Landfill Gas Collection System Design

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Air Regulations for MSW Landfills – NSPS and EGs
When is a GCCS required by rule?

• NSPS XXX minimum criteria that will require a GCCS:
  • Landfill must have a design capacity > 2.5 million Mg AND > 2.5 million cubic meters.
  • Landfill must have begun physical construction AFTER July 17, 2014
  • Landfill must have the potential to generate 34 Mg/yr of NMOC emissions

• NSPS WWW minimum criteria that will require a GCCS:
  • Landfill must have a design capacity > 2.5 million Mg AND > 2.5 million cubic meters.
  • Landfill must have begun physical construction AFTER May 29, 1991
  • Landfill must have the potential to generate 50 Mg/yr of NMOC emissions
When is a GCCS required by rule?

• EG Cf minimum criteria that will require a GCCS:
  • Landfill has accepted waste any time since November 8, 1987 or has design capacity for future waste acceptance.
  • Landfill must have a design capacity > 2.5 million Mg AND > 2.5 million cubic meters.
  • Landfill must have begun physical construction BEFORE July 18, 2014
  • Active landfill must have the potential to generate 34 Mg/yr of NMOC emissions
  • Closed landfill must have the potential to generate 50 Mg/yr of NMOC emissions

• EG Cc minimum criteria that will require a GCCS:
  • Landfill has accepted waste any time since November 8, 1987 or has design capacity for future waste acceptance.
  • Landfill must have a design capacity > 2.5 million Mg AND > 2.5 million cubic meters.
  • Landfill must have begun physical construction BEFORE May 30, 1991
  • Landfill must have the potential to generate 50 Mg/yr of NMOC emissions
Landfill Gas Emission Model

**LAND GEM**

- Official model used by the US EPA
- Minimal Model Parameters/Variables/Inputs
- Overly Conservative Gas Production Estimates
- Generally, NOT the Best Indicator for Gas Collection Design Systems
Industry Specific Models

GASSIM

- Not Used for Permitting
- More Dynamic Parameters/Variables/Inputs
  - Moisture
  - Waste Composition
- Better Indicator of Actual Landfill Gas Production
Passive Gas Systems
Passive Gas System
Passive Gas System

**GAS FLARING**

Solar Flares

- Installed in Passive Gas Vents
- Operate for Low Gas Flows
- Localized Gas Flaring
- Operate at Ambient Pressure
- Difficult to Operate in Cold Weather Climates
  - Heat Pads, Insulation and Running Power
Passive Gas System

DESIGN CRITERIA

PROS

• Cheap to Construct
• Can be Built During Landfill Closure
• Little to No Regular Maintenance

CONS

• Less Gas Collection
• Minimal or No Gas Destruction
• No Possibility for Energy Production
Active Gas Systems
Active Gas System
Active Gas System

VERTICAL EXTRACTION WELLS
Active Gas System

**VERTICAL EXTRACTION WELLS**

- Must Provide Safe Access During Installation
- Spaced based on Radius of Influence (ROI)
- >15’ Above Liner
Active Gas System

**HORIZONTAL EXTRACTION WELLS**

- Trenched into Waste
- Greater Gas Collection than Vertical Wells
- Best if Installed during Waste Placement
- Cannot be Modified after Construction
- Vulnerable to Waste Settlement
Active Gas System

CON D E N S A T E  S U M P S

- Provide Gas Knockout
- Deep Enough to Not Pull Condensate into Header
- Will Require Drainage Method
  - Self Draining Into Waste
  - Self Draining into leachate System
  - Pumping System
Active Gas System

HEADER AND LATERAL PIPEWORK

- Always Maintain >5% Grade
- Design for Cover to Drive Over
- Ensure Grades Don’t Interfere with Cap
- Pressure Test all Pipework
- Be Conservative on Pipe Sizing
- Install Valves for Isolation
Active Gas System

FLARE / BLOWER

• Enclosed Flare vs Candlestick
  • Cost vs Efficiency
• Sized Based on Gas Model Results
• Placed in a Secure Location on Site
• Immediately Down Stream of Condensate Sump
Active Gas System

**DESIGN CRITERIA**

**PROS**

- Targeted Gas Collection
  - Odor Control
  - Migration Management
- Possible to Earn Capital to Offset Costs

**CONS**

- More Expensive to Construct
- Should be Designed with Cell Landform
- Regular Maintenance and Upkeep
Economic Factors
Economic Factors

**COST TO CONSTRUCT-ACTIVE SYSTEM**

- ~$15,000 Per Well
  Includes all Associated Pipework
- >$100,000 for Flare
- Regular Monitoring, Upkeep
  - Wellfield Balancing
  - Permit Reporting
  - Replace Worn Pipes, Hosing, Valves, etc..
Economic Factors

**LANDFILL GAS GENERATORS**

- Require Additional Infrastructure
  - Powerlines, Transformers, etc…
  - Additional Pipework to Possibly Sell Gas Offsite
- Minimum ~650 SCFM to Operate a Single 2 MW Generator
  - May Require Multiple Generators for Return on Investment
- Requires More Stringent Gas Management
Economic Factors

**HIGH BTU GAS PLANT**

- Require Gas Plant Installed On Site
  - Refine Gas to >98% Methane
  - Pump Gas into Natural Gas Pipeline
- Extremely Stringent Gas Quality Requirements
- Cost-Benefit Dependent on Price of Natural Gas
Questions?