JUMP START METHANE PRODUCTION IN A BIOREACTOR LANDFILL USING SEPTAGE

St. Clair County, Michigan
CTI and Associates, Inc.
January 23, 2014
Outline

• Introduction/Background
• Legislative Changes
• Project Overview
• Funding
• Future
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Introduction/Background

St. Clair County (SCC), Michigan
- Suburb of Detroit
- Population ≒ 160,000
- Predominantly rural/agricultural
- Approx. 30% sewered
- Owns/operates Smiths Creek Landfill

- Smiths Creek Landfill (SCL)
  - 600 tons/day
  - 27M bcy capacity (≅ 7M in place)
  - Managed by Matt Williams (presenter)
History (2004-2005)

- SCC interested in increasing site life at SCL
- SCC interested in generating extra revenue from LFG
  - Initial RFP was met with hesitation from developers
  - Too little LFG to make investment
- Increasing concerns regarding pollution from land application of septage
  - Local study identified SCL as a potential location for a septage receiving facility based on central location
- Septage Bioreactor Landfill concept was identified
  - Regulatory hurdles to overcome
Why Septage?

- Readily available in many communities
- Not welcomed by WWTP
- Land application may lead to water contamination
- Promotes waste degradation by
  - Moisture addition
  - Microbial seed addition
  - Chemistry regulation
  - pH control
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Regulatory Hurdles

- In 2004, liquids other than leachate not permitted in Michigan landfills
- Federal regulations allowed for research, development and demonstration (RD&D) projects
  - Not adopted in MI at the time
  - No avenue for injecting liquids other than leachate
RDDP States (2013)

- CA ('07)
- NE ('08)
- KS ('09)
- MO ('07)
- IA ('09)
- MI ('06)
- WI ('06)
- IL ('06)
- IN ('05)
- OH ('13)
- VA ('09)
- NH ('10)
- AK ('11)
- Salt River Tribe ('09)
Legislative Changes

- SCC worked with legislators and MDEQ on rule change and project authorization.
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General Description

- Septage collected by local haulers processed at an on-site receiving facility
  - Volume tracked, solids removed, stored in on-site tanks
- Septage injected via subsurface lines into MSW
- LFG collected using horizontal gas extraction lines
- Entire system monitored for a variety of parameters to measure performance and document compliance
- In operation since 2008
Facility Overview
Septage Receiving

Odor control
Processing
Underground holding
Unloading
Septage Processing
Liquid/Sludge Separation

- West Tank: Sludge Settlement
- East Tank: Liquid Storage Before Injection
Septage Injection Lines
Landfill Gas Extraction Lines
Liquid Injection and Gas Extraction Lines

Waste Surface on Nov. 28, 2009
Waste Surface on Nov. 23, 2008
Waste Surface on Nov. 11, 2010
Waste Surface on Oct. 7, 2011

Easting

Elevation (ft MSL)
Observation/Benefits

- **Waste settlement**
  - Airspace utilization factor (AUF) is increasing over time
  - Airspace recovery ~5% per year

- **Leachate quality**
  - No increase in BOD from septage
  - Increases in total P and phosphate indicate a sufficient phosphate level for biomass growth
  - High levels of ammonia indicate a high degree of solid waste decomposition

- **LFG collection**
  - Significantly increased decay rate coefficient (k)
LFG Collection

8% of total waste is producing nearly 40% of total LFG!
LFG Generation Modeling

Septage Bioreactor

$$k = 0.30 \text{ yr}^{-1}$$

Leachate Bioreactor

$$k = 0.08 \text{ yr}^{-1}$$
Decay Rate Coefficient (k) Comparison

- **SCL Septage Bioreactor Landfill**: \( k = 0.30 \text{ yr}^{-1} \)
- **SCL Leachate Bioreactor Landfill**: \( k = 0.08 \text{ yr}^{-1} \)

**SWANA 2004 Relationship**
- Average precipitation and liquid addition 42 in/yr
- Annual precipitation + recirculation above 40 inches (EPA GHG)
- Annual precipitation + recirculation between 20 and 40 inches (EPA GHG)
Other Benefits

• SCC able to partner with developer & install LFGTE facility (3.2 MW capacity)
  ▫ Generates approx. $750k in revenue per year
• Increased settlement = site life increase
  ▫ Landfill can service residents for longer
  ▫ Construction costs are delayed (reuse existing cells)
• Siting of septage receiving facility has eliminated land application of septage in SCC
  ▫ Decreased water pollution potential
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Funding

- SRF loan used to fund majority of project
  - Low interest (2.5%) loan with 20-year payback
- Classified as environmentally innovative by the USEPA, subject to Green Project Reserve funding
  - 40% of loan was forgiven
  - Precedent for future similar projects
- Won the EPA’s 2010 Performance & Innovation in the SRF Creating Environmental Success (PISCES) award
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Planned Expansion

- Second RD&D permit granted for septage bioreactor technology expansion
- SCC expanding into new and existing areas of landfill
- Expansion will focus on applicability of technology to commingled waste
- Obtaining a second SRF loan to complete project
  - Considered environmentally innovative; expected to receive 50% principal forgiveness
A New Business Model

• Acceptance of septage gives municipality access to SRF funds (typically reserved for wastewater projects)
• Allows landfill construction to be financed
  ▫ municipalities able to conserve $$ in the short term
  ▫ obtain low interest loans not typically available
• Principal forgiveness of 40% and 50% has provided significant savings for SCC
Future Opportunities

- Any municipality could take advantage of SCC model with a few considerations:
  - Is septage readily available in my community?
  - Am I in an RDDP state or do I have any other state regulatory hurdles?
    - If not, amendments will need to be made (SCC demonstrated this is possible!)
  - SRF loan guidelines vary by State but all are required to provide $$ to green projects
Thank You!

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