To Digest or Incinerate Sludge...That is the Question

Mark Greene, O’Brien & Gere
To Digest or Incinerate Sludge...That is the Question

Today’s Presentation

- Statistics
- Incineration Basics
- Anaerobic Digestion Basics
- SWOT
- Moving Forward
Energy Usage Distribution By Treatment Process Train

- Wet stream, 65%
- Solids handling, 11%
- Non-potable process water pumping, 6%
- Lighting and HVAC, 4%
- Other, 14%

NYSERDA 2006
SUEMETERING MUNICIPAL WWTPs

© 2014 O’Brien & Gere
Energy Usage Distribution Within Solids Handling Stream

- Digestion, 0%
- Thickening, 0.01%
- Dewatering, 25%
- Disposal and Incineration, 34%
- Solids Pumping and Mixing, 41%

3.7% of WWTP total

NYSERDA 2006
SUEMETERING MUNICIPAL WWTPs

© 2014 O’Brien & Gere
US Biosolids Disposal Practices

- Land Application: 45%
- Landfill: 28%
- Distribution and Marketing: 9%
- Incineration: 17%
- Surface Disposal: 1%

WERF BIOGAS RESEARCH FACSHEET 1_201010V3

© 2014 O'Brien & Gere
Ohio Sludge Disposal Practices

- 2002 – Ohio EPA establishes sewage sludge regulations
  - Ohio Administrative Code rule 3745-40
- 2005 – Ohio EPA receives EPA delegation for the sewage sludge program.
  - 1 of only 7 States
- 2011 revised rules
- 2003-2009 biosolids reports
  - 30% of facilities process
  - 90% of the biosolids

- Northeast: 36%
- Southwest: 26%
- Northwest: 13%
- Central: 15%
- Southeast: 4%
- Out of State: 6%
Beneficial reuse requires sludge stabilization.
How to Stabilize?

- **Anaerobic Digestion**
  - Dewater cake to 20%+ solids

- **Incinerate Sludge**
  - Produce inorganic ash, use as landfill cover

- **Chemical Stabilization**
  - Dewater cake plus add lime, 25%+ solids

- **Combination**
  - Sludge drying
  - Other methods

- **Focus of this presentation**
  - Digestion and Incineration
Solids Handling Operating Costs

**Anaerobic Digestion**
- Fuel/Electricity: 0%
- Chemical: 17%
- Labor/Benefits: 19%
- Landfill Fees: 64%

**Incineration**
- Fuel/Electricity: 25%
- Chemical: 16%
- Landfill Fees: 3%
- Labor/Benefits: 56%
INCINERATION
Sewage Sludge Incinerators

- ~170 SSI plants in operation in US
- Three main types of incinerators are used
  - >80% are of the multiple hearth design
  - ~15 percent are fluidized bed combustors
  - 3 percent are electric
- Most located in the Eastern United States
  - Also a significant number on the West Coast
- New York has the largest number of facilities (33)
- Pennsylvania (21) and Michigan (19) have the next-largest numbers of facilities
- Ohio has ~10 plants with SSI’s

Incineration Practices in Ohio

Statewide (dry tons/year)

- Incinerated: 34%
- Class A: 18%
- Class B: 27%
- Landfill: 21%

Incineration (dtpy)

- Central: 23%
- Southeast: 31%
- Southwest: 21%
- Northeast: 46%
- Northwest: 0%
- Out of State: 0%
Other Biosolids Practices in Ohio

Class A (dtpy)
- Out of State: 7%
- Central: 16%
- Northeast: 41%
- Southwest: 26%
- Southeast: 0%

Class B (dtpy)
- Out of State: 10%
- Central: 9%
- Southwest: 30%
- Northeast: 23%
- Northwest: 22%
- Southeast: 6%

Landfill (dtpy)
- Out of State: 10%
- Central: 12%
- Southwest: 20%
- Northeast: 33%
- Northwest: 16%
- Southeast: 9%
Incineration no longer falls under “domestic sewage exclusion” provision of the Clean Water Act, but under Section 129 of the Clean Air Act

Compliance date is March 21, 2016

SSI classification determination is necessary
  - Emissions testing is required

Additional/New Controls may be required
  - Mercury scrubbing system
  - Caustic addition to wet scrubber venturis
    - Sulfur dioxide compliance and improved HCl emissions
  - Addition of wet electrostatic precipitator
    - Cadmium, lead, and particulates compliance
  - Selective Non Catalytic Reduction system
    - Inject ammonia in exhaust gas exit for NOx reduction
# Incineration

## Strengths
- Turn on/off as needed
- Ash residual (solids reduction)
- Proven Technology
- Operator familiarity
- Lower initial capital cost

## Weaknesses
- More fossil fuel (higher utility cost)
- Larger carbon foot print
- Limited grant potential
- Not "Green"
- Odor from sludge handling
- Higher operation cost
- Limited tipping fee potential
Incineration

**Opportunities**

- Merchant Facility: Accept outside sludge for revenue

**Threats**

- Utilize original/rebuilt incinerators
- **Future cost to replace**
- Potential changes in air emission regulations
ANAEROBIC DIGESTION
Anaerobic Digestion

- Primarily for solids stabilization as part of an overall solids handling system
- Mesophilic digestion is most prevalent
  - 95° to 98°F (35° to 37°C)
Mesophilic Digestion

- Features of a well-designed and well-operated mesophilic digestion process
  - Uniform feed of screened and de-gritted raw solids
    - semi-continuous/continuous
  - Automatic removal (positive control) of floatables, scum, and foam
  - Complete mixing
  - Adequate heating
  - Improved pre-thickening of feed
Anaerobic Digestion

Strengths

- "Green"/ sustainable technology
- Reduced carbon footprint
- Tipping fee generation
- Energy recovery
- Proven Technology
- Closed vessel/no odors
- No incinerator stacks
- Grant potential

Weaknesses

- Biological process
- Capital cost
- Operational skill (new skill set/training required)
- Residual sludge/digestate disposal
Anaerobic Digestion

Opportunities
- Grant potential
- Tipping Fees
- Rate stabilization
- Third party performance contracting
- Public Relations - Community Good Neighbor
- Future SSO waste & regulations/compost fee

Threats
- Sour digester if not property operated
- Odors if not operated properly
- Toxicity
- Overfeed/underfeed/loading
- Market competition for outside sources – new mind set
Digester YES, Incinerate NO

- Dairy whey
- Salad dressing
- Fats, oils, and grease
- Manure
- Outdated beer and soda
- Pulverized food waste

Small particles, no contamination, no grit
Municipal Solids Waste to Landfill

Food makes up the largest percentage of waste going into municipal landfills and combusted for energy recovery.

- 21% Food Waste
- 15% Paper & Paperboard
- 9% Yard Trimmings
- 9% Metals
- 5% Glass
- 18% Plastics
- 10.6% Rubber, Leather & Textiles
- 8% Wood
- 4% Other

Data from the 2011 Municipal Solid Waste Characterization Report
Future Sludge Management Options

Incineration
- Business as usual
- Uncertain Long Term Solution

Anaerobic Digestion
- New sources of revenue
- Operating cost reduction
Benefits of Anaerobic Digestion

- Anaerobic Digestion: Good neighbor technology
- High Strength Waste: Can be treated by this technology
- Revenue Potential: Tipping fees
- Cost Avoidance: Electricity purchase
Harvest Carbon or Waste Carbon?

- **Sludge**
  - 75% VS before digestion
  - 60% VS after digestion

- **Anaerobic Digestion**
  - Removes some carbon during the 20 day process
  - Converts it to carbon dioxide and methane

- **Remaining Carbon**
  - Still in the sludge cake
  - Hauled to composting or the landfill

- **Incineration**
  - Destroys virtually all of the carbon and volatile solids

- **Remaining Ash**
  - Mostly inert, inorganic material
  - Suitable to be used as daily cover at the landfill
Hub and Spoke

Small Plant Sludge

Medium Plant Anaerobic Digester

Small Plant Sludge

Small Plant Sludge

Small Plant Sludge
The decision to digest or incinerate sludge must be done on a case-by-case basis.

Not cost effective to digest or incinerate sludge at small wastewater plants.

Maybe cost effective to digest sludge at medium size facilities, but not cost effective to incinerate.

Possibly cost effective to digest and incinerate sludge at large facilities.
QUESTIONS?

Mark Greene, mark.greene@obg.com, (315) 956-6271
To Digest or Incinerate Sludge...That is the Question

**NOTICE**

- This material is protected by copyright. No other use, reproduction, or distribution of this material or of the approaches it contains, is authorized without the prior express written consent of O’Brien & Gere.

© Copyright, 2014 O’Brien & Gere Engineers, Inc., All Rights Reserved
THANK YOU