An Innovative Low-Energy Technology Application at MCB Camp Pendleton

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Overview of the Box Canyon Landfill GSR Project

• Location of Box Canyon (Site 7) Landfill
• History of Site 7 Landfill
• Laying the Groundwork to Use GSR
• Challenges to Incorporating GSR Projects
  – Regulatory Acceptance
  – Construction on Existing Landfill Cap
• GSR Projects at MCB Camp Pendleton’s Landfill, Site 7
  – Photovoltaic Project
  – Methane Micro-turbine Project
Regional Location of MCB Camp Pendleton
Specific Location of Box Canyon (Site 7) Landfill
History of the Box Canyon (Site 7) Landfill

- Landfill encompasses a 28-acre open area
- CAMU built next to a housing and elementary school on open municipal landfill
- Later lawsuit resulted in the only toxic tort case in Navy’s history
- Area continues to be a source of constant concern to State agencies
- Monitored methane gas levels fluctuate in and out of compliance
- Ongoing activities:
  - Landfill gas monitoring
  - Groundwater monitoring
  - Site maintenance
Laying the Groundwork for GSR Projects at the Site 7 Landfill

• Idea for photovoltaic (PV) panels onsite came from Mike Montgomery (Region IX Branch Chief) on a site tour

• MCB Camp Pendleton submitted request for $10M from the American Recovery and Reinvestment Act (ARRA)
  – Many strings attached, including an expedited schedule
  – Design complete, construction must start no later than 6 months after award

• Met with legal counsel, base, EPA and their attorneys to negotiate an ESD instead of a ROD Amendment

• Presented concept to the remaining Federal Facilities Agency (FFA) members supported by the EPA – important to note – resulting in a change in land use, not a remedy
Aerial View of Site 7 Landfill

Source:
Marine Corps Base Camp Pendleton
Aerial Photo Date 2007
Construction on an Existing Landfill Cap

- Settlement
- Bearing capacity of soil
- Stability
- Displacement
- Controlling erosion/soil loss
- Drainage control
- Infiltration
- Site access
- Landfill gas control system (not affected by design)
Site 7 Landfill Cap Drainage Plan

LEGEND

- Monitoring Well
- Gas Probe
- Storm Drain Inlet
- Settlement Monument
- Drainage Basin
- Drainage Sub-Basin
- Runoff Collection Ditch

STORM WATER RUNOFF SAMPLES TO BE COLLECTED AT OUTFALL HERE
Infiltration
• Approved vegetation list provided by NAVFAC SW biologist
  – Array area: short growth (<3 ft tall) & shade tolerant
  – In-between rows: “hearty” vegetation
• During construction, minimize disturbance to existing vegetation
• Conduct system O&M every 6 months, including vegetation checks

Site Access
• Existing improved surfaces will remain
• No additional improvements will be needed
Photovoltaic Design Specifications

- 1.48 MW (DC) capacity
- System made up of 220, 28-module 6.6 kW building blocks
- Each panel has a fixed 15° tilt, 190° orientation

Construction Specifications

- Units are built on self-ballasted, non-penetrating foundations
- Gravel interface between ballasts and landfill cover
- Adjustable system structure components
- Spacing between modules (maintenance)
- No excavation of the existing ET cover
Photovoltaic Layout Plan (~50% Design)
Site 7 Landfill P/V & Transmission Plan

FIGURE 2
Site Location Map
Design Considerations Report
Box Canyon Landfill (IR Site 7)
Marine Corps Base, Camp Pendleton, California
US Department of Navy Southwest Division
Naval Facilities Engineering Command

FIGURE REFERENCE:
PRELIMINARY DESIGN PROVIDED BY MB CAMP PENDLETON
SOLAR CONCEPTS 2010
GeoSyntec approached the Navy with GSR solution for continuing methane problem

Proposed a 30kW microturbine connected to methane gas collection wells and energy produced fed into PV panel system

Microturbine is the size of an industrial refrigerator
- Cannot see unit from the housing complex or school
- Unit runs quiet w/o a flare; optional night operation

System most adaptable to low methane production and fluctuations in gas volumes
Methane Gas Flow

- Uncovered front face is not venting
- Tributary canyon actively venting (GP-9 and GP-10)
- CAMU and final closure prevented upward discharge of methane
Proposed Gas Collection and Energy Production Schematic

- Gas Collection from Landfill
- Moisture separator
- Compressor
- Heat exchanger
- Gas Conditioning Unit
- Excess gas recirculation
- To Electric Grid or On Site Demand
- Microturbines
- Exhaust to Atmosphere
Summary

• Exciting opportunity to incorporate GSR on an existing, open IR site, i.e., ‘clean slate’

• Key to success was working with other agencies to meet Navy sustainability goals

• Key design criteria critical to success:
  – Counter-balanced, non-penetrating foundations will avoid construction into the existing landfill cap
  – High efficiency, fixed orientation, and modular PV cell units
  – Incorporating appropriate vegetation for use around PV cells
  – State-of-the-art microturbine capable of running efficiently at low methane concentrations (~7%)
  – Utilizing two GSR technologies at the same facility
Solar Power – General Issues to Consider

- Disturbs pristine desert environments (not an issue with landfills)
- May require cooling water, which is hard to find in deserts (the sunniest areas)
- A single solar panel generates very little electricity, so vast array is required
- Mechanical system required to keep panels adjusted towards the sun at all times
- Maintenance costs, weathering of expensive panels under the impact of the elements will need to be studied
- Need supplemental source of power during cloudy days, nights
- Carbon neutrality needs to be established on the basis of life cycle analysis. Specialty chemicals that go into solar panel manufacture have their own carbon footprint.
Microturbines – General Issues to Consider

• 11 operational projects (landfill gas microturbines) in California, utilizing 50 turbines, generating 2.7 MW of power
• Microturbines use 35% more fuel per kWh produced, compared to standard reciprocating engines and conventional turbines (US EPA, 2002)
• Energy produced may be sporadic, supplemental sources of power needed
• Maintenance requirements need to be tracked in the future
• Compressed landfill gas projects may also be worth looking at
Follow-up Contacts

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