Leak Detection & Measurement of Fugitive Methane Emissions

An EPA Best Management Practice for DI&M Programs

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Leak Survey Methods

Leak Detection
- Soap solution
- Flame Ionization
- Catalytic oxidation/thermal conductivity
- Ultrasonic
- LSI’s Gas Imaging Camera, the “Hawk”
- New Heath RMLD
- Visual
- Tag and number leaks on standard components
3 Main Categories of Leaks

• Standardized Components
  – Flange, Union, Thread & Tube Fittings, valve caps, fuel injector valves, stem packing leaks etc…

• Compressor Seal Systems
  – Rod Packing Vent or Combined Distance Piece and Packing Vent, Wet or Dry Seal Vents on Turbines

• Blow Down Systems
  – Unit Valves, Blow Down Valves, Pressure Relief Valves, Power Gas Vent, Condensate Tanks, ESD Vents
Screening & Tagging

- Recommend the use of a reliable pump-driven combustible gas indicator that can see down to 50 PPM.
- For Vented Components, recommend measuring as you go.
- For Standardized Components, recommend screening and tagging.
Reducing Emissions, Increasing Efficiency, Maximizing Profits
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Remote Methane Leak Detection
BASED ON TDLAS TECHNOLOGY

- Tunable Diode Laser Absorption Spectroscopy (TDLAS)
  - Every gas absorbs specific wavelengths (frequencies) of light
  - The RMLD laser beam emits a specific wavelength which is absorbed by methane
  - The amount of laser light absorbed is proportional to the total amount of gas in the path of the laser beam
  - Concentration is then expressed as parts-per-million-metered, or “ppm-m”
TECHNICAL APPROACH

- Laser light beam is remotely projected on to a target (e.g., grass, wall, etc.)
- A fraction of the beam is scattered from the target surface and returned to the source
- Returned light is collected and focused onto a detector
- The presence of methane is encoded within the returned light
- Methane readings are displayed in ppm-m
Example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan Distance</td>
<td>15 m (50 ft)</td>
</tr>
<tr>
<td>IR Beam 'Footprint'</td>
<td>4.9 m (16 ft) x .3 m (11 inches) @ 15 m (50 ft)</td>
</tr>
<tr>
<td>Background Methane</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Avg. Plume Concentration</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Plume Width (Distance IR beam passes through plume)</td>
<td>2 m</td>
</tr>
<tr>
<td>RMLD reading</td>
<td>Background + leak</td>
</tr>
<tr>
<td></td>
<td>= (15 m x 1 ppm) + (2m x 20ppm)</td>
</tr>
<tr>
<td></td>
<td>= 55 ppm-m</td>
</tr>
</tbody>
</table>
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Measuring Fugitive Methane Emissions

**Leak Measurement**
- Hi Flow Samplers
- Vent-Bag™
- Hot Wire Anemometer
- Rotameter
Measurement Methods

• For leaks up to 10 cfm – Hi Flow Sampler
  10 cfm @ $5/Mcf = $26,280

• For leaks 10 – 240 cfm – Vent-Bag Method
  50 cfm @ $5/Mcf = $131,400
  100 cfm @ $5/Mcf = $262,800

• For leaks >180 cfm - Anamometer
Hi Flow Sampler

Applications

Advantages:
- Total Leak Capture
- Measures Leak Rate Directly
- Can Measure 30 components per hour
- Repair Decision Based on Leak Rate & Repair Costs
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Hi Flow Sampler Technology

• Captures Entire Leak
  – Measures Flow Rate (F) and Concentration (sample)
  – Subtracts the background (back) Concentration
  – Leak Rate = F x (sample – back)
Condensate Tank Leakage
Identified Loses/Savings

Estimated Annual Loss
$67,575/yr
Or
13,515 Mcf/yr
Routine Monitoring of known culprits and plan for future DI&M
Partner Experience
Leaking Actuator on Methanol Injector Pump. Leak Rate at 3.5 cfm or $9,198/yr. Estimated repair <$500.
Partner Experience

Leaking Valve Actuator. Leak measured at 6.74 scfm or $17,713/yr. Estimated to have been leaking at current leak rate for last three years or more. Successfully repaired next day and reduced to zero emissions.

Entire Survey Paid
For in recovered gas, Including hands on training with Hi Flow Sampler

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## Partner Experience

### Midwest Compressor Station

September 2005

<table>
<thead>
<tr>
<th>Component Category</th>
<th>Leak Rate (scfh)</th>
<th>Leak Rate (Mcf/Yr)[1]</th>
<th>Leak Rate ($/Yr)[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak Rate from Standard Components</td>
<td>Standard</td>
<td>390</td>
<td>3,415</td>
</tr>
<tr>
<td>Leak Rate from Compressor Packings [Units 1-5]</td>
<td>Rod Packing</td>
<td>12,585</td>
<td>63,869</td>
</tr>
<tr>
<td>Leak Rate from Blowdown System (Unit Valves/Blowdown Valves/Pressure Relief Valves)</td>
<td>Blow Down System</td>
<td>520</td>
<td>4,552</td>
</tr>
<tr>
<td><strong>Total =</strong></td>
<td></td>
<td><strong>13,495</strong></td>
<td><strong>71,836</strong></td>
</tr>
</tbody>
</table>

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Partner Experience
Midwest Packing Leak
75 CFM when Running
98 CFM when idle & pressurized

$297,489 @ $5 gas
$475,982 @ $8 gas
About Rod Packing Leakage

• Under best conditions leak rate can be expected at a minimum of 11.5 scfh
• Leakage can be reduced through proper monitoring and a cost effective schedule for replacing packing rings & piston rods.
• Step one is to monitor and record baseline packing leakage and piston rod wear.
• Establish a replacement threshold
Annual Station Monitoring Program

• Inspect significant leaks identified from recent survey and verify repairs remain intact.

• Inspect all critical components for new leakage
  – Compressor Packings
  – Unit Valves, Blowdown Valves, Dump Valves

• Spot check yard for leaks