That Looks Nasty!

A PRIMER ON LANDFILL LEACHATE

For illustrative purposes only

Otter Lake Community Monitoring

Leachate refers to the liquid that forms when rainwater percolates through the waste in landfill, picking up various contaminants and dissolved substances along the way. Moisture within the waste itself also contributes to leachate formation in the landfill cell. Proper management of the leachate is crucial to prevent environmental pollution. Here's how leachate is generated and collected in municipal solid waste landfills.

Aerial Viw of the Otter Lake Landfill

1. Access Road
2. Scale and Administration
3. Stormwater Retention Pond
4. Leachate Tank
5. Stormwater Retention Pond
6. Closed Cells
7. Cells Under Construction

Leachate Generation

Composition

Leachate composition varies widely, based on the waste content. It typically contains organic matter, heavy metals, ammonia, pathogens, and various dissolved and suspended pollutants. Leachate is toxic to aquatic life and can contaminate groundwater or surface water used for drinking.

Anaerobic Conditions

Landfills create an anerobic (low-oxygen) environment due to compacted waste layers, slowing down decomposition. This environment promotes the generation of complex and often toxic compounds in leachate.

Age of Landfill

Leachate generation rates decrease over time as waste decomposition slows. However, even in older landfills, significant leachate continues to be generated for years, necessitating long-term management strategies.

Leachate Collection

Liner Systems

Modern landfills employ liner systems with multiple layers, including a composite liner (clay and geomembrane) or alternative systems, like geosynthetic clay liners (GCLs) to prevent leachate from migrating into the environment.

Leachate Collection System Components

Leachate Collection Pipes/Drains: These are placed above the liner and within the waste mass to intercept and transport leachate

Geotextile or Gravel Layers: These aid in the distribution of leachate, preventing clogging of drainage systems.

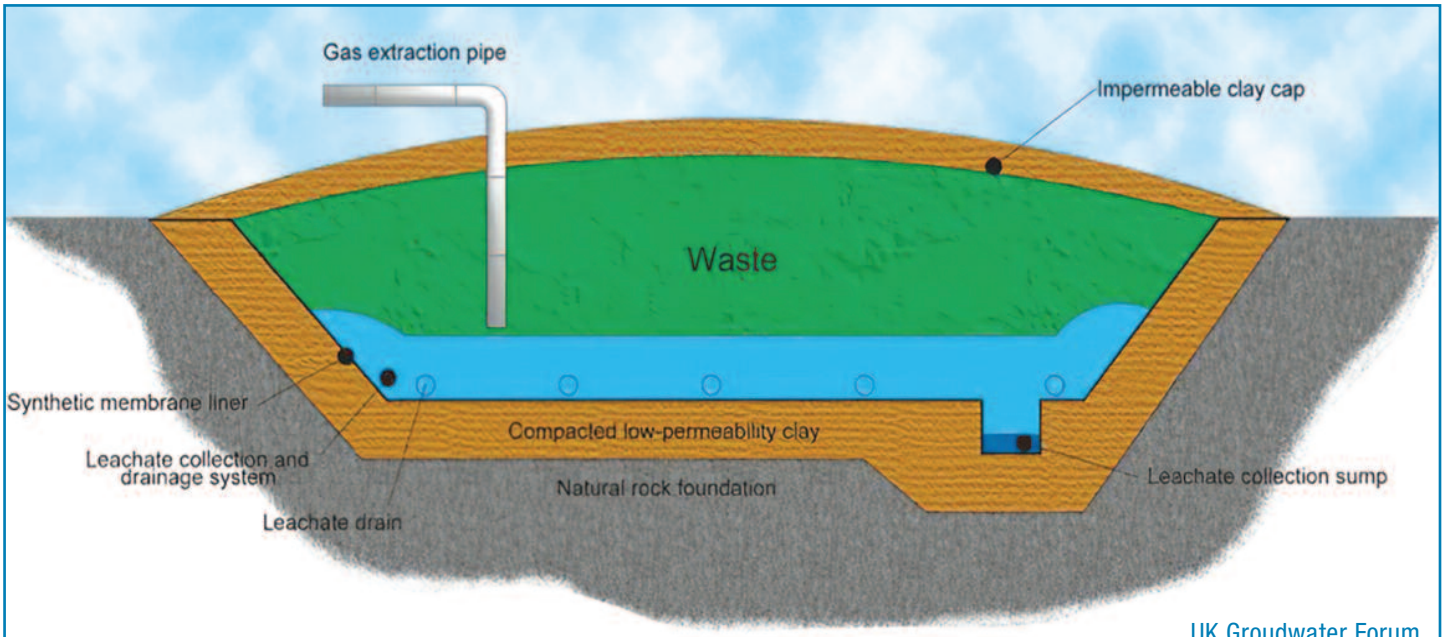
Sump Pumps and Wells

Sumps: These are low points in the landfill where leachate accumulates. Sump pumps are used to extract the collected leachate

Wells: Sometimes extraction wells are drilled into the landfill to collect leachate from specific depths.

A Typical Disposal Cell Cross-Section

Cross-section ilustration of a typical disposal cell showing components of leachate collection system



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A Complex Operation

The Otter Lake landfill has a complex network of leachate collection and conveyance piping. Leachate collects in sumps (low points) at the base of each disposal cell, just above the synthetic liner. Sensors in the sumps trigger pumps which send leachate via dedicated piping from each cell to a diked 250,000 gallon storage tank. The stored leachate is transported by tank trucks to the Halifax Water treatment plant at Mill Cove. In 2023, 81,828,000 litres of leachate were collected and removed from the Otter Lake landfill, an increase of 10 million litres over 2022.

Neither the landfill operator or the Department of Nova Scotia Environment and Climate Change is aware of a release of leachate from a landfill cell, the conveyance piping or storage area at the Otter Lake landfill.

Truck loading leachate

Environmental monitoring of site groundwater and on-site and off-site surface water is required by the landfill's operating approval and is conducted and assessed by a third party consultant. Groundwater monitoring is done by collecting water samples from wells, which intersect the groundwater table upgradient and downgradient from the disposal cells. Surface water monitoring is accomplished by collecting water samples from watercourses (streams, rivers) or drainage ditches, which cross or border the site.

Leachate storage tank

Treatments

Pretreatment: Initial screening and removal of large debris or particles.

Physical Treatment: Processes like sedimentation, filtration or aeration to remove suspended solids.

Biological Treatment: Using microorganisms to break down organic pollutants.

Chemical Treatment: Adding chemicals for neutralization or precipitation of contaminants.

Advanced Techniques

Recirculation: Some landfills employ leachate recircultion techniques where treated leachate is reintroduced into the landfill to enhance waste degradation and gas production.

Bioreactors: These are designed landfills where leachate recirculation and controlled aerobic conditions accelerate waste decomposition, minimizing leachate generation.

Challenges and Mitigation

Leachate Quality: Variability in leachate composition poses challenges in treatment. High ammonia, heavy metals, or persistent organic compounds require specialized treatment methods.

Climate Factors: Increased rainfall or changes in climate patterns can affect leachate generation rates, necessitating adaptable management strategies.

Landfill Gas Generation: Mangement of leachate is often linked with controlling landfill gas (mostly methane) emissions, as they are interrelated byproducts of waste decomposition.

Landfill Gas extraction well

Legal and Regulatory Aspects

Landfill leachate management is subject to strict regulations regarding its collection, treatment and disposal to minimize environmental impact and protect public health, The Department of Nova Scotia Environment & Climate Change has a *guideline document* on landfill construction which includes specifics on leachate collection.

The Otter Lake landfill was constructed after the introduction of these guidelines.

Continued research and technological advancements in leachate treatment and landfill design are essential for more effective and environmentally friendly waste management practices.

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Learn more about the Otter Lake Community Monitoring Committee at www.otterlakecmc.ca

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