



**Bureau of Environmental Health
and Radiation Protection**

“Protect and improve the health of all Ohioans by preventing disease, promoting good health and assuring access to quality care.”

Landfill Gas

Answers to Frequently Asked Health Questions

Municipal Solid Waste Landfills (MSWLF):

Private homes, business and industry all produce waste. The wastes we create are regulated as either hazardous waste or solid waste. It is the non-hazardous solid wastes that are often sent to a municipal solid waste landfill (MSWLF). Commonly called trash or garbage, the non-hazardous waste accepted at MSWLF include items such as paper products, food items, plastics, metals, glass and household items such as old furniture, appliances and household hazardous wastes.

Note: For a listing of the common household hazardous wastes that can be taken to your local household waste collection events, visit the Ohio EPA household hazardous waste web site at: www.epa.ohio.gov/dhwm/recycpro.aspx

Ohio Environmental Protection Agency (OEPA) regulations require Ohio landfills to be designed and operated to prevent contamination from moving into the environment. The landfill design and operation system include a liner and a leachate (landfill water) collection systems. Landfills also monitor for methane gas and have gas collection systems.

What are landfill gases?

Landfill gases are colorless vapors that are produced at solid waste landfills and other waste disposal sites where trash and garbage are buried in the ground and covered with dirt. Over time, the bacteria in the soils will break down (decompose) the organic wastes in the landfill. The by-product of these bacteria breaking down the

garbage will produce gases, just as humans produce carbon dioxide gas when we breathe out the oxygen we take in. Volatile organic compound (VOC) gases can also be produced in a landfill when common household chemical products vaporize (turn from a solid or liquid into a gas).

The amount and type of gases created by a landfill depends on the amount of garbage buried in the landfill, the type of garbage buried, the age of the landfill, the size and depth of the landfill and the chemical environment within the landfill.

The gases created in a landfill will try to move through the landfill to reach the surface air. Once in the outdoor air, landfill gases will mix with the air and be carried by the surface winds. Wind speed, wind direction and barometric pressure can affect whether residents will come in contact with these landfill gasses. Because wind speed and wind direction change, the degree of the exposure to odors will be different from day to day. At locations near a landfill, landfill gases tend to be most noticeable in the early morning, when winds tend to be most gentle, providing the least mixing of air and dilution of the gas. Landfill gas production tends to be highest when the weather is hot and dry; it decreases with cooling temperatures or frequent rainfall.

Characteristics of landfill gases:

- Landfill gases try to 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 will be

released to the air through any cracks it can find

- Landfill gases will take the path of least resistance, often following buried utility lines (water, electrical, or gas lines)
- At older, unlined landfills, the landfill cover (cap) will often cause gas to move out sideways underground from the landfill. **Note:** A landfill cover or cap is usually made of clay or some other rainproof (impermeable) material
- Gases will usually move away from the decaying garbage, but it is difficult to predict the specific directions the gas will follow

What kinds of gases are found in a MSWLF?

Landfill gases are typically made up of hundreds of different types of gases. The main gases produced by a MSWLF are usually methane at 40-65% and carbon dioxide (CO₂) are colorless and odorless gasses. Methane, at certain levels, can be flammable or even explosive and can pose a physical hazard. Since methane is lighter than air, it can pose a physical hazard if trapped in confined spaces of buildings, such as basements and crawl spaces.

Other landfill gases are produced by bacteria breaking down organic material and are called reduced sulfur gases or sulfides (examples: hydrogen sulfide (H₂S), dimethyl sulfide and mercaptans). These gases *do* have odors and they give the landfill that familiar "rotting" smell. But hydrogen sulfide (H₂S) and non-methane VOCs make up a much smaller proportion of the landfill gas at less than 1%.

How can we detect landfill gas?

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

- **Odors:** Landfill gases commonly contain hydrogen sulfide (H₂S) gas which produces a foul, rotten egg odor. This H₂S odor can be detected at very low levels, levels much lower than

those at which this chemical can cause toxic health problems. In contrast, potentially harmful VOCs have a distinctive, sweet, ether-like smell, but you cannot usually smell them in landfill gases because they are present at such low concentrations.

- **Stressed or dead vegetation:** Landfill gases will reduce the amount of oxygen in the soils. 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 will not grow vegetation or the vegetation will be 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 create a public health threat.

How can landfill gases affect my health and safety?

Under the right set of environmental conditions, landfill gas can be a potential health hazard to residents living close to a landfill. However, a person must be exposed to specific concentrations of chemicals and over a specific period of time before health effects can occur. The two types of health hazards include:

- **Physical Hazard:** The methane gas that typically makes up 40-65% of landfill gas is not toxic, but it can ignite and cause an explosion under specific conditions. The specific conditions include the right combination of methane and oxygen, plus a source of ignition (spark-fire). Methane can be explosive at concentrations that range from 5-15% methane per volume of air. At concentrations below 5%, methane levels are too low to ignite. At concentrations above 15%, methane levels are too rich and oxygen levels are too low to combust.
- **Toxic Chemical Hazard:** H₂S and

VOCs like benzene, perchloroethylene (PCE), trichloroethylene (TCE) and vinyl chloride can be toxic to people if they are inhaled at certain concentrations. If concentrations are high enough, breathing these gases can cause breathing difficulties, nausea (upset stomach), dizziness, headaches and central nervous system problems. Breathing these gases at high concentrations for extended periods of time (years) can cause the development of specific types of cancer and other serious health problems.

How can we reduce landfill gas hazards?

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, that are located within 1,000 feet of landfill waste placement (OAC Rule 3745-27-12). Containment and abatement can reduce the possible health hazards due to the movement of landfill gases off-site into nearby properties. Containment simply means to contain the landfill gasses on-site and not allow them to move off-site. Abatement means to remove, subtract from or completely stop the production of landfill gasses.

- **Containment:** Ohio landfills are required to contain the landfill waste and gases through impermeable bottom liners and an engineered cap or cover.
- **Abatement:** 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, or
 - A pipe system that pumps the gas from the landfill to a central collection area.

The collected gasses can be simply released to the air, burned off in a flare, or collected to be used as a fuel resource (natural gas).

References:

ATSDR. Landfill Gas Primer: An Overview for Environmental Health Professionals. November 2000

Georgia Division of Public Health, Environmental Health and Injury Prevention Branch, Chemical Hazards Program. Landfill Gases and Odors. 2000

U.S. EPA. Municipal Solid Waste website. www.epa.gov/osw/nonhaz/municipal/msw99.htm. Accessed 2009.

For information on Ohio landfills:

Ohio Environmental Protection Agency web site at: www.epa.ohio.gov/dsiwm

Where Can I Get More Information?

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