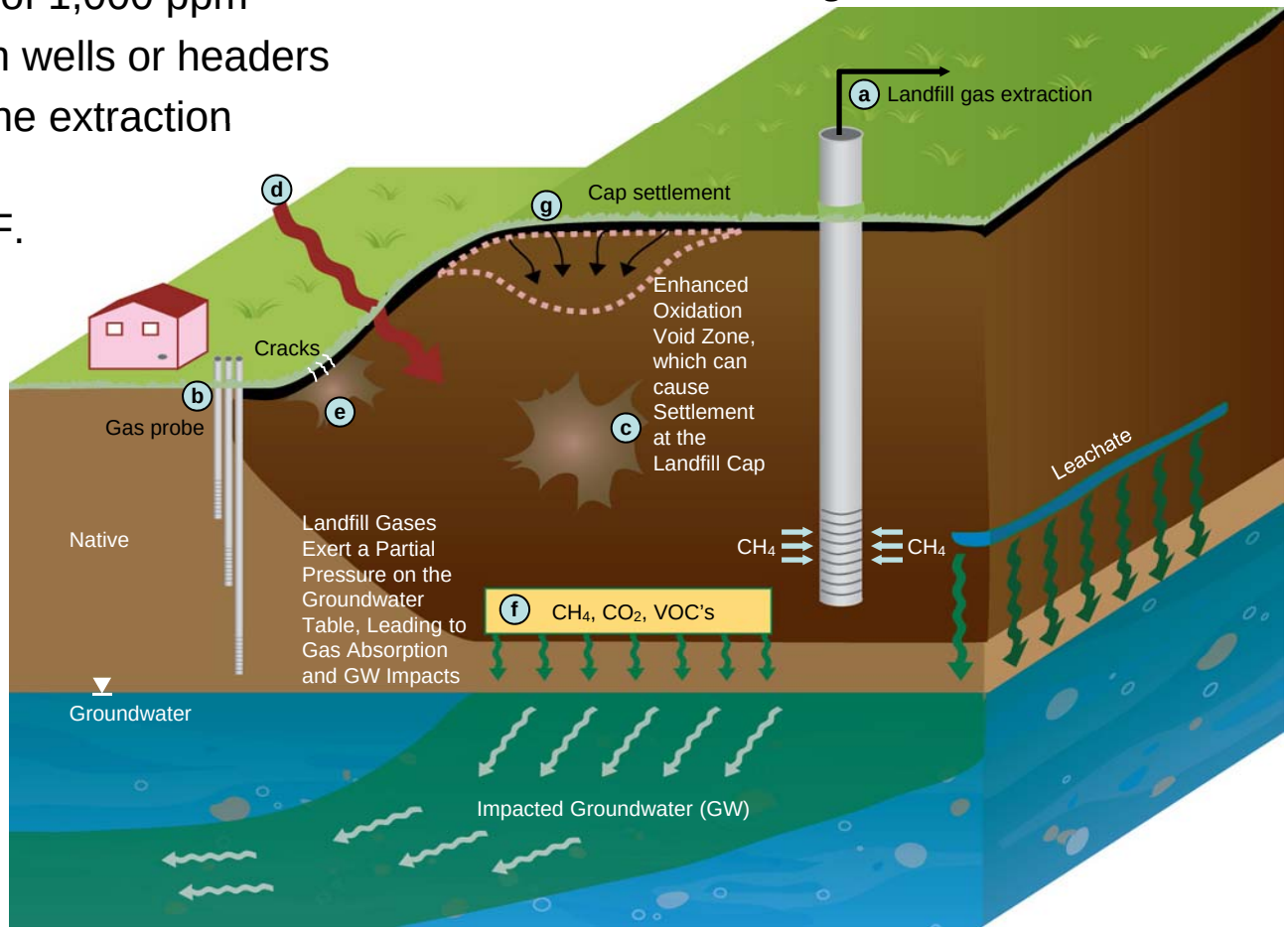
Landfill Fires Have Different Drivers

Signs of Subsurface Enhanced Oxidation

- Substantial settlement over a short period of time
- Smoke or smoldering odor emanating from the gas extraction system or landfill
- Elevated levels of CO in excess of 1,000 ppm
- Combustion residue in extraction wells or headers
- Increase in gas temperature in the extraction system (above 140 F)
- Temperatures in excess of 170 F.

After many years of working at characterizing and developing mitigation methods to minimize the subsurface propagation of landfill fires, Project Navigator, Ltd. staff believe that distinctly different phenomena contribute to the growth of landfill fires



1 The Phenomena.

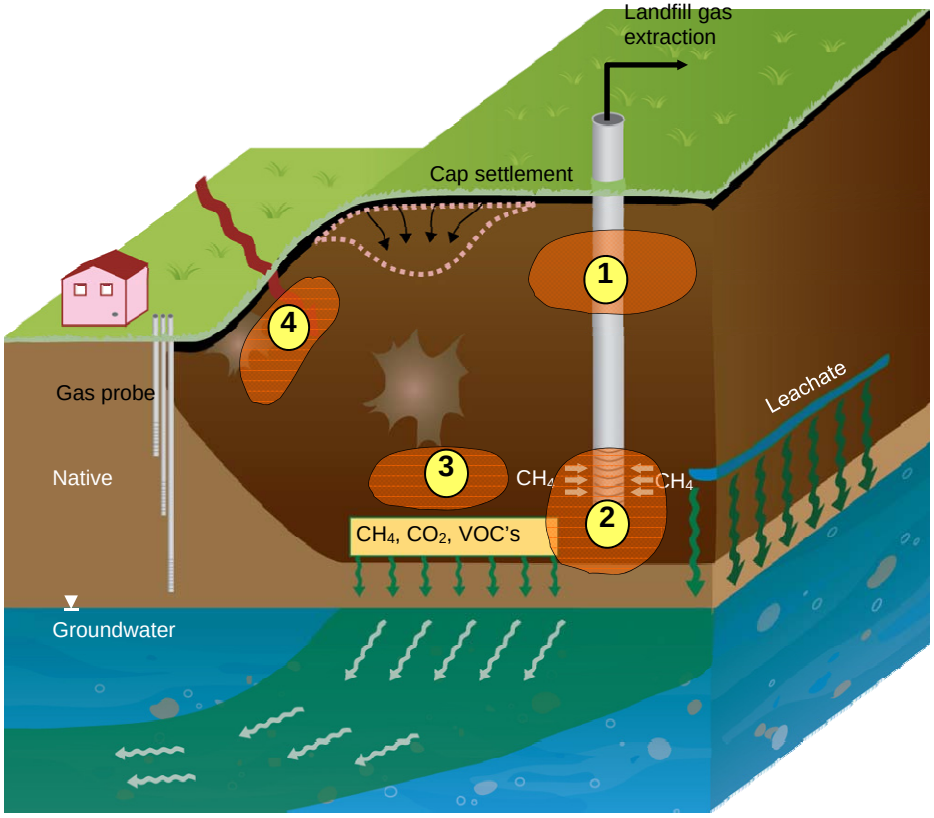
Increased oxygen levels within the landfill, coupled with the exothermic biodegradation reactions, cause increased temperatures. The combined effects can cause the trash to burn internal to the landfill prism.

2 What Can Happen with a Gas Collection System.

(a) Gas is extracted from the landfill to (b) ensure that the perimeter methane concentration remains <5% (which is the lower explosive limit). The imposition of a vacuum on the landfill can exacerbate subsurface fires (c), and cause, (d) air infiltration through the cap further promoting oxidation. (e) Cracks in the cap can also cause greater air infiltration. Gas needs to be aggressively extracted if gas is proven to cause groundwater impacts (f). Cap settlement can occur at oxidation zones allowing more air infiltration (g).

Classification of Landfill Fires

Idealized Landfill Cross Section Showing Four Distinctly Different Types of Landfill Fires



Fire Location	Driver	Mitigation Method	Typical Extent
1 Close to surface by Gas Extraction Well	Air Intrusion Caused by Excessive LFG Well Vacuum	Shut of Vacuum to Wells Closest to Fire Zone	Localized
2 Deep location with gas collection wells	?	Decrease Well Vacuum and Monitor LFG Composition	Can be Significant
3 Deep location without gas collection wells	Air Transflow from Cap to Well Screen	I/D LFG Wells Exerting Greatest Influence and Decrease Vacuum	Can be Significant, Tough to Extinguish, and Exist for Years
4 Close to landfill boundary compliance probes	Air Intrusion through Cap Cracks	Repair Cap Cracks, Decrease Vacuum, Locally Stockpile Soil for Use as a Blanket	Localized and Important to Control Given Location by Probes

Evidence of Landfill Fires at a Los Angeles Landfill

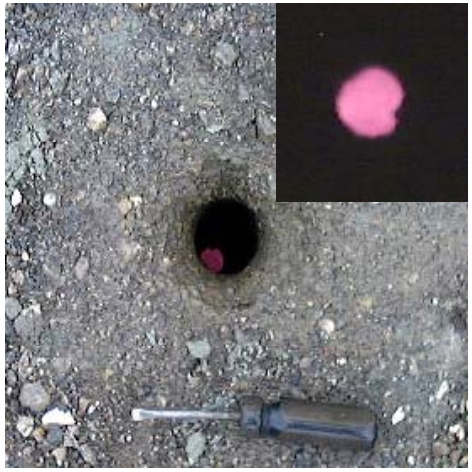


Photo shows combusting wastes at the location of a former landfill gas extraction well. Insert is close up.

During the installation of a landfill gas extraction well, a hot zone was encountered between 8 ft and 30 ft BGS.

Steam emissions during extraction well drilling

Observations during landfill gas extraction well Installation

- Ash-like materials
- Easily blown by light breeze
- Black ash and powdered brick materials
- Burnt refuse, paper and cardboard
- Smoke
- Large void zone around well installation location