



LANDFILL FIRES

There are two types of landfill fires:

- Δ Above ground – surface fires usually occur on the landfill working face. The fire is easily discovered and extinguished by suffocation and/or removing the source of combustion. If ignored, the fire can grow large and become dangerous.
- Δ Underground – subsurface fires usually start out small and localized. If left unattended, the fire can spread and can be extremely difficult to extinguish.

Requirements for fires – All must be present to support combustion:

- Δ Combustible materials – especially those with a low threshold for combustion such as petroleum based products, tars and oils.
- Δ Elevated temperatures – high temperatures are required to initiate combustion. Temperatures generated during aerobic and anaerobic decomposition within a landfill can reach as high as 106° F (70° C).
- Δ Oxygen – air is essential for combustion. Control a fire's air supply and you can smother a fire.

Differences between surface & subsurface fires

- Δ Surface fires are extinguished by removing: combustible materials, ignition sources (heat) or oxygen.
- Δ Subsurface fires are far harder to control. Combustible materials are not easily removed and temperatures cannot be easily changed. However, if the source of oxygen is eliminated or sufficiently restricted, the fire can be smothered. Typically this provides the best approach.

Sources of Oxygen intrusion into the landfill

- Δ Passive Air Intrusion sources are cracks/fissures in the cover, inadequate cover material, wind impaction on the surface, or diffusion of the atmosphere through the surface.
- Δ Active Air Intrusion – collection system design. Poorly designed gas collectors can allow air intrusion at the well-bore or into shallow collection zones. Subsurface piping not designed to withstand soil loads and landfill settlement can break along collection headers or laterals near the surface prompting air intrusion.

- Δ Active Air Intrusion – operation of collection system. Excessive gas extraction is called “overpull”. Localized overpull caused by an improperly operated or balanced gas extraction system can cause air intrusion.

Preventing Underground Fires

- Δ Preventing is the best policy. Eliminate conditions which can initiate subsurface fires.
- Δ Eliminate atmospheric intrusion through fissures and cracks in the cover. The solution is to repair them and maintain the cover. Poor surface cover or no cover is not permissible.
- Δ Well-bore seals must be effective to prevent intrusion. Common seals are : Bentonite (clay), native soil, and impermeable barriers like LANDTEC's Well-Bore Seal (WBS-100).
 - Bentonite seals dry out, crack and may leak. Bentonite settles at a different rate than the surrounding cover.
 - Native soil seals are cheap and available but can be very porous and settle at different rates than the surrounding trash.
 - Well-bore seals such as LANDTEC's WBS-100 provide an effective seal because they extend beyond the well-bore region and are made of impermeable materials. They also prevent landfill gas leakage at the well casing/landfill interface.
- Δ Operation of the gas collection systems can be improved by utilizing proper flow control at each gas extraction wellhead to prevent overpull and air intrusion. This can minimize the potential for fires. A properly designed wellhead, such as LANDTEC's Accu-Flo series, provides important data that can help a landfill technician prevent and/or detect subsurface fires before they become serious or spread. LANDTEC's Accu-Flo wellhead provides the technician with the following information:
 - An integrated gas temperature indicator.
 - Built-in flow metering to determine accurate gas extraction flow rates at the wellhead.
 - A port for sampling gas composition, i.e. methane, oxygen, carbon dioxide levels in the landfill gas.
 - Ports for measurement of the static and impact pressures at the wellhead.

If you suspect a fire exists

- Δ Check local ground temperatures. If elevated, perform a soil temperature survey of the surface to determine the spatial distribution of the elevated temperatures with respect to background temperatures.
- Δ Inspect the surface of the landfill in the vicinity of the suspected fire for fissures, cracks, erosion, or other areas where air (oxygen) may be readily entering the landfill.
- Δ Monitor the gas temperature of the extraction wells in the fire area to determine if elevated gas temperatures are present.
- Δ Monitor the carbon monoxide levels in the gas extraction wells in the suspected area to determine if elevated levels of carbon monoxide are present. (Carbon monoxide gas is a by-product of combustion.)
- Δ Inspect the gas wellheads internal components in the impacted area for the presence of soot and combustion odors.
- Δ Inspect the ground around the impacted area for signs of accelerated subsidence. **USE CAUTION** – subsurface fire can undermine areas of the landfill that could result in collapse of surface areas and creates an extremely hazardous situation for personnel who could fall into an extremely hot pit. Areas that are suspect should be barricaded and safety precautions taken. Bulldozers and heavy equipment must be kept away from the region until it is deemed safe. **REMEMBER – DO NOT WORK ALONE – USE SAFETY PRECAUTIONS AT ALL TIMES.**
- Δ Inspect the gas extraction system for signs of damage due to heat or combustion. Turn off, isolate or bypass affected systems. Seal damaged wells. Reduce the gas extraction rates from all operating wells in the affected area to minimize atmospheric intrusion.

Is the fire shallow or deep?

- Δ Use the data obtained from surveying the surface soil temperatures and from monitoring the gas extraction wells flow rates and gas temperatures to help determine the intensity of the fire and potential depth.

Shallow fires

- Δ Cautiously excavate the fire zone and completely remove all combustible materials. Inspect the affected area to determine that temperatures within the excavation have returned to background levels. Backfill the excavation with clean inert material and replace the cover material to its original integrity.
- Δ Continue to monitor soil surface temperatures to ensure that they have returned to normal background levels.

Deep fires

- Δ Use precautionary measures mentioned earlier. Eliminate any and all potential sources of atmospheric intrusion.
- Δ Reduce the gas extraction rates at all wells in the vicinity of the fire.
- Δ Continue monitoring gas extraction rates and gas temperatures to determine if the fire is diminishing.
- Δ Fill-in any surface subsidence and restore landfill cover grading as required.
- Δ If the above fails, consider the following measures (given the proper authorization from regulators): Inject water into the fire zone to quench it. Saturate the surface cover with water each day to maximize its seal and minimize air intrusion. Other options include smothering the fire by injecting liquid nitrogen or carbon dioxide into existing or new wells placed in the zone of the fire (costly).

In Conclusion

- Δ Never underestimate the potential danger of a landfill fire. A proactive approach in preventing landfill fires is the safest and most cost-effective method.
- Δ Practice preventive measures each and every day to keep the potential for fires at a minimum.
- Δ Most importantly, maintain the landfill surface cover and operate the gas extraction system as required to prevent air intrusion into the landfill.

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