

Important Things to Know About Landfill Gas

Landfills can produce objectionable odors and landfill gas can move through soil and collect in nearby buildings. Of the gases produced in landfills, ammonia, sulfides, methane, and carbon dioxide are of most concern. Ammonia and hydrogen sulfide are responsible for most of the odors at landfills. Methane is flammable and concentrations have sometimes exceeded explosive levels indoors. Methane and carbon dioxide can also collect in nearby buildings and displace oxygen.

This fact sheet provides information on what measures can be taken to prevent gases from leaving landfills and entering off-site structures and how building owners can reduce landfill gas collection indoors, particularly in confined areas like basements and crawl spaces.

Landfill Gas

Landfill gas contains many different gases. Methane and carbon dioxide make up 90 to 98% of landfill gas. The remaining 2 to 10% includes nitrogen, oxygen, ammonia, sulfides, hydrogen, and various other gases. Landfill gases are produced when bacteria break down organic waste. The amount of these gases depends on the type of waste present in the landfill, the age of the landfill, oxygen content, the amount of moisture, and temperature. For example, gas production will increase if the temperature or moisture content increases. Though production of these gases generally reaches a peak in five to seven years, a landfill can continue to produce gases for more than 50 years.

Movement of Landfill Gases into Buildings

Landfill gases can move from a landfill through soil into outdoor air as well as the indoor air of nearby buildings. Landfill gases in outdoor air can enter a building through windows, doors, and ventilation systems. In soil, landfill gases can migrate and enter a building through cracks in the basement floors and walls, utility entry points (e.g., where underground water or electrical lines enter a building), sump pump holes or floor drains. This is called soil vapor intrusion. Once they enter a building, landfill gases may collect in areas of poor ventilation, such as basements, crawlspaces, and utility tunnels.

Odors from Landfill Gas

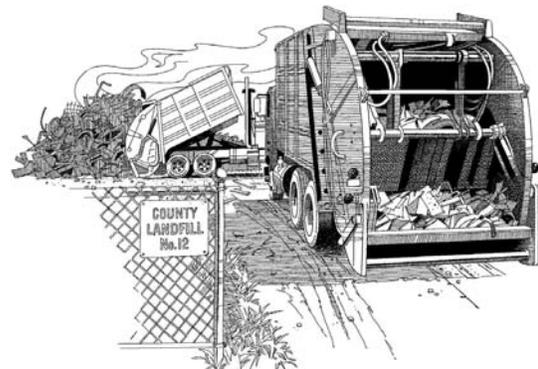
Odors in landfill gas are caused primarily by hydrogen sulfide and ammonia, which are produced during breakdown of waste material. For example, if construction and demolition debris contain large quantities of wallboard (also called drywall or gypsum board), large amounts of hydrogen sulfide can be formed. Hydrogen sulfide has the foul smell of rotten eggs, while ammonia has a strong pungent odor. Humans can detect hydrogen sulfide and ammonia odors at very low levels in air, generally below levels that would cause health effects.

Health Effects of Ammonia and Hydrogen Sulfide

Short-term exposures (typically up to about two weeks) to elevated levels of ammonia and hydrogen sulfide in air can cause coughing, irritation of the eyes, nose, and throat, headache, nausea, and breathing difficulties. These effects usually go away once the exposure is stopped. Studies have been conducted in communities near landfills and waste lagoons to evaluate health effects associated with exposure to landfill gases. These studies lasted for several months and reported health complaints which coincided with periods of elevated levels of hydrogen sulfide and landfill odors. The reported health complaints included eye, throat and lung irritation, nausea, headache, nasal blockage, sleeping difficulties, weight loss, chest pain, and aggravation of asthma. Although other chemicals may have been present in the air, many of these effects are consistent with exposure to hydrogen sulfide.

Methane Safety Hazards

Methane is the major component of natural gas. It is highly flammable and can form explosive mixtures with air if it concentrates in an enclosed space with poor ventilation. The range of air concentrations at which methane levels are considered to be an explosion hazard is 5 to 15% of the total air volume. Landfill gas explosions are not common occurrences.



Health Effects Associated with Methane and Carbon Dioxide

Methane and carbon dioxide are colorless, odorless gases that can displace oxygen in enclosed spaces. Health effects associated with both methane and carbon dioxide result from the lack of oxygen rather than direct exposure to these gases. Health effects caused by a reduced oxygen level include a faster heartbeat and having to take deeper breaths, similar to the effects felt after vigorous exercise. A greatly reduced oxygen level (that is, when the oxygen level is well below its usual level of 21% of the total air volume) can cause reduced coordination, fatigue, nausea, vomiting, and unconsciousness. These effects have rarely been reported from landfills.

Controlling Landfill Gas Migration at Landfills

When landfills have reached the maximum amount of waste they can hold, several feet of cover material are placed over the landfill mass. Gas collection wells are then installed throughout the capped landfill. These wells are made of perforated pipes which give the gas an easy path to move vertically to the surface rather than laterally (outward) toward off-site locations (e.g., buildings). As the gases enter these wells they are either vented into the outdoor air, passed through a flame and broken down by burning, passed through a filter, or used in an energy recovery program. Landfill gas vents need to be kept drained and clear of obstructions such as snow and debris. Older landfills and smaller dumps may not have gas control measures.

Reducing Landfill Gas in Homes

Homeowners should contact their Regional New York State Department of Environmental Conservation office if they suspect landfill gases are entering their home. A link for contact information is provided in the "For Additional Information: On a specific landfill" section of

this fact sheet. Measures a homeowner or developer can take to help prevent landfill gas from entering a building include minimizing entry points and making sure there is adequate ventilation. Entry points for landfill gas can be minimized by eliminating cracks and gaps in the basement by caulking and sealing. These measures will help to reduce the potential for landfill gases to build-up in indoor air. In some cases, additional measures may be needed to reduce landfill gas migration from soil into buildings. For example, installing a sub-slab depressurization system will direct soil vapor away from the building. A sub-slab depressurization system is often included in new construction on or adjacent to landfills.

For Additional Information

On a specific landfill:

New York State Department of Environmental Conservation
Regional Office Contact Information
www.dec.ny.gov/about/558.html

On a specific landfill gas:

U.S. Environmental Protection Agency
www.epa.gov/methane/

New York State Department of Health
www.health.state.ny.us/environmental/emergency/chemical_terrorism/ammonia_tech.htm
www.health.state.ny.us/environmental/chemicals/hydrogen_sulfide/index.htm

Landfills & landfill gas control measures:

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/HAC/landfill/html/intro.html

U.S. Environmental Protection Agency
www.epa.gov/landfill/

U.S. Energy Information Administration
www.eia.doe.gov/cneaf/solar.renewables/page/landfillgas/landfillgas.html

Exposure:

New York State Department of Health
www.health.state.ny.us/environmental/about/exposure.htm

Soil vapor intrusion:

New York State Department of Health
www.health.state.ny.us/environmental/indoors/vapor_intrusion/index.htm
U.S. Environmental Protection Agency
www.epa.gov/region02/superfund/npl/vaporintrusion/

Landfill gas health effects, contact:

New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square, 547 River Street, Troy, New York 12180
1-800-458-1158 (extension 2-7800)
e-mail at: ceheduc@health.state.ny.us

Landfill Gas Movement into Buildings

