Landfill Gas and Confined Spaces

With Lock - Out

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Garbage to Gas

(Anaerobic Bacteria)

\((C_6H_{10}O_5) + H_2O \rightarrow 3CH_4 + 3CO_2\)

- Up to 60% Methane \((CH_4)_v\)
- Variable amounts of:
  - water vapor,
  - carbon dioxide \((CO_2)\),
  - hydrogen sulfide \((H_2S)\),
  - carbon monoxide \((CO)\)
Components of Landfill Gas

Traces of:
◆ Benzene
◆ Ethyl Benzene
◆ Toluene
◆ Vinyl Chloride
◆ Dichloromethane
◆ Trichloroethylene (TCE)
◆ 1,2, Dichloroethylene
◆ Tetrachloroethylene (PCE)
Basic Principle

Never Allow Flammable Mixtures of

- air
- fuel
- energy
LEL = 5% Gas by Volume = 50,000 ppm
UEL = 15% Gas by Volume = 150,000 ppm
Hydrogen Sulfide

- Absorbed through the lungs
- Strong odor, but
  - Olfactory Fatigue
- Heavier than air (drops to ground)
- Test for $\text{H}_2\text{S}$ before going
  - in
  - down
Hydrogen Sulfide in Landfills

- $\text{H}_2\text{S}$ is usually below 100 ppm
- High sulfate (e.g. gypsum) levels produce high levels of $\text{H}_2\text{S}$
- Construction debris containing wallboard
NIOSH IDLH

- Immediately Dangerous to Life and Health (IDLH)
- Irreversible health effects or Escape impairing symptoms
- Within 30 minutes
- Hydrogen Sulfide’s IDLH
  - 300 ppm
Explosion Control Measures

- Perform work while wet
- Minimize sparks
- Minimize exposure of fill
- Use temporary flare
- Monitor gas all the time
- Stop spark-producing work when levels > 10% of LEL
Air Monitoring

◆ Monitor continuously for
  ◆ Dust emissions
  ◆ Gas and vapor emissions
  ◆ Combustible gases
◆ In work zone
Action Levels

- Triggers for changes in
  - operation,
  - evacuation, or
  - more PPE
- Base triggers on
  - OELs and
  - instruments you will use
# Work Area Action Levels

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Action Level</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible Gas</td>
<td>25% LEL</td>
<td>Prevent Sparks</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>10 ppm</td>
<td>Respirator</td>
</tr>
<tr>
<td>Total Dust</td>
<td>500 μg/m³</td>
<td>Respirator</td>
</tr>
<tr>
<td>Organic Vapor</td>
<td>5 ppm</td>
<td>Respirator</td>
</tr>
</tbody>
</table>
## Oxygen Deficiency

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;19.5% O(_2)</td>
<td>Enter only with Air</td>
</tr>
<tr>
<td>19.5 - 23.5%</td>
<td>Work continues</td>
</tr>
<tr>
<td>&gt;23.5% O(_2)</td>
<td>Work must stop</td>
</tr>
</tbody>
</table>

**NOTE:** What dilutes O\(_2\) to 20%, is at 44,700 ppm
A COMPILATION OF LANDFILL GAS FIELD PRACTICES AND PROCEDURES

HEALTH AND SAFETY SECTION

SWANA LANDFILL GAS DIVISION

HEALTH & SAFETY TASK FORCE
VACUUM IS YOUR FRIEND

- Vacuum in the system means that small leaks are inward
- Leaks appear as higher oxygen levels at the flare
- Enough air can extinguish the flame
- Protect the vacuum
When adding a sampling port

- Combustible gas indicator
- Explosion-safe drill
- Manual drill
- 0.3 millijoule of static electricity is enough to ignite methane
Safety Plans and Programs

- Accident Prevention Program
- Noise Control.
- Dust Control.
- Respiratory Protection
- Confined Space Entry Safety
- Medical Surveillance
  - Often optional
- Safety Training
  - hazardous materials
  - hazardous waste training?

HEALTH AND SAFETY PLAN FORM

This document is for the exclusive use of CDM and its subcontractors.

PROJECT NAME: Adams Brush Manufacturing

PROJECT #: 18416

JOBSITE ADDRESS: 94-02 104th Street

CLIENT: Queens, New York 11416

CLIENT CONTACT: 

CLIENT CONTACT PHONE: 

( ) AMENDMENT TO EXISTING APPROVED H&SP?

( ) H&SP AMENDMENT NUMBER?

( ) DATE

OBJECTIVES OF FIELD WORK:
(e.g. collect surface soil samples):

To drill soil borings with a Geoprobe, as well as a hollow stem auger drill rig; to obtain soil samples from both the Geoprobe and auger rig; to install monitoring wells; to collect groundwater samples from the monitoring wells.
Personal Protection

- Full-length trousers.
- Shirt with sleeves and a collar
- Steel toe and shank footwear:
- Hardhat:
- High-visibility vest
  - *(for heavy equipment)*
- Safety glasses with side shields:
Well Drilling and Construction

- Owner’s representative all the time
- Avoid the borehole
  - You could fall in
- Buddy system
- Subsurface surprises
- Cover every night.
Emergency Preparedness

- Federal OSHA regulations followed for emergencies
- You’ll require
  - Community Communication Plan
  - Emergency Alerting
  - Response Procedures
When is a Space Not Confined?
CONFINED SPACES ARE:

- Big Enough to Enter,

and

- Not Designed for People,

and

- Hard to Enter or Exit
Big Enough to Enter

- Your Whole Body Would Fit Both:
  - Inside the Space, and
  - Through the Opening
Definition of Entry

Occurs, “As soon as any part of the entrant's body breaks the plane of an opening into the space.”
Not Designed for People

- Never Filled with Dense Material
- Heat, Light, & Ventilation
- Tall Enough to Stand up
- Meets Building Codes
- You Could Put Your Desk There
Hard to Enter or Exit

• Doorways are Easy
• Stairs are Easy
• Ladders are Hard
• Hatches are Hard
• Crouching is Hard
• Crawling is Hard
CONFINED SPACE DANGERS

- Oxygen deficient,
- Toxic, or
- Explosive
- Engulfing
- Entrapping
- Mechanical
No Hazard Spaces

- Most Valve Vaults
- New Pipelines without
  - Connection
  - Gassy soil
  - Concrete sealant
  - Water present
Alternate procedures allowed if

- Bad air is the only hazard
- Ventilation alone is sufficient
- Monitoring & inspection prove that
- Entry follows special permit
Summary Conclusion

- Many small spaces are not confined per OSHA
- Many large spaces are
- Many confined spaces require no permit
- Special permits will suffice for many confined spaces
Lock - Out and Tag - Out

Use Lockout Devices

MACHINE LOCKOUT POINT

DANGER
DO NOT OPERATE
Lockout / Tagout

Unexpected equipment start-ups account for 100 injuries each day

Some fatal.
Lockout/Tagout

• Types of Personnel
  • “Authorized”
  • “Affected”
  • “Other”
• “Tagout” Procedure
Lockout Procedure

- Each Person Has His or Her Own Safety Lock(s)
  - Use Special Locks
  - Stock Lock Out Equipment
- Flexible Cord and Plug
  - Plug in Your Possession
Step 1 - Prepare for shutdown.

- What kind of energy is used?
- Which energy sources need lock-out?
- Tell other workers you are shutting down.
Step 2 - Shut the equipment Off
Step 3 - Isolate equipment from every power source.

- Don’t just shut the power off.
  - Close valves.
  - Throw main disconnects
- Block or blank auxiliary systems.
  - (hydraulic or pneumatic)
Step 4 - Lock and tag primary & secondary energy sources.
Step 5 - Control stored energy.

- **Even with power off:**
  - Consider residual energy
  - Check for moving parts
  - Vent or drain trapped pressure.
  - Install electrical ground wires
  - Block or support elevated equipment.
Step 6 - Clear the area and double-check your steps.

• Warn other employees
• Make sure the area is clear.
• Ensure that all:
  • equipment is locked out
  • energy has been contained or released.
Perform Work
Reverse the Order
Any Questions?