


6. LFG Quantification and Modeling (English)



Methane to Markets


Landfill Gas Generation Quantification and Basis of Design



Question???

- How do you know if your landfill is a good candidate for energy recovery and how big the LFG collection pipes and the flare for a gas control system need to be?


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Answer

- Use EPA Basic Screening Tool for project potential and use LFG generation modeling.

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Step 1: Is My Landfill Right for Energy?

Is your landfill a landfill with energy gas?

Are you sure you have a landfill gas collection system? If not, you may want to consider a landfill gas collection system.

How long has your landfill been operating?

How much waste is being landfilled?

How much waste is being landfilled per year?

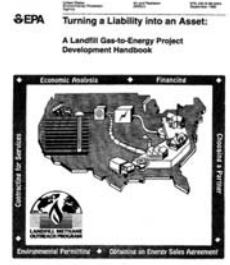
How much waste is being landfilled per acre?

How much waste is being landfilled per acre-foot?


How much waste is being landfilled per acre-foot per year?

How much waste is being landfilled per acre-foot per year per acre?

How much waste is being landfilled per acre-foot per year per acre per year?



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LFG Generation

- Phases of LFG generation
- LFG generation volume (Lo)
- LFG generation rates (k)
- LFG generation life (a long time)

Collection Rate = Generation Rate x Collection Efficiency

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Landfill Gas Recovery Rate

The amount of LFG that can be collected is a function of:

- How much LFG is being generated
- LFG system collection efficiency
- Air infiltration (cover issues)
- Geometry of the landfill
- Refuse permeability
- Extraction well spacing

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Modeling vs Measurement

- In U.S., modeling using U.S. EPA published default values, or assumptions based on experience at similar sites,
- Site specific data and/Limited field testing program consisting of an extraction *pump test* from either a single LFG extraction well or a limited number of wells in a portion of the site being tested, or
- A combination of the two.

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EPA Modeling

- LFG Flow = $k \times Lo \times \text{Exp}(-kt)$
- t = years
- k = rate factor yr^{-1}
 - Dry 0.02; AP42 0.04; NSPS Wet 0.05; Bioreactor up to 0.70
- Lo = methane yield per unit of mass
 - 100 cu m/kg = 1.6 cu ft/lb
 - 170 cu m/kg = 2.6 cu ft/lb
- C_{NMOC} (4,000 ppmv)

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Modeling

- Lo and k are never what the EPA suggests.
- At some sites this gets you close.
- Some sites the results are as much as an order of magnitude off.
- It is best to solve for Lo and k from other similar landfills.

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Relationship between Lo and k

- There are a number of combinations of Lo and k that can be used to predict LFG generated by a landfill.
- Can calculate k based on methane collection data from a closed section of a landfill. This allows the modeler to clearly see the methane decline with respect to time.

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LFG Extraction System Design Criteria (Extraction Wells)

Refuse Permeability	Horizontal to Vertical
▪ Design - Wet landfills	3:1
▪ Design - Dry landfills	5:1 – 10:1
▪ Measured (localized)	33:1

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Radius of Influence

- *Radius of influence* (ROI) field testing had been attempted to guide well spacing. One such method (EPA's Method 2E) has been published. However, such tests are costly and often difficult to interpret.
- ROI is more like an amoeba than a circle.

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Radius of Influence

- The Rules and Regulation Committee surveyed well design practices at over 58 United States landfills in 1991.
- It was found that nearly 60% of landfills used spacing of 200' or greater
- Some landfills use mixed spacing.

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Active System

- Flare Station: The facility at which the LFG is gathered and thermally destroyed.
- Recovery: The utilization of the LFG for productive purposes; can include power generation, low/high BTU fuel.
- If recovery system goes down, the flare starts so LFG continues to be burned.

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