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Elevated Temperature Landfills (ETLF's) Understanding the Issues for Site Workers

Gary Pons, CIH, CSP, Health and Safety Director, SCS Engineers
F. Daniel Brennan, P.E., Senior Project Engineer, SCS Engineers

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Elevated Temperature Landfill (ETLF) - Agenda

- Definition – Reaction, Not a Fire
- Several large ETLF's to date
- Symptoms, Challenges
- Risk Factors
- "Contain & Manage"
- H&S Exposures
- H&S Controls

Conventional Landfill Fires

- Often caused by O_2-intrusion from overdrawn LFG extraction well
- Isolated, shallow, confined
- Elevated temps, stressed gas system (GCCS), isolated settlement around well
- Char, smoke, even flame
- Small-area, short-term fix
- Fix is usually enhanced cover

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ET Landfills
(aka Area-wide LF Reactions)

- Not a landfill fire
- Start small, but can cover dozens of landfill acres over time
- Run deeper than landfill fires
- Lacking O2
- The primary gas ratio (CH_4/CO_2) is diminishing or very low (<1.0 or <<1.0)
- Do not appear to be triggered by GCCS

ET Landfill Symptoms

- Gas composition changes – CH_4 and CO_2
- H_2 and CO appear in the landfill gas
- LF Gas and liquid temperatures increase
  - Temperature range (Gas and liquid): 131 to 300 degrees F
- Gas generation volumes increase (increased pressures in the LF)
- Liquid volumes increase (leachate and condensate)
- Leachate and gas quality deteriorate

ETLF Effects on LF Components

- Settlement, cracks, fissures
- Significant LF volume reduction
- Impacts on GCCS in wellfield
- Impacts on blower/flare station
- Liquids management issues
- Leachate management issues
- Fugitive emissions and odors

ET Landfill Solutions

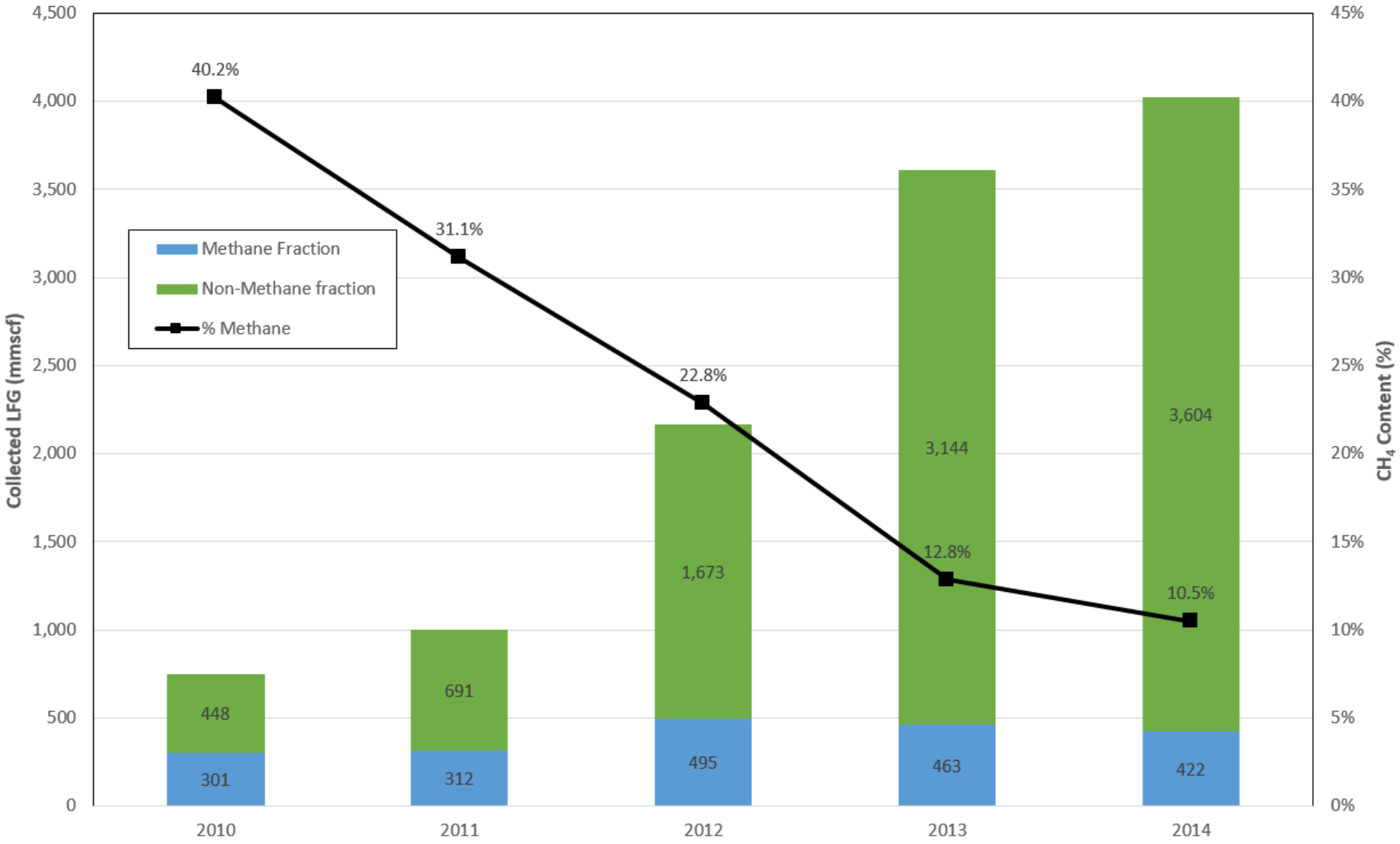
- Approach = “Contain & Manage”
- Enhanced cover – soil, EGC
- Enhanced GCCS
- Enhanced processing blower/flare station
- Liquids management
- Leachate management/treatment
- Fugitive emission/odor control

ET Landfill Solutions (Cont'd)

- Stabilization to mitigate effects of volume reduction – on stormwater mgt, GCCS, cap, etc.
- Long-term,

  enhanced O&M

LFG in an ET Landfill



Health and Safety (H&S) Risks at ETLF's to Site Workers

- High Temperature Gas
- High Temperature Liquids
- Leachate
  - Lower pH (<6), higher concentration of VOCs, increased electrical conductivity
- Odors
- Excessive Landfill Pressure (Artesian wells)
- Extreme Subsidence (settlement)
- Degradation of GCCS System Components
- Elevated Hydrogen Considerations

H&S Risk Management - Exposed Geomembrane Covers

- Used to control fugitive odors
- Hazard in wet or frozen conditions
- Cannot have equipment drive on it
- Usually have GCCS piping above EGC
- Above grade GCCS becomes walking hazard
- EGC becomes “trampolines” if localized settlement occurs

H&S Risks (Cont'd) - GCCS Components

- High temps may require steel well casings (hot to touch)
  - Use infrared thermometer to test objects before handling
- Usual flex hose will degrade and could split or burst
- High pressure in ETLFs along with excessive liquids could make extraction wells become artesian
- Localized rapid settlement could leave wellheads tough to access safely

Steel well that needs to be cut down due to differential settling

H&S Risks (Cont'd) - GCCS Well Drilling

- Exclusion Zone
- Buddy System
- Airborne hazards
- Odors
  - Vacuum box
- Special spoils handling
- Sonic drill rig
- PPE Needed

Odor Control Considerations

- Fugitive emissions through landfill surface
  - Need effective gas system (GCCS)
  - Need effective cap/cover (EGCs, e.g., EVOH)

- Uncombusted gas at control device due to low heat content of gas (200 BTU/cf)

Other ELTF Observations to Consider

- Visual inspections of gas collection components for damage and/or changes
- Inspections of leachate components
- Cover and elevation observation and surveys
- Waste Composition (Dark and wet)

Final Thoughts

- Landfill reaction sites (aka ET landfills) are not landfill fires
- Each ETLF is unique...avoid generalizations and understand that the hazards they pose are site-specific.
- Deep, wet, massive landfill areas more susceptible to ETLF conditions developing.
- Understanding of reaction mechanisms developing. More study needed.
- Waste acceptance may be an issue
- Effective communication and coordination between all parties is the key to success!

Final Thoughts (Cont'd)

- Onsite issues for workers are different with ETLFs than normal LFs
- O&M routines are more challenging and the frequency of repairs sharply increases
- EGCs control fugitive odors but create many obstacles for workers
- Rapid settlement creates challenges for the EGCs and the GCCS wells

Final Thoughts (Cont'd)

- Excessive pressures in the landfill strain pump repair routines and place excessive liquids in GCCS piping
- High levels of hydrogen require different "flame arrestors" (either deflagration arrestors or liquid seals)
- Harsh environment deteriorate valve seals making emergency shutdown of pipe sections problematic

Final Thoughts (Cont'd)

- Odors are an on-going characteristic of ETLFs
- Good interaction with regulators is key
- Once the ET condition develops, it may peak and stop spreading in 3-5 years, but enviro effects continue long-term
- No need to panic – only a minority of large, deep, wet sites affected so far
- But those sites affected can incur significant costs