

Subsurface Fire Response

Slow and Steady

presented by:

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Environmental Solutions for *More Than 50 Years!*

Landfills • Waste Planning/Diversion • Industrial Compliance
Brownfields • Industrial Wastewater/PFAS • Site Cleanups
Carbon Sequestration



SCS ENGINEERS

Spontaneous Combustion



- Oxygen gets into the waste mass
 - Overdraw on gas system
 - Leak in airline
 - Crack or other damage at surface
- Heat comes from the organic degradation process
- Fuel is the methane gas and organic material

Identification

- Because no visible flames, rely on other indicators
- Settlement (especially quick)
- Smoke
- Odor – landfill fires are very distinctive
- Carbon monoxide
- Combustion residue in wells/headers
- Increase in temperature (above 140 degrees F)

Health & Safety

- CO levels
 - IDLH level is 1,200 ppm
- Chemical exposures
- High temperatures
- Cave-ins/sinkholes

Extinguishing the Fire

- Eliminate one side of fire triangle and the fire will cease
 - In the case of landfill fires – eliminate the oxygen!
- Identify what is happening
 - Is there a fire currently? Or was there a fire in the past?
 - How did the oxygen get in?
- So we can determine the best way to eliminate it



Three Examples

Example 1

- June 2018
- Smoke noticed from a gas well

Example 2

- September 2021
- Sudden depression and odor

Example 3

- January 2022
- Smoke and subsidence

June 2018 – Smoke at Well







Initial Response

- SCS observed on Saturday
- Notified site, operator
- Shut down gas system
 - Smoke significantly reduced
- Covered with soil (20' radius, 4' thick)
- Decided to notified MDNR on Monday
 - Should have called spill notification line
- Monitored for smoke multiple times per day over weekend
- Develop plan and distribute on Monday



First Two Weeks

- Monitor surface daily for subsidence, cracks, smoking
- Keep system shut down
- Cap vacuum line to impacted well
- Monitor gas system weekly (surrounding wells)
- Re-start system, but close vacuum to wells surrounding impacted well
- Re-start whole system, only cracking open wells surrounding impacted well
- Draeger tubes for CO analysis

CO Concentrations

- Above 1,000 ppm
 - Active underground fire
- Between 100 and 1,000 ppm
 - Suspicious and requires further investigation/monitoring
- Under 100 ppm
 - Indicates previous fire, but no active combustion



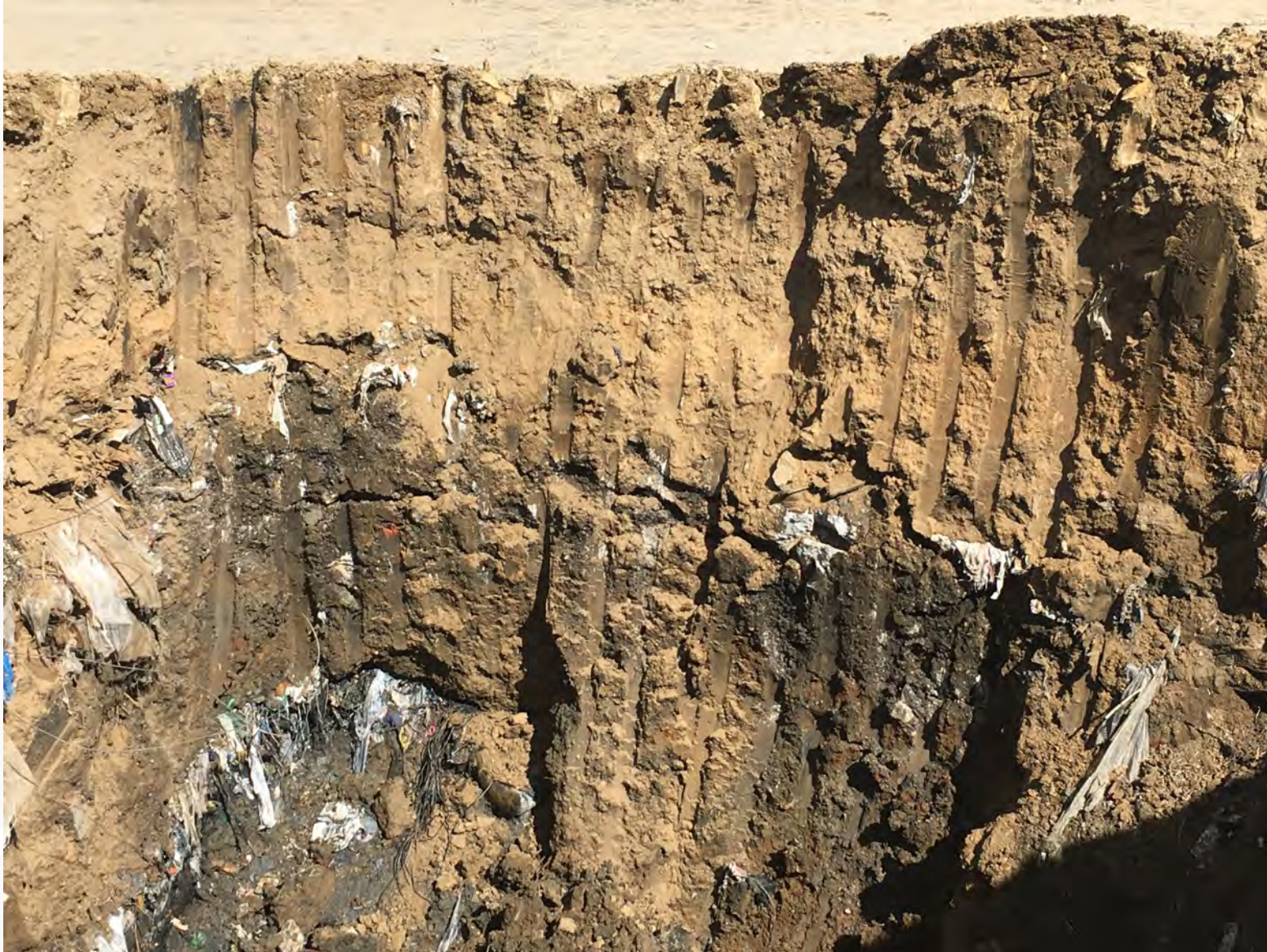
Next Steps

- After being smothered for two weeks, excavate well to determine extent of damage
- MDNR staff attended and monitored temperatures with FLIR camera











September 2021 – Sudden Depression and Odor







Initial Response

- SCS observed during routine monitoring
- Notified site
- Notified MDNR
- Shut down gas system, closed valve at impacted well
- Shut down compressed air system
- Reviewed as-built data
- Contacted on-call contractor to move soil

Days 1-4

- Capped impacted well
- MDNR site visit with FLIR camera
- One-Call in borrow area
- Cover with soil
- Action plan submitted to MDNR



Weeks 1 and 2

- Restart gas system, shut down wells in vicinity
- Draeger tubes in impacted and surrounding wells
 - Out of stock – long delivery times!
- Observed cover area daily
- Monitored gas system weekly around impacted well
 - Limited O₂ and balance gas
 - CH₄/CO₂ ratios – good gas production
 - Temperatures
- Crack open impacted well, check for CH₄
- Kept MDNR updated

Continuing On

- Wells surrounding impacted well continued to perform adequately
 - Acceptable temperatures
 - Adequate CH₄/CO₂ ratios
 - No or limited O₂ and/or balance gas
- Vegetated cover soil
- Continue to check well for methanogenesis; will bring back online slowly if/when vacuum is reestablished to this well
- Closed out with MDNR

January 2022 – Smoke and Subsidence





Initial Response

- SCS observed during routine monitoring
- Notified site
- Notified MDNR
- Shut down gas system, closed valve at impacted well
- Shut down compressed air system
- Placed soil above subsidence and crack to smother
- Reviewed gas data
 - Likely air leak





Next Steps

- Monitor surface daily for subsidence, cracks, smoking
- Monitor gas system weekly (surrounding wells)
- Draeger tubes for CO analysis
- Run jumper and air lines to wells with restricted vacuum and cap impacted airline
- Expansion planned for system to address with a permanent solution

Conclusion

- Be observant!
- Be safe
- Immediate notification
- Cover/smother
- Further identify oxygen source
- Cut it off