

# Phew! What's that Smell?

A PRIMER ON LANDFILL GAS



Otter Lake Community Monitoring

## Gas Generation in Landfills

### What is landfill Gas?

When trash is dumped in a landfill, it starts to decompose. The decomposition of organics and compostable waste produces gases such as methane and carbon dioxide, which are colourless and odourless. Hydrogen sulfide gas, also a byproduct of this decay process, is anything but odourless. Collectively, these gases are known as landfill gas. Inorganic materials such as plastic do not decay rapidly and do not contribute appreciably to landfill gas production. However, these materials should be diverted from landfills for recycling.



**Stop!** Don't add to the creation of landfill gas by putting organic waste like this banana peel in the trash. Organic and compostable waste belong in the green bin.

**Anaerobic Decomposition:** When organic waste, like food scraps, paper and plants decompose in a landfill without oxygen (anaerobic conditions), it produces gases. Bacteria break down the waste, releasing gases as byproducts.

### Hydrogen Sulfide (H<sub>2</sub>S)

**Formation:** When organic matter containing sulfur breaks down without oxygen, it releases hydrogen sulfide gas.

**Odour:** Hydrogen sulfide has a strong unpleasant odour, often described as similar to rotten eggs.

**Health Concerns:** Even at low concentrations, hydrogen sulfide can be harmful. It can irritate the eyes, throat and respiratory system. Prolonged exposure to high levels can cause health problems.

**Mitigation:** Landfill operators work to minimize hydrogen sulfide production through waste management practices and gas collection systems. Gas collection helps capture hydrogen sulfide along with methane and other gases, reducing its release into the air.

## Managing Hydrogen Sulfide and Other Gases

### Gas Collection Systems

These systems include networks of wells and pipes that collect landfill gas for treatment or later use. Typically in Nova Scotia, collected gases are flared (burned) at landfill cells, the designated waste disposal areas within the landfill. Flaring landfill gas results in Greenhouse Gas emissions but is better than having untreated landfill gas emissions leak directly into the atmosphere.

## Monitoring

Regular monitoring of gas levels helps identify increases in hydrogen sulfide and other gas, allowing for prompt action.



*A Gas Control System Team member at the Otter Lake Landfill takes readings from a hand-held gas detector. They are used to guide the suction rates of the gas vacuums attached to each of the landfill's 75 active wellheads. Photo: Jason Timms*

## Cover Systems

Applying covers on sections of the landfill can help contain odours and reduce gas emissions. Daily cover, typically ground up construction materials, is applied over newly deposited waste to reduce moisture intrusion and deter scavengers such as rodents and gulls. An impermeable layer, either synthetic or clay, is applied to hold gases in the cell and keep moisture from seeping into it. Vegetation is encouraged as a final effort to keep the cover intact.

## Four Factors Influencing Gas Generation

### Waste Composition

Different types of waste break down at different rates, affecting the speed and amount of gas production.

### Moisture Content

Wetter conditions can enhance decomposition and gas generation.

### Temperature

Warmer temperatures usually accelerate the breakdown of waste and subsequent gas production.

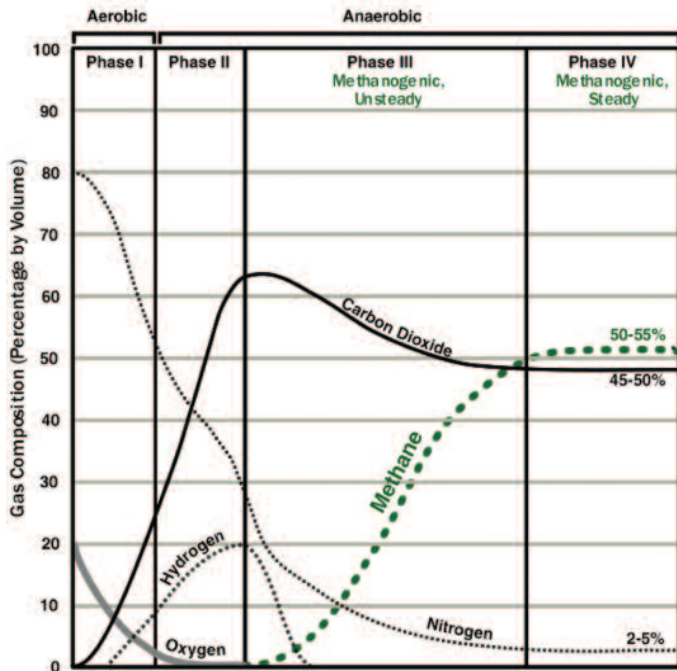
### Stage of Decomposition

Older (deeper) layers of waste may be more saturated with water and deprived of oxygen, laying the foundation for anaerobic decomposition resulting in the formation of hydrogen sulfide gas.



*These dead hydrangeas should have been put in a green bin.*

## Graphic representation of percentage of gas type produced versus length of burial.



## Landfill Gas Collection

### The Rationale

Landfill gas can be harmful to the environment if it is released into the air. Methane, for example, is an especially potent greenhouse gas that contributes to climate change and *needs to be collected*.

### How Landfill Gas is Collected

Vertical wells are drilled into the cells and connected with pipes, fitted with holes, to let the gas flow inside the pipes. They are placed deep into the landfill and a vacuum or pump sucks the gas out through the pipes. In Nova Scotia, as previously noted, landfill gas is flared.



The brick building at the Otter Lake landfill contain blowers that suction the methane and the sulfur compounds found in landfill gas from the waste burial cells through a pipe network. The large tank fills with condensate; flares from the larger pipes burn the gas, and the smaller pipes relieve pressure. Photo: Jason Timms

### Storage or Use

When cleaned, collected gas can be stored in tanks or used for different purposes such as energy generation and fuel. Some landfills use gas to produce electricity or to heat buildings. Used as fuel, it can power vehicles or machinery.

### Benefits of Collecting Landfill Gas

By collecting the gas, harmful emissions are prevented from entering the atmosphere and the gas can be used as an energy source, reducing the need for other fossil fuels.

### Challenges

Maintenance and monitoring are key issues. Collection systems need regular maintenance to work efficiently and constant monitoring is required to ensure gas is properly collected and treated.

## Accidental Odour Release from Landfills

Even with good management of the waste stream and well-designed and maintained containment and collection systems, accidental releases of landfill gas occur.

Still, managing landfill gas is crucial to minimizing their environmental and health impacts. Successful management requires a combination of gas collection systems, monitoring and waste management strategies. Humidity, atmospheric pressure and wind strength/direction all influence the impact of odours on surrounding neighbourhoods.



*The hand-held GEM5000™ samples and analyzes the methane, carbon dioxide and oxygen content of landfill gas and the results guide adjustments to the suction rates of the gas vacuums attached to each of the active wellheads at the Otter Lake Landfill. Photo: Jason Timms*



*The methane gas suctioned from the garbage burial cells at the Otter Lake Landfill is being flared. The process consumes the sulfur compounds, the source of the noxious odour in landfill gas. In daylight, flares are hardly visible because of methane's nearly transparent blue flame. Photo: Jason Timms*

### Three Reasons for Accidental Odour Releases

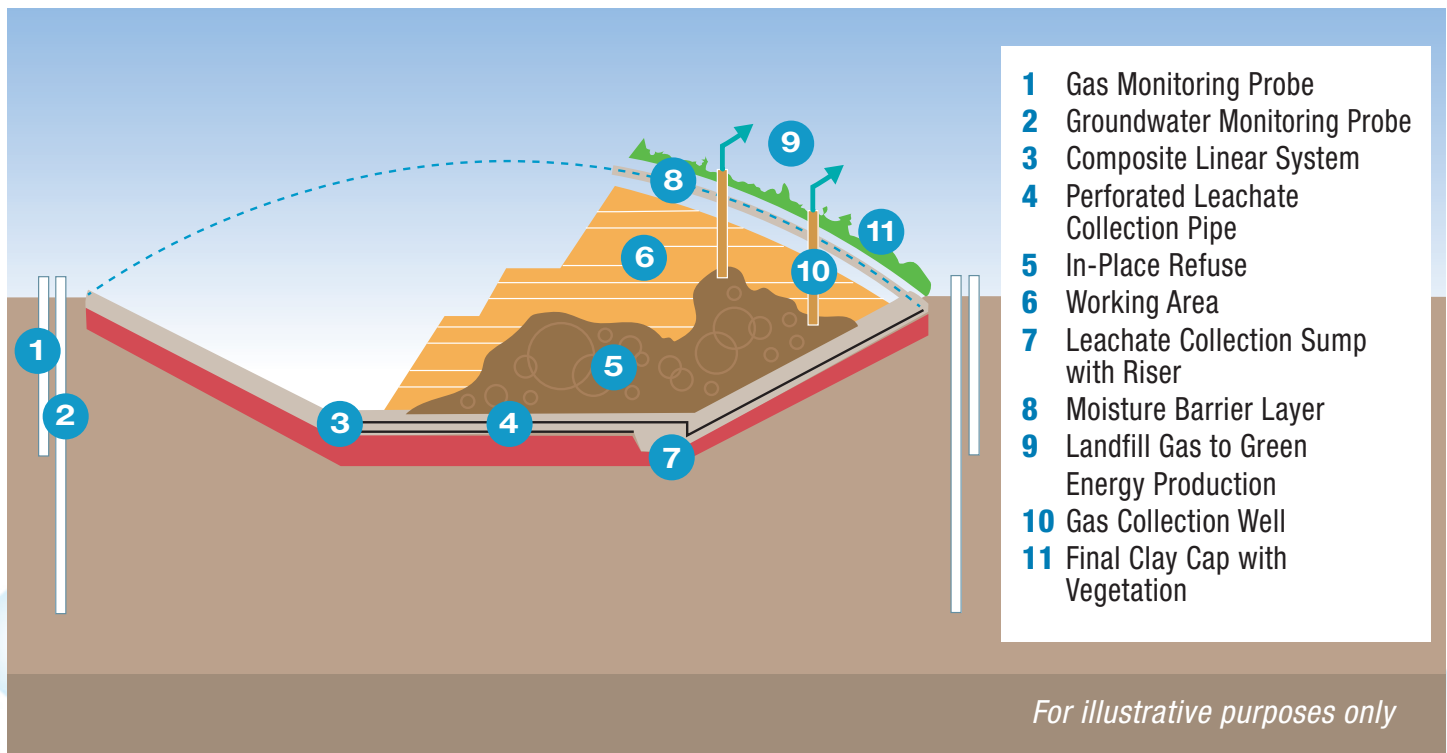
**Integrity of Cover:** The integrity of the final vegetated cover is essential to the functioning of the cell. Weather extremes such as drought can dry out and crack the clay cover and allow the release of gasses. Similarly, excessive moisture can degrade the cover, and water infiltration can upset the chemical balance in the cell, leading to more generation of hydrogen sulfide.

**Gas Collection System Damage:** A failure in the gas extraction system or an obstruction in the ports of the gas collection piping can lead to a build-up of gas volumes in the cell. The resulting pressure could force uncollected gas into the atmosphere.

**Cell Maintenance:** Should it become necessary to excavate a portion of a disposal cell in order to enhance or repair portions of the gas collection or leachate collection systems, a release of landfill gas will result. The Leachate collection system refers to the process of gathering the liquid that forms after water filters through landfill waste.

## A Typical Landfill Cross-Section

A landfill usually has four layers supported by a thick bottom liner to prevent waste or liquids from seeping into the ground.



**Top layer (Cover):** Often soil or special materials are used here to minimize odours and prevent rainwater from trickling through.

**Active Waste:** Below the cover layer, lies recently deposited waste, where decomposition and gas generation are most active.

**Landfill Gas Collection System:** Beneath the active waste and buried in the garbage is a network of pipes that collect the landfill gas as it forms.

**Drainage Layer:** This layer helps manage liquids that form as waste breaks down by directing them away from the waste to prevent them from mixing with the gas.



## Conclusion

**Landfill gas is a natural result of trash break down. Collecting and using it responsibly helps protect the environment and it can even provide a source of useful energy. Through proper collection and treatment, we can reduce pollution and make the most of what would otherwise be a harmful byproduct of waste.**

The chemical processes, which take place within a disposal cell are for the most part predictable and depend on waste composition, moisture and oxygen content, and the control and removal of resulting byproducts. The inadvertent release of landfill gas into the atmosphere can have a negative short-term effect on nearby healthy communities, but it can also create serious difficulties for some individuals with pre-existing health conditions.

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