The MOST important step...

Discussion of Leak Check Methods:

- Review of industry suggested leak check methods
- Examination of the most common methods
- Suggestions for improved sampling in the future
A Review of Industry Supported Leak Check Methods

• Gaseous Methods

• Liquid Methods

• Preventative Leak Methods
Gaseous Leak Check Methods

- Discussed in half of the industry documents.
- Tests for leaks in the field using meters.
- **Theory:** Prevent collection and analysis of bad samples.
- **Procedure:** Cover probe and connections with a shroud, inject a gaseous compound, then test the probe for presence of the leak check compound.
Gaseous Compounds

- Lesser used Compounds
  - SF6
  - Carbon Monoxide
  - Carbon Dioxide

- Most Common: **Helium**
  - Lab Grade?
  - Party Helium?
## DETECTIONS SUMMARY

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>Reporting Limit</th>
<th>Units</th>
<th>Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>120</td>
<td>4.8</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>1.7</td>
<td>0.6</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>7.3</td>
<td>1.8</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>m,p-Xylene</td>
<td>33</td>
<td>1.8</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>o-Xylene</td>
<td>13</td>
<td>1.8</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>4-Ethyltoluene</td>
<td>160</td>
<td>2.0</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>220</td>
<td>2.0</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>840</td>
<td>2.0</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
<tr>
<td>TPHs (C5 - C11)</td>
<td>600</td>
<td>100</td>
<td>ug/m³</td>
<td>EPA TO-15</td>
<td></td>
</tr>
</tbody>
</table>

**Benzene:** 1.7 ug/m³  
5% = 0.085 ug/m³  
10% = 0.17 ug/m³
Helium Leak Threshold

Surface Concentration: 20-50% Helium

Threshold(s): 5% - 15%

Allowance of “surface air” in a 1L Summa: 50-150 cc
Liquid Leak Check Methods

• Discussed in all of the industry documents reviewed.

• Simple process, easily obtained, most common type of leak check.

• **Theory:** The compound vaporizes around the cloth, and can be tested with a mobile lab.

• **Procedure:** A cloth saturated with the liquid leak check is placed near the probe seal and connections. The compound is included in the analyte list and, if detected, indicates that a leak may have occurred.
Liquid Compounds

- Problematic Compounds
  - Pentane
  - Butane & Isobutane

- Most Common
  - 1,1-Difluoroethane (DFA)
  - Isopropyl Alcohol (IPA)
Surface Concentration: ?? ?? ??

Threshold(s):
- 10-20 ppbv
- 50-1000 ug/m³
- 10-100 ug/L
- 10 %

Allowance of “surface air” in a 1L Summa: ?? ?? ?? ??
Surface Concentrations of DFA/IPA

**ASSUMPTIONS:**
Concentration of the compounds when they equilibrate to their vapor pressure at ambient temperatures.

**RESEARCH:**
H&P wanted to further define the surface concentrations by measuring DFA/IPA concentrations emitted from a saturated cloth over a period of time, similar to a sampling event.
Surface Concentrations + Time

<table>
<thead>
<tr>
<th>1,1-DFA</th>
<th>IPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting concentrations of</td>
<td>Starting concentrations of</td>
</tr>
<tr>
<td>12,000,000 ug/m³ to 300,000,000 ug/m³</td>
<td>40,000,000 ug/m³ to 430,000,000 ug/m³</td>
</tr>
</tbody>
</table>

Within 5 minutes...

- Within a 5 minute period, the concentrations emitted from the cloth dropped by over 90%.
- 1,000,000 ug/m³ to 10,000,000 ug/m³
Surface Concentrations + Time

<table>
<thead>
<tr>
<th>1,1-DFA</th>
<th>IPA</th>
</tr>
</thead>
</table>

**After 10 minutes...**
- Concentrations are not consistently high enough to accurately identify leaks
- **<5,000 ug/m³**

**IMPLICATIONS**

Consider your purge and sample time!!
DFA/IPA Leak Threshold (<5 min)

- **<5 Minute Threshold(s):**
  - **0.0025%** (10 ppbv, AZ)
  - **0.0054%** (54 ug/m³, DTSC CA)
  - **1-10%** (10-100 ug/L)

- **Surface Concentration:**
  - **1,000,000 ug/m³** (conservative)

- **Allowance of “surface air” in a 1L Summa:**
  - AZ: **0.025 cc** (1/40th)
  - CA: **0.054 cc** (1/18th)
  - Other States: 10-100 cc
Preventative Leak Methods:

“Shut In Test”

- Most effective way to identify and prevent surface leaks.
- Discussed briefly in only half of the industry documents.
- Simple concept, easy to implement.
- Assemble all above ground equipment, apply a vacuum to the system, and monitor for any loss in vacuum.

VIDEO
Leak Testing the Surface Seal

• Shut in test verifies the above ground equipment, but the surface seal needs to be tested.

• Important for <5’ and subslab probes - demonstrate that ambient air is not being pulled down into the vapor probe.

• Liquids only work for 5 min, unless you reapply. Helium is costly and has complications.

• *A simple and cost effective solution that everyone can use?*
Options for Testing the Surface Seal

- Shroud method requires that He concentrations remain stable.
- Liquids (DFA/IPA) can be reapplied every 5 minutes.
- In what other ways can liquid compounds be stabilized?
- Research: Liquid Tracer Enclosure
- A simple and cost effective solution that everyone can and will use?
Research: Liquid Tracer Enclosure

- Smaller than a shroud – intended to test just the surface seal.
- Contain the liquid tracer inside the enclosure; either spray it in or place a saturated cloth beneath.
- The integrity of the sampling train has already been verified.
# Liquid Tracer Enclosure

<table>
<thead>
<tr>
<th></th>
<th>1,1-DFA</th>
<th>IPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting concentrations of</td>
<td>500,000,000 ug/m³ to 770,000,000 ug/m³</td>
<td>270,000,000 ug/m³ to 1,010,000,000 ug/m³</td>
</tr>
<tr>
<td><strong>Within 5 minutes...</strong></td>
<td>550,000,000 ug/m³ to 770,000,000 ug/m³</td>
<td></td>
</tr>
<tr>
<td><strong>Within 10 minutes...</strong></td>
<td>900,000,000 ug/m³ to 1,010,000,000 ug/m³</td>
<td></td>
</tr>
</tbody>
</table>
# Liquid Enclosure Leak Threshold

**Surface Concentration:**

\[ >500,000,000 \text{ ug/m}^3 \]

<table>
<thead>
<tr>
<th>Shroud Threshold:</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,000,000–15,000,000 ug/m(^3)</td>
</tr>
<tr>
<td>5%–15% leak</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CA/AZ Liquid Threshold:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10–20 ppbv</td>
</tr>
<tr>
<td>&lt;0.00001%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other State Thresholds:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10–100 ug/L</td>
</tr>
<tr>
<td>0.002–0.02%</td>
</tr>
</tbody>
</table>
A Need for Consistency

Quality Leak Check Procedures for a Quality Sample

Understand and Implement a Consistent Framework

• Leak Check Methods are often discussed interchangeably, although you can see they are very different.
  ▫ Application procedures are inconsistent.
  ▫ Tolerance for leaks is variable between methods.

• As we move forward with lower screening levels and more samples, a framework for developing consistent leak check procedures will be essential.
<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. PREVENT</strong></td>
<td>• Conduct a shut in test to find and fix leaks before they occur.</td>
</tr>
<tr>
<td><strong>2. DETECT</strong></td>
<td>• Apply a compound at the surface to detect leaks in the probe seal – choose the compound and application based on your sample period.</td>
</tr>
<tr>
<td><strong>3. EXECUTE</strong></td>
<td>• Use a procedure that is practical for training and simple to implement in the field, and one that is cost effective.</td>
</tr>
<tr>
<td><strong>4. EVALUATE</strong></td>
<td>• Surface leaks happen, and are expected. Understand your regulatory thresholds, talk with your lab, and know your objectives.</td>
</tr>
</tbody>
</table>
Soil gas is an evolving science, with changes and advancements happening all of the time. Thinking outside of the box (shroud) is encouraged!

QUESTIONS?

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