Maximizing Landfill Gas Collection for Reuse in a Recirculating Landfill

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Solid Waste Regulations Developed To:

- Protect Groundwater Quality
  - Clay, synthetic liners
  - Leachate collection

- Limit Leachate Generation
  - Clay, synthetic covers
  - Smaller working areas
  - Reach intermediate slopes quickly

THE "DRY-TOMB" APPROACH
An Alternative…

THE WET LANDFILL APPROACH

• Leachate Recirculation – State Approval
  • Bioreactor – Federal Approval

Complete Waste Stabilization by Post-Closure

POTENTIAL TO REDUCE POST-CLOSURE FINANCIAL ASSURANCE OBLIGATION
Recirculation Benefits

• Short Term Benefits
  – Waste/Leachate Stability
  – Leachate Volume Storage/Reduction
  – Additional Leachate Treatment
  – Enhanced LFG/GHG
  – Accelerated Waste Settlement
  – Leachate Management Savings

• Long Term Benefits
  – Reduced Post-Closure Cost & Liability
  – Leachate Quality
  – Leachate Generation
  – Landfill Gas Generation
  – Settlement
Concerns

- Leachate Distribution
- Decreased LFG Collection Efficiency
- Leachate Ammonia
- Landfill Seeps
- **Increased LFG Generation**
- Landfill Gas Odors
- Slope Stability
Moisture Impact on LFG Generation

- **WET**
- **AVVERAGE**
- **DRY**

Landfill Gas Generation (ft$^3$/lb/yr)

- LANDFILL CLOSURE
- 0
- 5
- 10
- 15
- 20
- 25

Years
Methods of Recirculation

- Spray Application at Working Face
- Spray Application on Intermediate Cover
  – e.g., Compost
- Infiltration Ponds/Cells
- Vertical Injection Wells
- Recirculation Laterals (Horizontal Trenches)
- Granular Beds
Methods of Recirculation
Recirculation with Proactive Gas Collection

Granular Blanket, See Plan View

Horizontal Gas Collector

Perforated Gas Collection Pipe

Perforated Recirculation Pipe

Leachate and Gas Collection

Landfill Cell with Recirculation and Proactive Gas Collection

Plan View of Granular Blanket

Perforated Recirculation Pipe

Perforated Gas Collection Pipe Loop

Extent of Permeable Media
Original Recirculation Landfills

Legend

- Original Recirculating Landfill

Locations:
- Polk County Landfill
- Crow Wing County Landfill
- Rolling Hills Landfill
- Elk River Landfill
- Spruce Ridge Landfill
- Burnsville Sanitary Landfill
- Lyon County Landfill
- Nobles County Landfill
Current Recirculation Landfills

Legend:
- ★: Currently Recirculating Landfill
- ⭐: Permitted to Recirculate Landfill
- ✭: Landfill Gas Reuse Projects

- Clay County Landfill
- Crow Wing County Landfill
- Morrison County Landfill
- East Central Sanitary Landfill
- Elk River Landfill
- Spruce Ridge Landfill
- Lyon County Landfill
- Blue Earth Landfill
- Steele County Landfill
City of Sioux Falls Landfill

- Largest Landfill in South Dakota
  - Opened in 1979
  - Services 5 Counties
  - Services Population of 250,000 People
  - 600 tons MSW per Day
  - 170 tons C&D per Day
  - 710 Acre Facility
    - 206 Acres Permitted for MSW
    - 91 Acres of Pre-Subtitle D
  - Life Projected through 2086
Landfill Gas Utilization

• 2005 – 2010: Dual Phase Leachate Extraction and LFG Collection System with Flare (128 Vertical DPW)
• 2006: LFG to Energy Feasibility Study
• 2007: Negotiated Gas Purchase Agreement with POET
• 2008: 11-Mile Pipeline Design/Construction
• 2010 to 2013: Recirculation Lateral/Horizontal Gas Well Installation (12 Horizontal Gas Wells, 5 Recirculation Laterals)
• 2011: Replacement LFG Flare Operational
• Current LFG Sales: $150-200K per Month
• Current LFG Flows: 2,000 scfm
LFG Conditioning System
LFG Flare
Landfill Overview

Subtitle D

(Active) = 25% Gas

Pre-Subtitle D (Closed) = 75% Gas
Sioux Falls LFG Generation

City of Sioux Falls LFG Generation & Collection

- Model 1: Modeling 1979 to 2005
- Model 2: Modeling the dewatering effect in the East MSW Area
- Model 3: Modeling the filling of waste unaffected by the standing water within the waste (everything after 2006 through 2010)
- Model 4: Modeling Tipping Fee growth from 2013 to 2031

Standard Cubic Feet per Minute (SCFM)

Year

Model 1
Model 2
Model 3
Model 4
Total
LFG Total - Chasing
LFG Total - Vertical

2,200 SCFM
LFG Operation

• “Chasing the Curve” – Collecting from the Active Area
• Collecting LFG from:
  – Horizontal Gas Laterals
  – Leachate Collection Pipes
  – Recirculation Laterals
Leachate Recirculation

• Applications
  – Recirculation Laterals
  – Surface Applying

• Benefits
  – Increased Gas Production
  – Faster Waste Stabilization
  – Improves Leachate Quality

• Operations
  – Communicate with Operations
  – Train Operators Effectively
  – Mobile Equipment
  – Operational in Colder Months
  – Extract Gas when Laterals not in Use
  – Keep Costs Low by Utilizing Existing Equipment
Gas Lateral Installation

- 12 Horizontal Wells Installed from 2010 to 2013
  - Currently 25-30% of Total Gas Production
  - Installed in Active Filling Area
  - Design Change Due to Poor Drainage
Gas Lateral Tire Shred Backfill
Gas Horizontal Operations

- Horizontal Wells are Designed to Move as the Waste Moves
- Train Operators to Work Around Wells During Installation
- Move Active Face During Installation
- Design Wells to Act as Dual Phase
- Evaluate Various Dewatering Options
- Various Pumps May Need to be Used
Gas Lateral Connection (2010)
Gas Lateral Connection (2011+)
Gas Lateral Design (2010)

- LFG Flow
- Condensate Flow

Vertical Pipe for Pumping

2% Slope

Drain Pit

Drain Pit
LFG Manager’s Top 5

5 Key Factors to Stay Ahead of the Curve

1. Keep wells dewatered (may have to be creative).
2. Effectively train and communicate with all employees who work within these operations.
3. Preventive maintenance and keep downtime to a minimum.
4. Expand the gas system when gas is available (if you don’t you could be losing revenue).
5. Don’t get discouraged and learn from your mistakes!
Questions?

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