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Landfill Gases and Odors

Where does my trash go? What is a landfill?

Private homes, business and industry all produce waste. This waste is regulated as either hazardous waste or solid waste. It is the non-hazardous solid waste, commonly called trash or garbage, that is often sent to landfills. Examples of non-hazardous waste accepted at municipal solid waste landfills include paper products, discarded food, plastics, metals, glass, and household items such as old furniture and appliances.

Where does construction trash go?

Waste generated during construction, demolition, remodeling, or repair of pavements, houses, commercial buildings, or other structures is sent to a construction demolition and debris landfill. Waste such as stumps, wood, brush, leaves, soil, and road spoils that are generated from clearing operations are also sent to this type of landfill.

What types of gases are found in a landfill?

Landfill gases are typically made up of hundreds of different types of gases. The main gases produced by a municipal solid waste landfill are usually methane (40-65 percent of all gases produced) and carbon dioxide (40-60 percent). Both carbon dioxide and methane gas are colorless and odorless. Methane is lighter than air. Landfill gas also contains small amounts of nitrogen, oxygen, ammonia, sulfides, hydrgen, carbon monoxide, and non-methane volatile organic compounds.

Where does landfill gas come from?

Most landfill gas is produced when organic matter is broken down by bacteria naturally present in the waste and the soil used to cover the landfill.

How can landfill gas reach my neighborhood?

- Landfill gases move from higher pressure areas (areas deep within the landfill) to lower pressure areas (areas such as ground surface and off-site areas).
- Landfill gases easily move through loose sand or gravel soils and are released to the air through any available crack or opening.
- Landfill gases follow the path of least resistance, often moving along buried utility lines (water, electrical or gas lines).
- At older, unlined landfills, the landfill cover (cap) often permits gas to move out sideways underground from the landfill. Note: A landfill cover or cap is usually made of clay or some other rainproof material.
- Gases usually move away from the decaying garbage, but the specific pathway is unpredictable.

Weather conditions can have a role in how readily gas leaves the landfill's property boundary. Gas released into the air is carried by wind. While wind dilutes the gas with fresh air, it can also move gas into neighboring communities. Temperature inversions may also play a part in how long odors from gas stay in the lower air levels. Wind speed and direction determine how much gas reaches nearby residents, so the amount of gas at a particular location varies greatly from day to day. At locations near the landfill, the worst time of the day for odors is often early morning as morning winds tend to be gentle, resulting in less dilution of the gas than occurs during windier times of the day.

Wet weather, such as what Virginia experienced in the fall and winter of 2009-10, can enhance the decomposition process and potentially add to odors.

How are landfill gases detected?

Landfill gases are mostly invisible, but can be detected in the environment by:

- Odors: Landfill gases commonly contain hydrogen sulfide gas which produces a foul, rotten egg odor. This odor can be detected by humans at very low levels – levels much lower than those at which this chemical can cause health problems. In contrast, many potentially harmful gases such as volatile organic compounds have distinctive smells, but cannot typically be detected in landfill gases because they are present in low amounts. Although certain types of gas cause odors, odor alone is not a good indicator of whether gas is present in surrounding areas because: (1) many gases do not have strong or distinctive odors, and (2) people get used to odors quickly and may stop noticing them. Periodic monitoring is necessary to determine the nature and extent of landfill gas emissions.

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✦ Stressed or dead vegetation: Landfill gases reduce the amount of oxygen in the soil. The lack of oxygen affects deep root growth and often results in the death of deep-rooted plants, especially trees. Soils with high levels of landfill gases may not grow vegetation or the vegetation is stunted and limited to shallow-rooted plants.

✦ Landfill gas monitoring probes: Landfill gas probes are narrow, hollow tubes inserted in the ground. There are holes in the sides of these tubes that allow gas vapors to flow into the tube. The tubes are then sealed to trap the gas. These sample results can show the type and amount of gas and whether it is at a level that can raise public health concerns.

What landfill odors do I smell?

Sulfides and ammonia are the most common sources of odor in landfill gas. Sulfides produce a rotten-egg smell that humans can detect even at very low amounts. Ammonia produces a pungent odor that many people are familiar with from its use in household cleaning products. Both are normally present in the air, regardless of the presence of a landfill. The formation of hydrogen sulfide gas within a landfill depends on certain factors, including moisture content, temperature, pH, amount of available oxygen and presence or absence of a sulfate source.

Gypsum wallboard, a component of construction and demolition debris waste, is a major contributor to hydrogen sulfide gas formation in landfills. CDD and crushed CDD "fines", containing gypsum, are a significant source of sulfate. Other waste streams that may contain sulfate include wastes from pulp and paper mill bleaching and coating operations as well as sludges from wastewater treatment plants.

In addition to landfill gas, there are three other common sources of landfill odor:

- New waste being dumped
- Specific wastes with strong odors such as manure and fermented grains
- Liquid within the landfill known as leachate coming to the surface

Is landfill gas hazardous to my health?

Landfill gas has the potential to be a short-term health hazard. People with respiratory ailments such as asthma are especially sensitive to landfill gas. However, these temporary conditions are reversed as soon as the gases are reduced or eliminated.

Many people find the odors emitted from a landfill to be unpleasant. Although these odors are undesirable, no medical attention is usually required. Landfill odors may cause temporary symptoms such as nausea and headache, but there is considerable variation in how sensitive people are to these effects.

Certain volatile organic compounds, when inhaled at large concentrations over a long period of time, can be harmful to people. However, it is unlikely that concentrations released from landfills can cause any permanent or long-term health effects.

Who can I call for health-related questions about landfill gases?

Contact your local Virginia Department of Health director (http://www.vdh.state.va.us/lhd/districtpubliclst.doc).

How can landfill gas odors be reduced?

✦ Under state law, landfill owners and operators must monitor methane gas levels at their property boundaries and take action to protect occupied structures, such as homes.

✦ Containing and removing gases can reduce the possible health hazards due to the movement of landfill gases off-site into nearby properties. "Containing" means to contain the landfill gases on site and not allow them to move off-site. "Removing" means to remove, subtract from or completely stop the production of landfill gases.

✦ Containing: Virginia landfills are required to contain the landfill waste and gases through impermeable bottom liners and an engineered cap or cover.

✦ Removing: Landfill gas is vented from the interior of the landfill to the outside. This reduces gas pressure within the landfill and limits the ability of the gas to move off-site. Gas abatement can be done passively or actively through:

- Simple vents installed at points around the landfill.
- A pipe system that pumps the gas from the landfill to a central collection area.
- The collected gases can be simply released to the air, burned off in a flare, or collected to be used as a fuel resource (natural gas).
- Minimize the amount of open area on the landfill by covering the waste daily or weekly, as well as applying the final cover within the regulatory time frames.
- Develop an odor control management plan.

For More Information:

Landfill Gas, Answers to Frequently Asked Health Questions, Ohio Department of Health, Bureau of Environmental Health, Health Assessment Section, Rev 02/03/10

Report on Odor and Gas Management at Solid Waste Facilities, Maine Department of Environmental Protection, January 2009

Landfill Gas and Odors, Chemical Hazards Program, Environmental Health and Injury Prevention Branch, Georgia Division of Public Health, Georgia Department of Human Resources

Landfill Gas Primer An Overview for Environmental Health Professionals, Agency for Toxic Substances and Disease Registry, November 2001