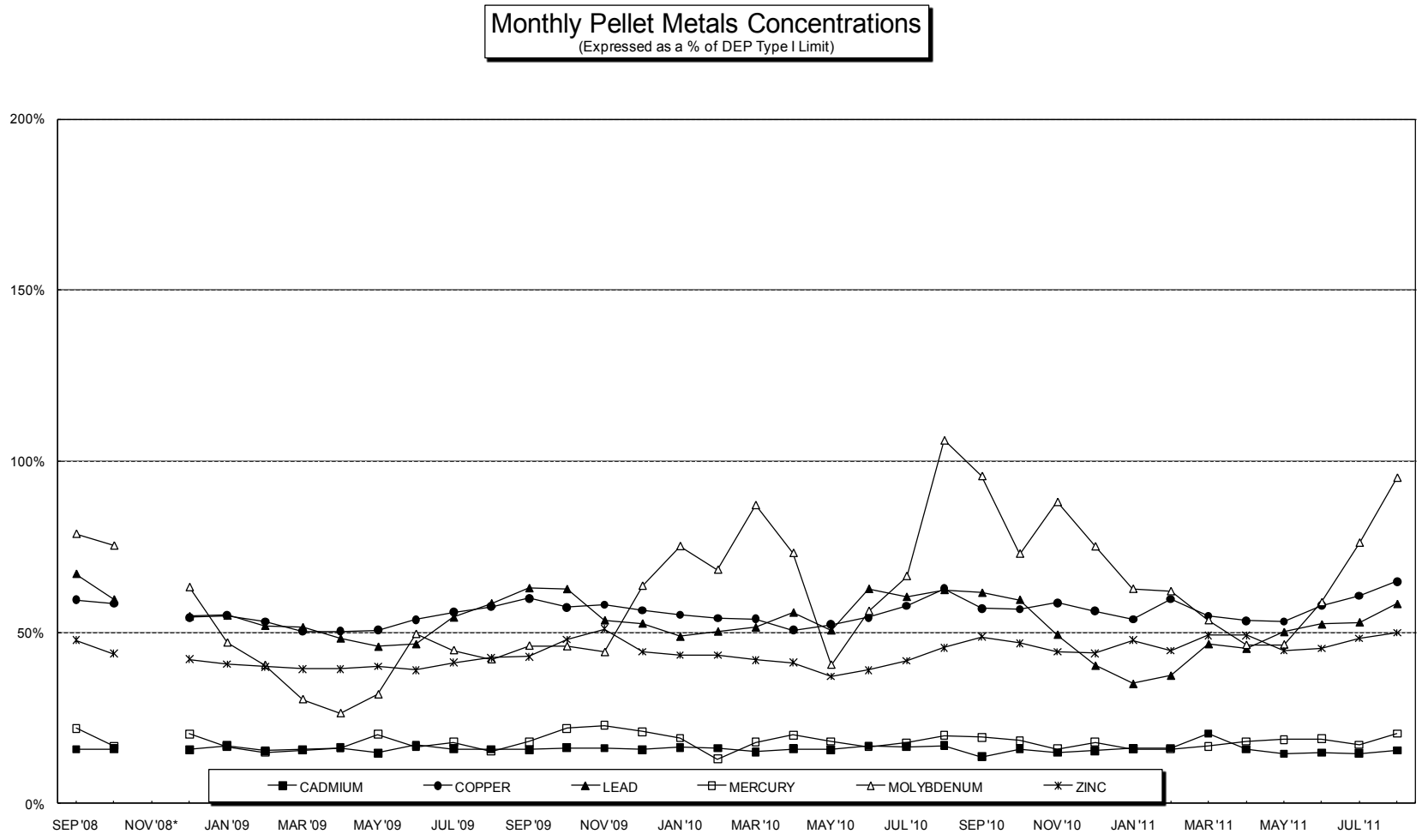

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Basic Long-Range Planning Goals

- Optimize Existing Facilities/Investment
- Take Advantage of Emerging Technologies
- Consider Lessons Learned from Other Major Utilities
- Maximize Solids Destruction/Gas Production
- Reduce Net Operating Costs
- Maintain Class A Sludge Classification & Beneficial Re-use
- Consider Regulatory Trends at Federal and State Levels
- Continue to be “Good Neighbor” in Host Communities
- Operate in a Safe and Reliable Manner

Basic Long-Range Planning Steps

- Assess Condition of Existing Facilities/Assets
- Engage in Technology Transfer with Industry Leaders
- Review Viability of Emerging Technologies
- Develop Technology Screening Model reflecting MWRA Needs
- Indentify Short-List of Potential Process Improvements
- Pilot Most Promising Ideas, if feasible
- Begin Design – Construction Phase
- “Fast-Track” Partial Improvements , if possible
- Solicit MWRA Board, Advisory Board and WAC Input

Constraints or Considerations in Long-Range Planning

- Previous Capital investments ("sunk costs")
- Location of existing facilities – split operation – DI and Quincy
- Prior permit, environmental or mitigation obligations
- Available land area for facility expansion
- Logistics - access for construction, O&M needs – e.g. chemicals
- Regulatory/Legislative – local, state, federal
- Scale of MWRA operation – need proven technologies
- Drivers – volume reduction, gas production, energy recovery, cost
- Operating plans – NEFCO contract, privatize, transition plan
- TBL Assessment – economic, environmental, social

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Outreach to Industry Leaders

- Early 2009 – Invited Seven Nat'l Firms for Technology Exchange
- Presented Current Staffing Credentials and Opinions
- Firms Involved were:
  - AECOM
  - Black & Veatch
  - Brown & Caldwell
  - CDM
  - CH2M-Hill
  - Malcolm-Pirnie
  - Parsons

Consultant Views on MWRA – Good Points

Deer Island/MWRA is doing **much better than most:**

- Volatile solids reduction of ~65% is excellent (typical is 45-50%)
- Gas capture/reuse results in model operation (use 98%)
- Gas generation figures continue to improve
- Renewable energy work is commendable
- Consistent production of Class A Biosolids product is notable
- Diverse distribution market is also a positive metric
- Pelletization is gaining popularity; we made a good choice early
- MWRA's early planning for the future is admirable

Consultant Views - MWRA Constraints

Deer Island faces the following planning constraints:

- Recent major sunk costs in facilities – impacts decisions
- Large-scale facility – only want proven technology
- Split operation – Deer Island-Quincy – restricts options
- Available space – Deer Island-Quincy – restricts options
- Access to Deer Island – impacts options/logistics
- Prior environmental/permitting commitments – mitigation?
- Newer Technologies – can they scale up to DI needs?
- Industry seeing huge leaps in Class A product – impacts market

Consultant Views – "Big Picture" Advice

- Define basic goals – volume reduction, energy recovery
- Develop objective screening criteria

- Develop solid cost-estimating model
- Involve senior management, Board, stakeholders early on

- Consider expert peer review panel
- Contact or visit other major utilities that use newer technology

- Procurement options – D-B-B, D-B, D-B-O, D-B-O-O
  - Design, Bid, Build, Operate, Own

Consultant Views – Technology Points

- Volume Reduction – Add'l WAS destruction is best bet
- Volume Reduction – Are you then left with excessive redundancy?

- Energy Recovery – Waste heat recovery, co-gen at pellet plant
- Conditioning – Some options lead to improved digestion

- Stabilization – two-phase digestion, CAMBI, co-burn
- FOG Co-Digestion – Seeing success, but logistics very tough here

- End Product – We already have a Class A, so what's next?

Consultant Views – Common Themes

- Optimize existing assets where feasible
- Consider some "fast-track" improvements; don't wait until 2015

- Utilize pilot/demo units if available; scaling up is an issue
- Additional energy recovery looks viable

- Regulatory initiatives may limit future options
- If pelletization stays; keep markets diverse

- Take advantage of RPS, GH credits, etc
- Don't rule out any options w/o at least some screening

Facilities Condition Assessment – Pellet Plant

- Condition Assessment conducted 2009-2010 by AECOM
- Found the facility to be in good-excellent shape
- Encouraged more investment in controls upgrades (obsolescence)
- Support utilities assessed for long-term use & redundancy
- Any safety deficiencies were addressed immediately
- Continue to monitor key equipment
- Follow-up on implementing short-term recommendations

Technology Screening Step

- RFQ Issued in March 2010
- Five Basic Tasks
  - Identify Technology Options
  - Assess Regulatory Trends
  - Develop Case Studies on 20 Major Utilities
  - Screen/Rank Technology Options
  - Develop Three Potential Options for Further Study
- Four Respondents: AECOM, B&C, B&V, CDM
- Proposals reviewed, but placed on hold
- Reconsidering Approach and Planner/Designer Conflict
- Expect to resume progress in early 2012

Emerging Technology – Piloting Options

- RFI Issued in November 2010
- Solicit Interest in On-Site Piloting (no cost to MWRA)
- Four Respondents
  - Bio-Organic Catalyst
  - PMC-Biotec
  - Prodex-BAE
  - Bio-Wish Technologies
- Some firms have completed preliminary off-site testing
- No on-site testing has begun
- RFI remains open for other vendors

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Proven/Emerging Technologies in Residuals Processing (partial listing)

- Sludge-to-Oil (Pyrolysis) - SlurryCarb or EnerSludge
- Enhanced gas production - Cambi or BioThelys
- Sludge reduction – AFC (PMC Bio-Tec)
- Thermal solidification – GlassPack (Minenergy)
- Cell Destruction – Microsludge or Ultrasonic