



SMALL DIAMETER LFG WELLS

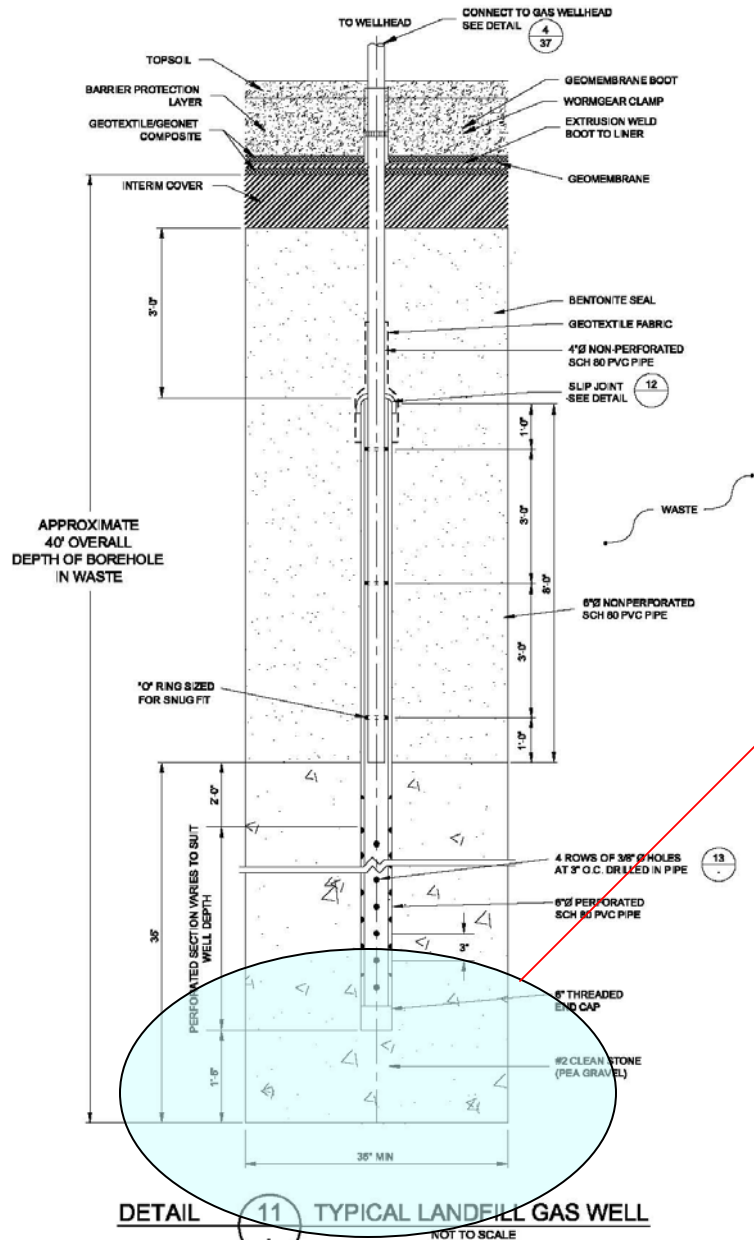
Conestoga-Rovers & Associates

Presented by Darlene Coons at:

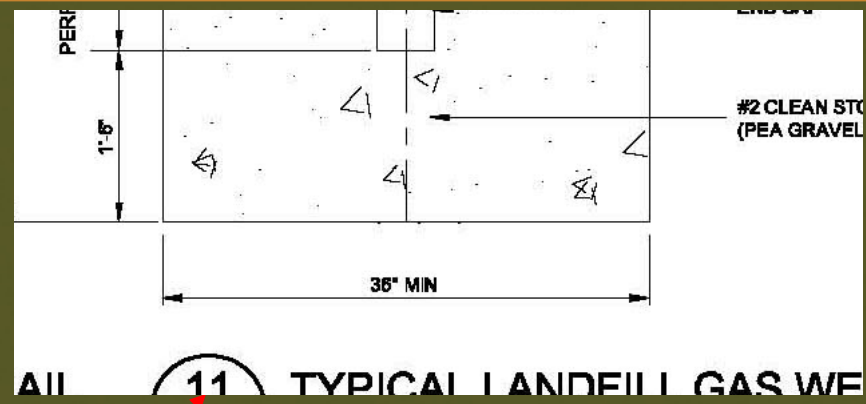


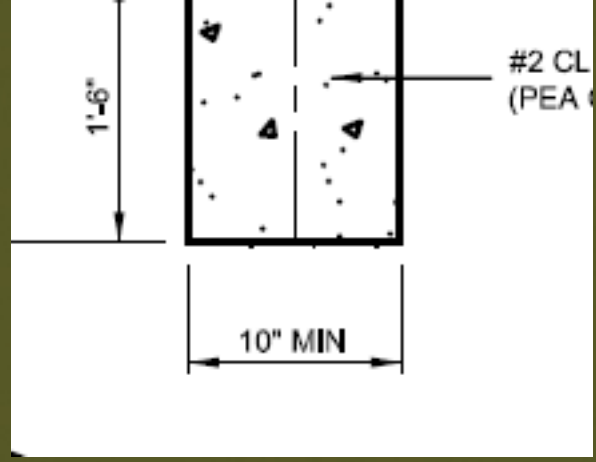
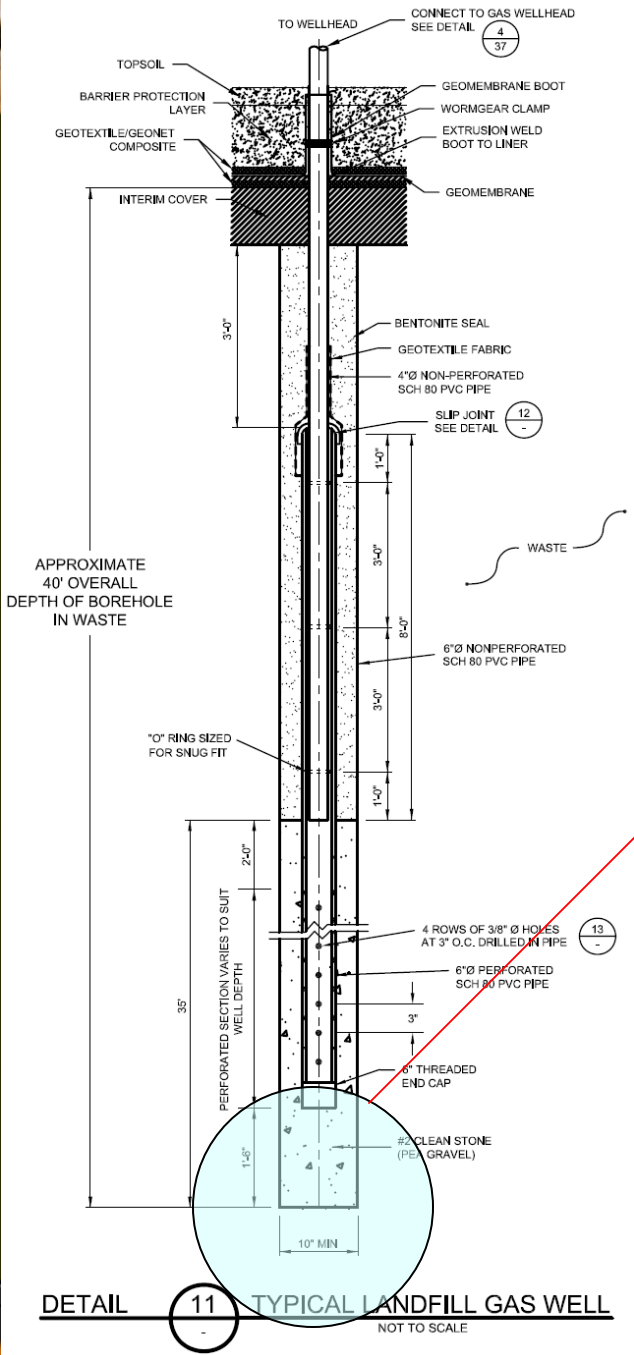
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**Solid Waste &
Recycling Conference
*with Trade Show***



DETAIL (11) TYPICAL LANDFILL GAS WELL
NOT TO SCALE





➤ 10" diameter of pea gravel around 6" well as opposed to 3 feet

Typical Vertical LFG Well

- 36-inch diameter boreholes
- drilled using bucket augers (~ 3 ft. wide)
- well depths up to 150'
- 3 feet of porous material (stone or tire chips) around well for most of depth (except for ~ top 10 feet)
 - Assumed greater area of influence
 - Assumed easier to get LFG



Ref: www.aegl.net/images/Well_Drill.jpg



Small Diameter LFG Wells

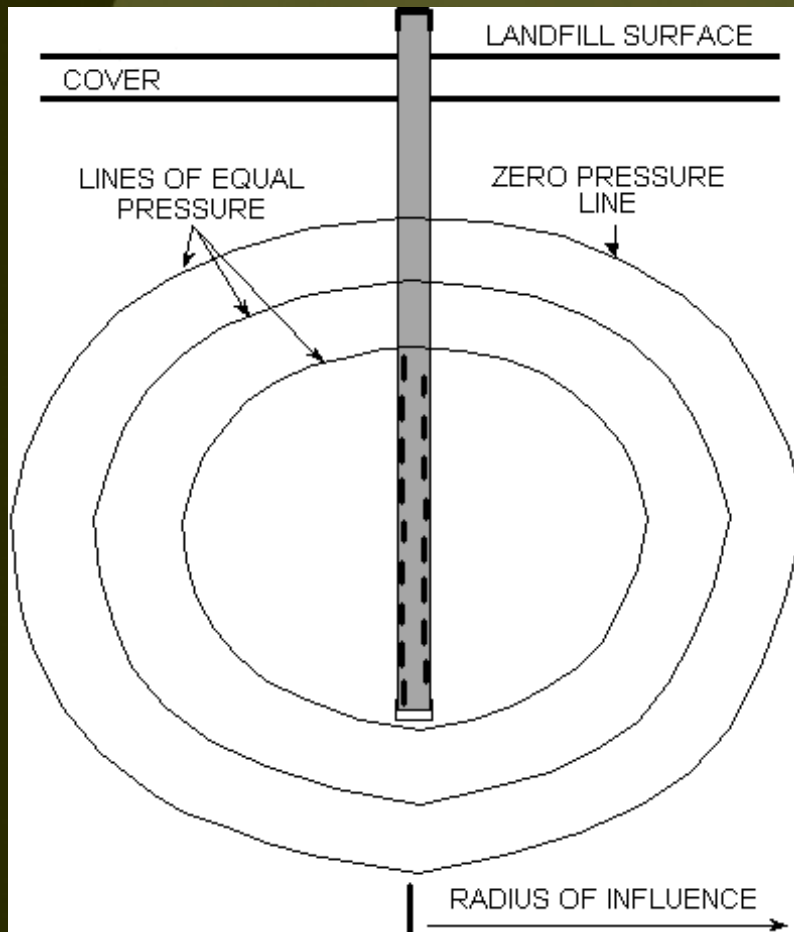
- 8-12 -inch diameter boreholes
- drilled using hollow-stem augers (HSA)
- less stone/tire chips (and clay/bentonite)
- typically shallow in depth (40-60 feet)
(but can be drilled to depths of up to 100 feet)
- in more modern landfills, often used in conjunction with horizontal LFG collectors



Basis for GCCS/Well Design

- Purpose
 - Control odors / emissions
 - Prevent gas migration
 - Maximize gas collection for energy recovery
- Age / type of waste / permeability
- Depth of waste / wells
- Operating pressure / vacuum
- Landfill construction / phasing
- Well spacing / radius of influence

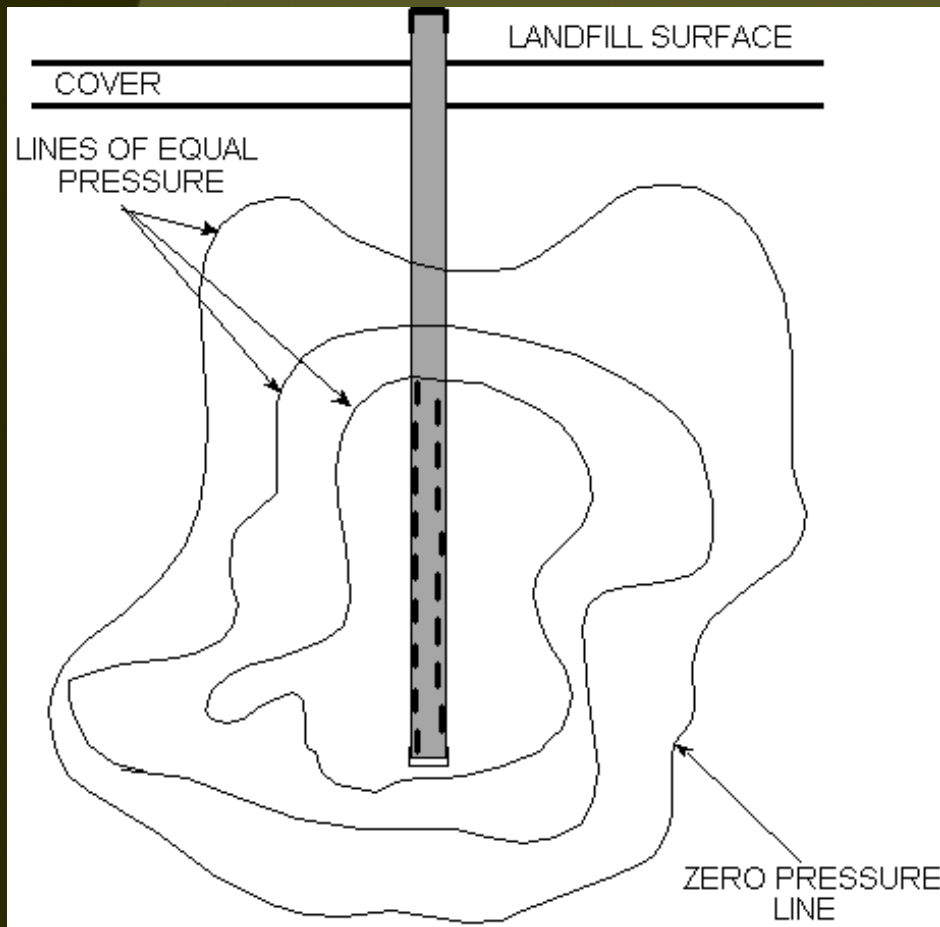
Theoretical Radius of Influence



- Thought that use of extra stone increases permeability and extends zone of capture and increases LFG flow
- Influence greater horizontally than vertically

Actual Zone of Influence

- Likely due to variation in waste characteristics
- Influenced by presence of liquids
- Vertical influence greater than horizontal





CRA's Findings

- Radius of influence is function of:
 - applied vacuum
 - condition of waste (e.g., layering/lensing)
 - level of saturation
- Studies show no significant change in performance compared to larger wells (waste already porous enough, and additional stone/tire chips does not improve permeability)



Typical Vertical LFG Well

- Pros:
 - expertise in installation/use
 - history/track record of proven effectiveness
 - in areas with water problems/localized perching, wells will tend to clear themselves and equalize more quickly



Typical Vertical LFG Well (cont'd)

➤ Cons:

- greater occurrence of breakouts on side slopes due to increased surface area
- costs of installation (~ 3-4 days for 1 well)
- cost of stone/tire chips (and clay/bentonite)
- potential for encountering large/entangling waste during installation (mattresses/cables) and associated difficulties if occurs
- need to handle mass of waste removed during well installation



Typical Vertical LFG Well (cont'd)

- Cons (cont'd):
 - amount of LFG escaping during borehole installation
 - harder to close off at surface and maintain seal
 - potential for easier air intrusion



Small Diameter LFG Wells

➤ Pros:

- reduced costs of installation (~ 1 day for 1 well)
- installed with conventional drill rig
- less stone/tire chips (and clay/bentonite) needed
- significantly less potential for encountering large/entangling waste during installation
- significantly less mass of waste removed & needed to handle from well installation



Small Diameter LFG Wells (cont'd)

- Pros (cont'd):
 - significantly less LFG escaping the borehole during well installation
 - less potential for air intrusion





Cost Comparison Vertical Extraction Wells

Assume 50' well

	<i>10" diam well</i>		<i>36" diam well</i>	
	<u>Quantity</u>	<u>Price</u>	<u>Quantity</u>	<u>Price</u>
Stone (35')	0.95 tons	\$ 23.75	12.4 tons	\$ 300.00
Clay/Bentonite (11')	0.11 tons	\$ 2.75	1.4 tons	\$ 35.00
Installation	1 day	\$ 1,000	2 days	\$ 2,000.00
	<i>Subtotal</i>	\$ 1,026.50		\$ 2,335.00



CONCLUSIONS

- Typical large diameter wells work just fine
- No need to abandon larger wells
- Small diameter wells work just as well
 - Control odors / emissions
 - Prevent gas migration
 - Sufficient gas collection for energy recovery
- Cost savings

