



Methane to Markets

Landfill Operations to Improve Landfill Gas Collection

Amarjit Riat P.E, Assistant Director
Solid Waste Management Program
County of Fairfax, Virginia, USA

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Presentation Topics

- Landfill Basics
- Components of Modern Landfill
- Leachate
- Landfill Gas

Types of Landfills

- Open Dumps
- Sanitary Landfills
- Construction Demolition Debris
- Industrial
- Hazardous Waste Landfills

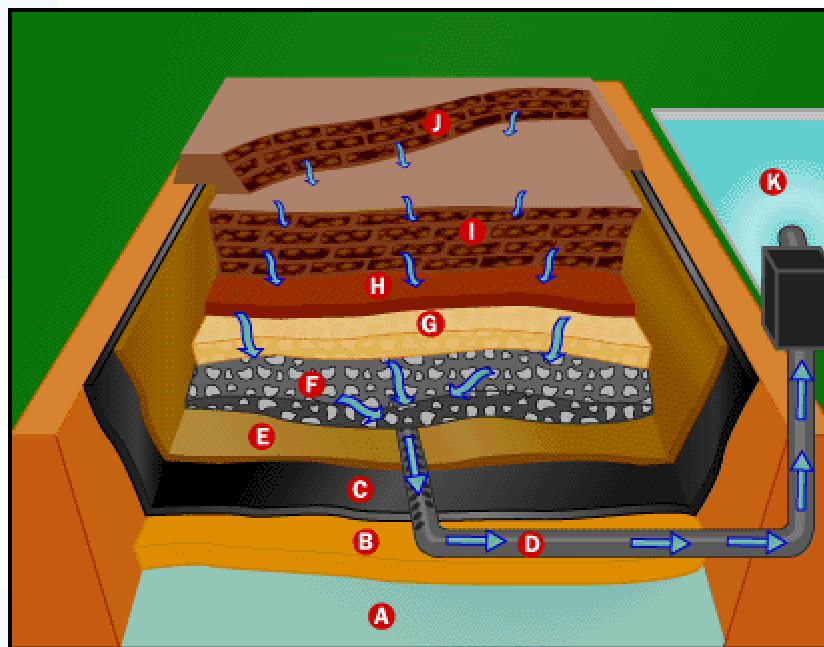
Landfill Basics

- Landfills provide for land disposal of waste.
- Designed to prevent pollution, fires, disease.
- Basics of sanitary landfill:
 - Waste containment in engineered cell
 - Water infiltration prevention
 - Liquids leaching prevention
 - Proper LFG management

The Sanitary Landfill

- Landfills are a Method of Disposing of Solid Wastes on Land Without Creating Nuisances or Hazards to Human Health or the Environment.
- Protect Safety and Health of staff and Citizens.
- Meet Regulatory Requirements

Sanitary Landfill



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- | | |
|-----------------------------------|-------------------------|
| A Ground Water | G Drainage Layer |
| B Compacted Clay | H Soil Layer |
| C Plastic Liner | I Old Cells |
| D Leachate Collection Pipe | J New Cells |
| E Geotextile Mat | K Leachate Pond |
| F Gravel | |

Sanitary Landfill

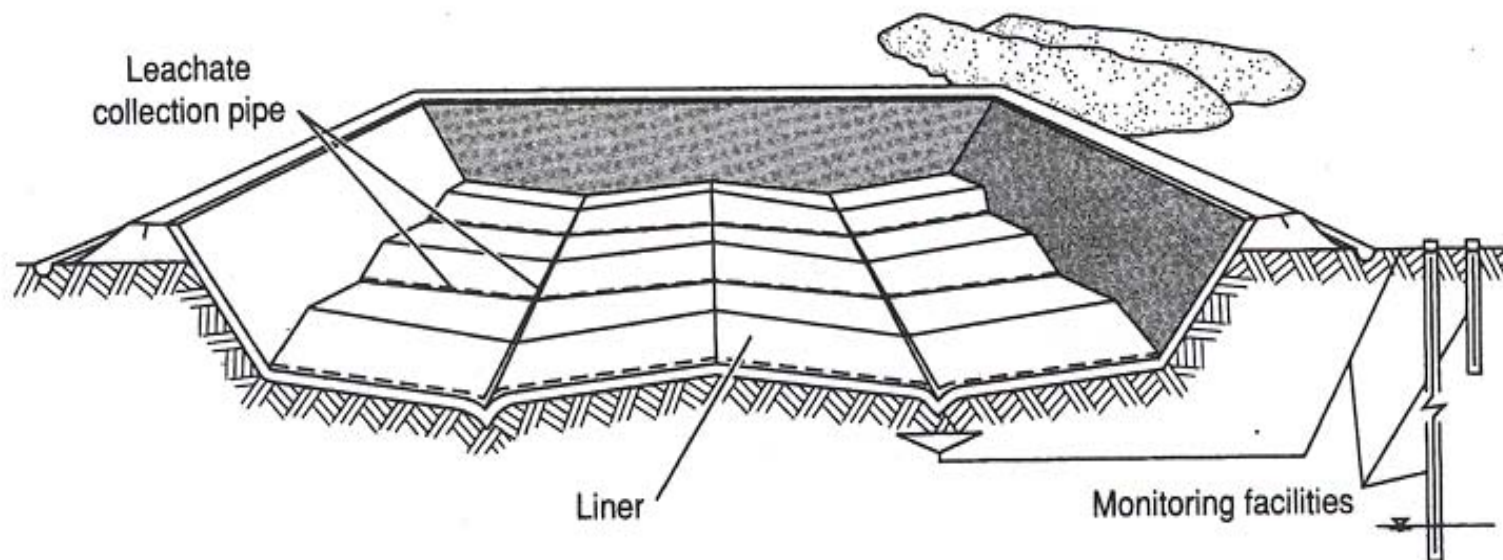
- Engineered Landfill
- Have bottom Liner (Clay or Synthetic)
- Leachate collection system
- LFG Collection System
- Groundwater Monitoring
- Surface Water Monitoring
- LFG Monitoring
- Meets the Regulatory Requirements
- Landfill Cover system (daily cover)
- Accepts MSW
- No Hazmat
- Post Closure Care

Modern Landfill

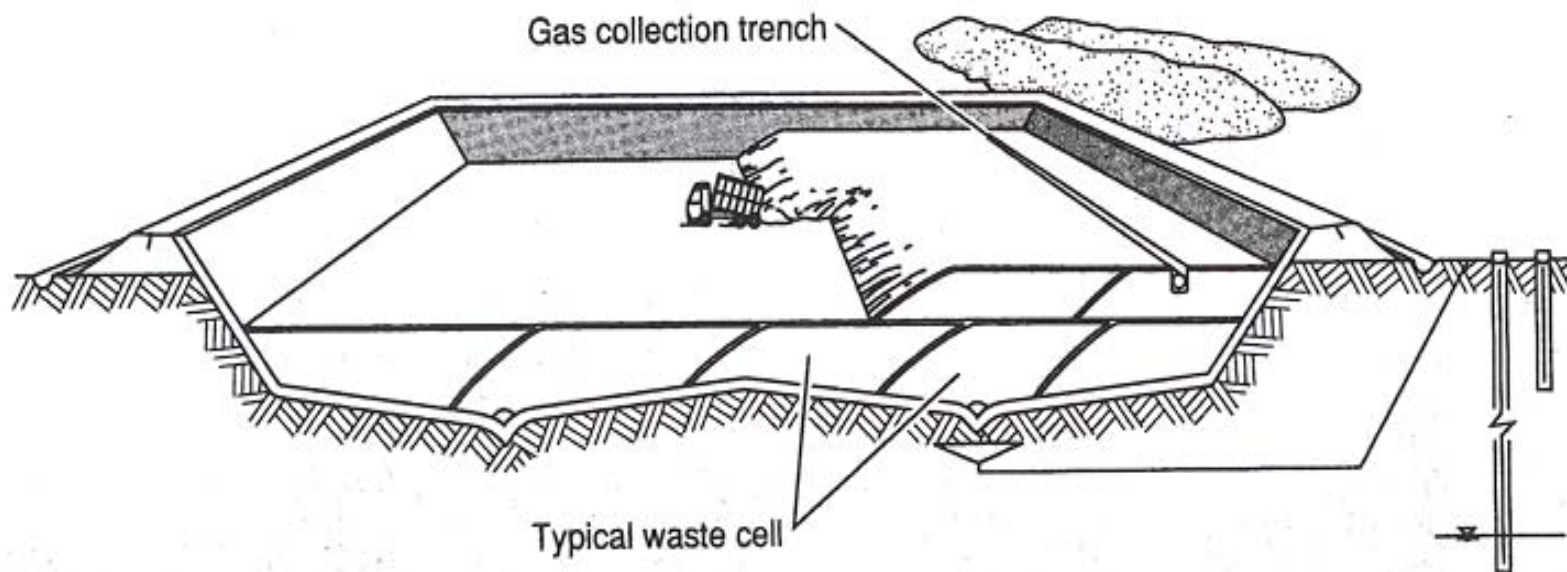




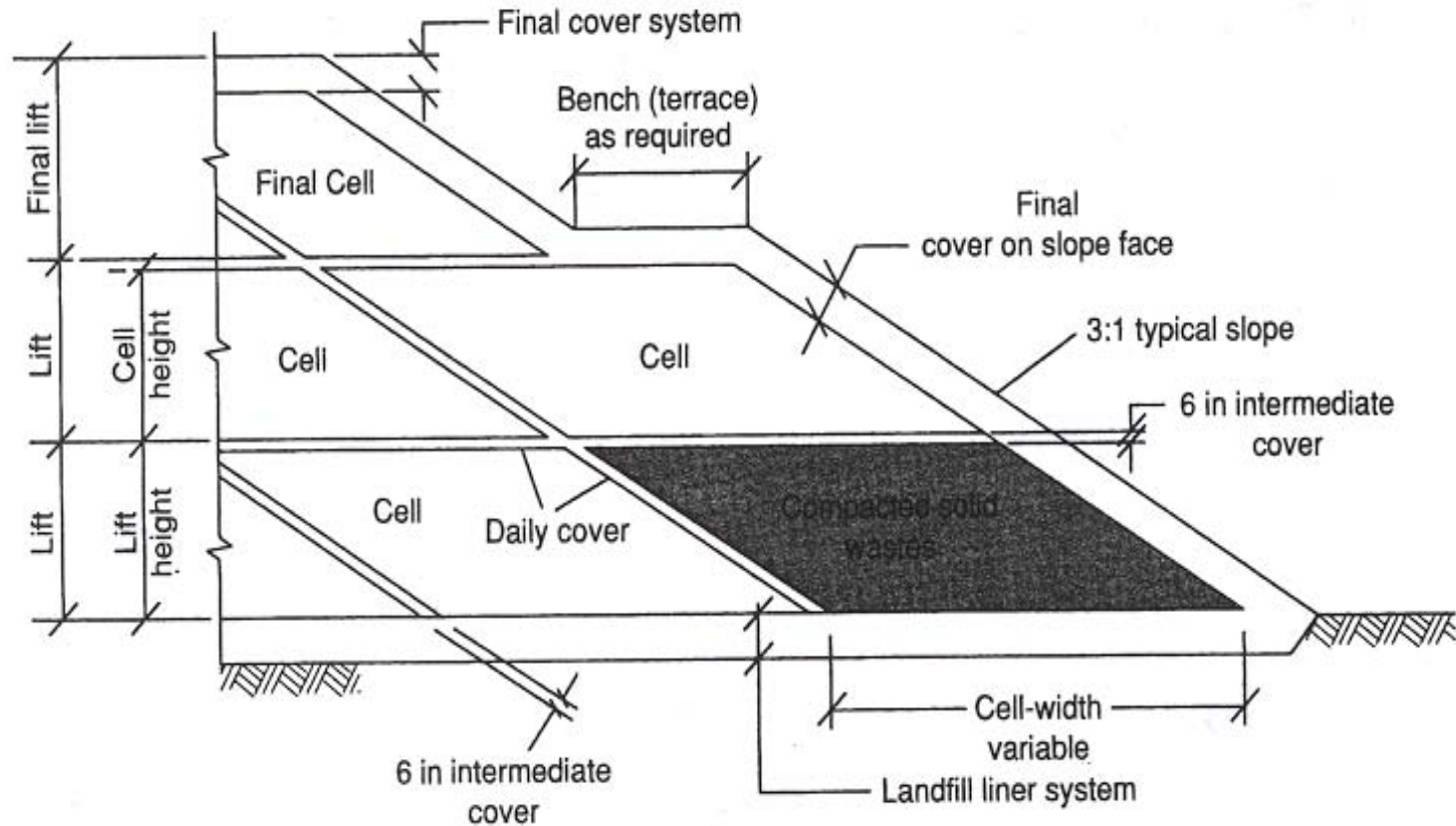
Development of a Landfill



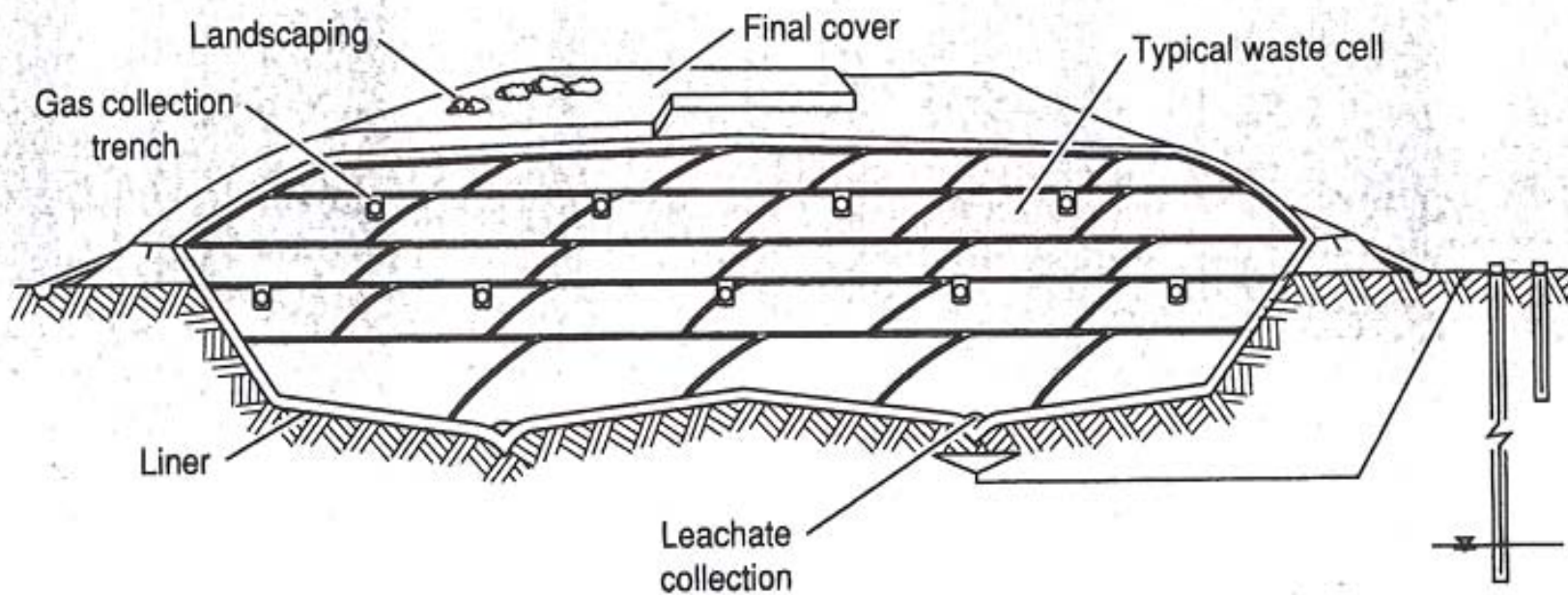
Landfill During Operations



Section Through a Landfill



Completed Landfill



Liner Construction



Spreading Liner



Liner Construction Defects



Leachate Collection



Leachate Pipe in a Gravel Trench



New Liner During Landfill Operations



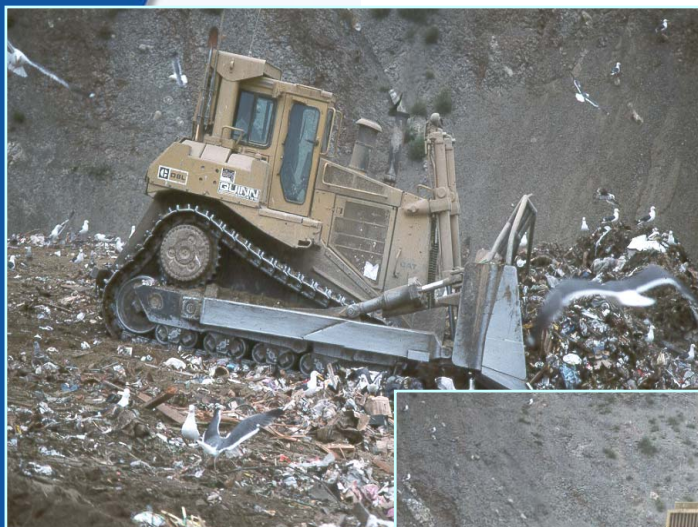
Working Face



Controlled Face



Landfill Equipment



Waste Spread With Dozer



Working Face in Layers



Compact Waste & Cover



Daily Soil Cover



Daily Cover With Dozer



Foam Daily Cover Application



Tarp Daily Cover



Closure of Landfill



HDPE Cap





Stormwater Management



Exposed Earth

Stormwater Management (continued)



With Sediment Control

Leachate

- Leachate is a Solution Containing Dissolved and Finely Suspended Particles from the Waste
- Contaminants in the Leachate are Dependent on:
 - Solid Waste Composition
 - Physical, Chemical, and Biological Activity within the Landfill

Leachate

- Leachate is Typically a High Strength, Soluble Organic Waste, with High Concentrations of Inorganic Constituents

Leachate Treatment



Leachate Management

- Inspect and repair collection and storage systems
- Treat leachate on site and discharge
- Transport leachate for off-site treatment
- Repair leachate seeps

Landfill Gas

- Produced from Solid Waste Decomposition
- Amount & Composition Dependent on Solid Waste Characteristics
- Increase in Organics Equals an Increase in Gas Generation
- Gas Production Ends with End of Decomposition

Landfill Gas Well Drilling

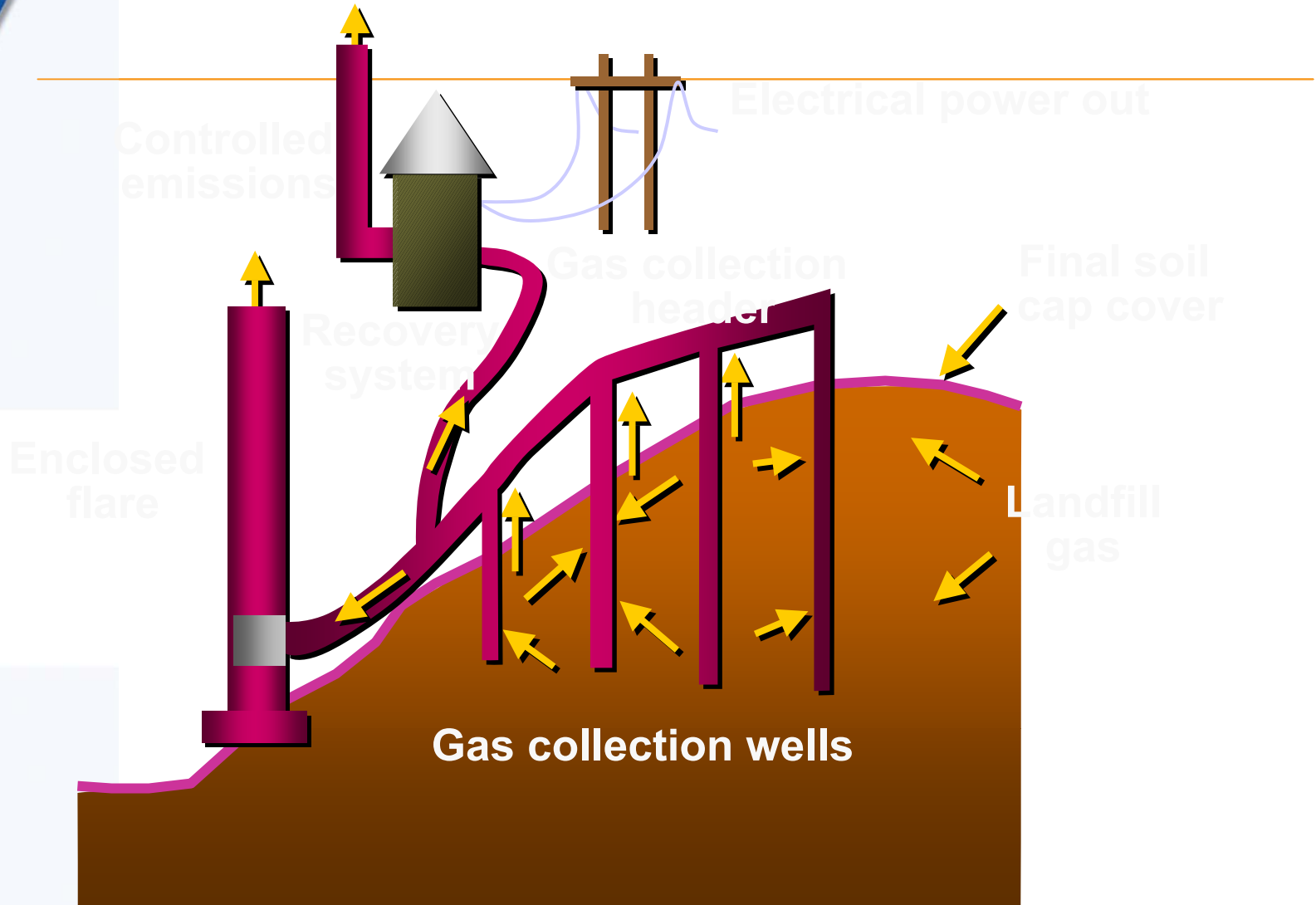


Landfill Gas

- Methane (CH₄) and Carbon Dioxide (CO₂) Make Up Almost 100% of Landfill Gas
- All Other Constituents Make Up Less Than 1% of Landfill Gas
- Production gas depend upon composition of waste and type of degradation (Aerobic or Anaerobic)
- Type of Cap at the landfill also impact the gas production



Landfill Gas Collection System Components



Landfill Gas Management

- Inspect and repair collection system
- Inspect the landfill look for distressed vegetation
- Condensate removal and disposal
- Maintain flares and other destruction devices
- Operate and oversee recovery system
- Check settlement at Landfill
- Check settlement of Pipes



Optimizing the LFG Production

- Regular Inspection of Cap at the landfill
- Proper LFG Well Construction
- Installation of Collection Headers
- Monitoring and balancing well field
- Monitoring for Migration and Surface Emission
- Proper Management of Leachate/Condensate
- Regular Maintenance of LFG Collection System
- All weather Access to LFG Collection System
- Good Record Keeping
- Staff Training and attending LFG conferences and networking
- Good communication system

LFG Flare Station



LFG Monitoring

Monitoring for Pressure
Oxygen
Temperature
Migration and Surface
Emission
Composition of Gas
Perimeter Monitoring

LFG Monitoring

