

The Impact of Elevated Leachate Levels on LFG Generation and Recovery at MSW Landfills in Asia

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Presentation Outline

- ❑ Formation of Leachate?
- ❑ Observations at LF sites in Asia
- ❑ Impacts Due to High Leachate Levels
- ❑ Leachate Collection
- ❑ Leachate Treatment
- ❑ Minimization of Leachate
- ❑ Improving LFG Recovery
- ❑ Q&A

Landfill Leachate

Formed from a combination of sources

- Moisture deposited with the waste**
- Moisture from decomposition process**
- Moisture contacting the waste (i.e. not diverted away from waste)**
- Infiltration of precipitation through cover materials**
- Groundwater or tidal influences – through un-lined areas**



Leachate Characteristics

- ☹️ **Black liquid (Anoxic and Acetic)**
- ☹️ **Strong Odor**
- ☹️ **High in Total Dissolved Solids (TDS)**
- ☹️ **High in metals & chlorinated compounds**
- ☹️ **High in Ammonia, BOD, and COD**
- ☹️ **Also high in**
 - ☹️ **Hydrogen Sulfide**
 - ☹️ **Mercaptans**
 - ☹️ **Other VOCs**
- ☹️ **Foam – methane in solution**



Observations at Sites in Asia

- Wet waste with high organic fraction
- Unconfined tipping areas
- Scavengers
- Poor cover conditions
- Lack of surface water management
- Elevated leachate levels
- Inadequate leachate treatment systems
- Slope Failures
- Discharge to nearby rivers and lakes

Lower LFG Recovery Rates!



Full of Leachate!



Signs of High Leachate Levels

Visual

- Foam from leachate or gas wells / boreholes
- Seepage along landfill slopes
- Excavation (trenches / pits) full of leachate
- Discoloration of nearby water bodies
- Leachate in surface water channels
- Ponds on landfill surface
- Slope Failures

Quantitative

- Measurement of liquid levels in vertical wells / boreholes
- Sampling and analyses of leachate characteristics

Signs of Leachate



Pond on LF surface



Impacts to LFG production

- **Elevated leachate levels can reduce LFG generation and collection efficiency**
 - ☹ **Impedes methane production process**
 - ☹ **Excessive Ammonia levels**
 - ☹ **Excessive moisture percentage**
 - ☹ **Reduces LFG collection efficiency**
 - ☹ **LFG collection components flooded**
 - ☹ **Dewatering required**
- **Other Operational Impacts**
 - ☹ **Overloads leachate collection and treatment systems**
 - ☹ **Seepage can overload surface water management systems**
 - ☹ **Erosion and potentially Slope failures**

LFG and ER decrease



Environmental Impacts

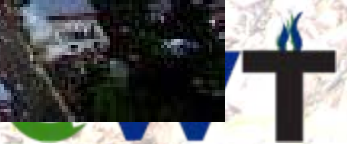
- **Leachate Contamination and Potential Toxicity Issues**
 - Groundwater contamination – in some areas this means drinking water!
 - Contamination of rivers and lakes
 - Aquatic ecosystem toxicity,
 - Detrimental to fish population and fishing industries
 - Odor issues (Ammonia, H₂S, Mercaptans)
 - Potential hazards due to offsite migration of leachate (explosive gases and H₂S in confined spaces)

Issues with Slope Stability

Indonesia - Leuwigajah dumpsite
21st Feb 2005. 150 fatalities



Philippines - Payatas dumpsite
10th July 2000 - 230 fatalities

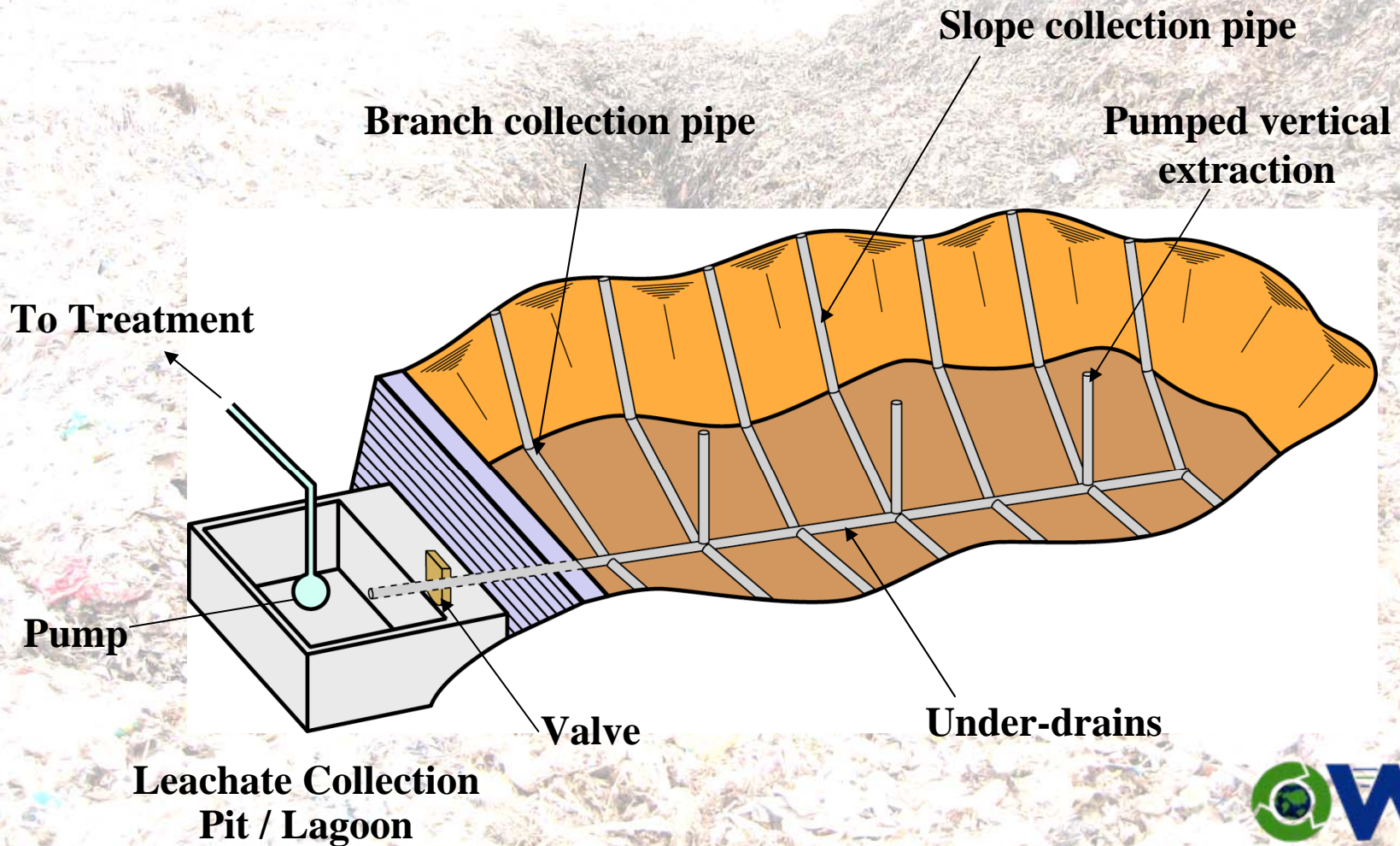


Leachate Collection Methods

- **Lining system – containment is key!**
 - **Gravity flow under-drains**
 - Installed (above liner) prior to waste placement
 - **Extraction via pumps in vertical wells**
 - Pneumatic or Electrical
 - **Combined Extraction**
 - LFG and Leachate
 - Vertical wells
 - Horizontal trenches



Leachate Collection



Landfill lining and leachate collection systems



Leachate Treatment Methods

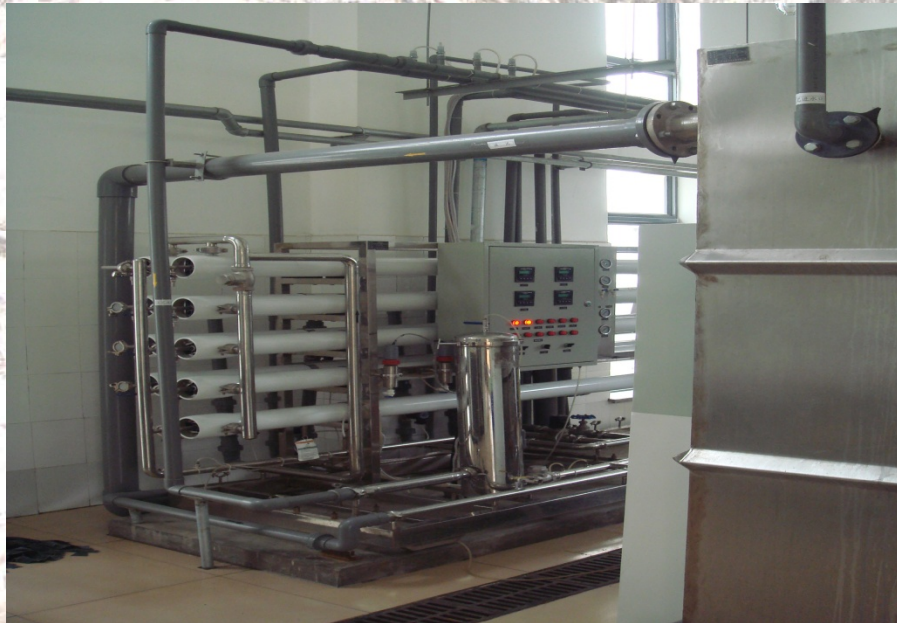
- **Often a combination of mechanical, chemical or biological technologies:**
 - Lagoon Evaporation
 - Aeration
 - Sedimentation
 - Ammonia Stripping
 - SBR anaerobic treatment - Aerobic polishing
 - Reverse Osmosis
 - Leachate Evaporation
 - Reed Beds
 - Carbon Adsorption
 - Transfer to Public Pre Treatment Works

Aerobic Treatment



Extended Aeration





Reverse Osmosis



Sequential Batch Reactor (SBR)



Chemical Additives



pH Adjustment
Fenton Reagent



Leachate Evaporation



**Volume reduction up to 97% - residual returned to
Landfill**



Leachate Re-Circulation

- **Control of leachate level within landfill by re-circulation**
 - Pumps and injection wells / trenches
 - Sprinkler systems
- **Promote biodegradation through recirculation of nutrients and distribution of moisture**
 - Improves LFG production
 - Lowers leachate treatment requirements
 - Additional air space created
 - Close monitoring required

Capping / Cover Systems

- **Temporary / intermediate / final capping layer system**
 - Minimize infiltration
 - Limit air intrusion
 - Composite systems
 - Daily Cover
 - HDPE / LDPE
 - Clayey Soils



Interim Cover



Surface Water Management

Goal is to minimize water entering waste mass, reducing the levels of leachate, and the amount for collection and treatment

- **Temporary drainage berms and channels to partition or segregate surface water from entering the active filling area**
- **Channels on the side slopes drain to perimeter channels for storm water runoff**

Surface Water Management



Results: Improved LFG Recovery

- **Removal of excess leachate from the landfill (in conjunction with proper maintenance of capping and surface water management systems):**
 - Improved methane generation rates
 - Improved LFG collection efficiency
 - Allows extraction from a larger prism of waste
 - Increases radius of influence
 - Reduced Infiltration of precipitation
 - Reduced fugitive emission of LFG
 - Reduced air intrusion
 - Reduced environmental and operational impacts



Additional LFG-to-Energy



Lessons Learned at Several Landfills in Asia

- **Improving leachate, capping, and surface water management practices has resulted in the following trends:**
 - **Increases in LFG recovery ranging from 30% to 100 % in LFG**
 - **Additional revenue from power generation, gas export, renewable credits, and CER**
- **Operation practices can be improved with proper training and time for implementation**
- **More data collection is ongoing to determine the long-term results!**

**Thank you for your kind
attention!**

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