Overview of DI&M, Quantification and Economic Repair for Compressors

Turkmenistan Meeting

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Agenda

- Program to Find and Fix Large Leaks, also referred to as Directed Inspection and Maintenance Programs (DI&M), the process
- Establishing your “Priority of Work” plan.
- Leak Screening & Tagging
- Leak Measurement and quantification
- Safety Considerations with heights and blow down occurrences. Ladders, man-lifts and use of fall protection
- Prioritize Leak Repair
- Opgal Gas Imaging Camera Demonstration
Partial List of Potential Leak Sources

- Compressor Unit Valves
- Relief Valves
- Unit Blowdowns
- Compressor Packing
- Meter Tubes
- Valve Stems
- Fuel Valves
- Various Piping & Vessel Flanges
- Online Gas Analyzers
- Centrif. Comp. Seals
- Pipeline Damage
Top 4 Typical Fugitive Sources

- Reciprocating Compressor Packing
- Blow Down Valves
- Unit Valves
- Scrubber Dump Valves

“Find The Needle In The Haystack”
Component Category Profile

Annual Leakage by Component
Natural Gas Compressor Station

<table>
<thead>
<tr>
<th>Component</th>
<th>Total Leakers</th>
<th>Annual Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanges</td>
<td>5</td>
<td>$468</td>
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<tr>
<td>Fuel Injection Valves</td>
<td>60</td>
<td>$13,352</td>
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<tr>
<td>Gaskets</td>
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<td>$3,085</td>
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<tr>
<td>Rod Packings Systems</td>
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<td>$47,532</td>
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<tr>
<td>Blow Down Valves</td>
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<td>$144,197</td>
</tr>
<tr>
<td>Unit Valves</td>
<td>13</td>
<td>$98,081</td>
</tr>
</tbody>
</table>

Source: Heath Consultants Incorporated, Environmental Services.
Approach to Reducing Leakage

- Institute a measurement program that accurately measures all leaks
- Station personnel then have the information necessary to weigh the cost of the leak repair versus the value of the lost gas for each leak.
Implementing a Leak Reduction Program at Compressor Stations

1. Conduct baseline survey
2. SCREEN and MEASURE leaks
3. FIX on the spot leaks
4. Estimate repair cost, FIX to Payback criteria
5. PLAN for future surveys (recommend annually)
6. Record savings or monetize for carbon credits
Step 1: Familiarize & Strategize

- Walk through facility and determine plan of attack
- Focus your attention on all Vented Components (i.e., Packing Vents, Distance Piece “dog-house” Vents, Blowdown Vents, Pressure Relief Vents, Starter Gas Vents, ESD Vents & even Crankcase vents).
- Determine safe approach to access vents with the use of ladders, man-lifts and Certified Fall Protection.
Step 2: Screening & Tagging

- Recommend the use of a reliable pump-driven combustible gas indicator that can see down to 50 PPM. (Infrared Imaging Cameras, Lasers and non-corrosive bubble solution are the best combinations.)

- For Vented Components, recommend measuring as you go. (if you can’t pre-screen for leakage)

- For Components on the ground you should screen, tag and then quantify.
Leak Survey Methods

- Leak Detection Tools
  - Remote Methane Leak Detector (RMLD)
  - Gas Imaging Cameras
  - Liquid bubble solution
  - Infrared Methane Detectors
  - Catalytic oxidation/thermal conductivity
  - Ultrasonic
  - Visual
Screening Difficult to Reach Vent Stacks – With Electronic Screeners ($,$$$)
What Does Passive Plume Imaging Look Like

Source: Heath Consultants Incorporated
Eye-C-Gas Video Recordings for You to See Firsthand

Video recording of fugitive leaks detected by Heath Consultants using the Opgal Eye-C-Gas thermal infrared Gas imaging camera.

..\..\Gas Imaging\New Folder\Eye-C-Gas Videos\Opgal Video Demo.wmv
What does Active Plume Detection Look Like?

- Real-time detection of methane leaks
  - Quicker identification & repair of leaks
  - Screen hundreds of components an hour
  - Screen inaccessible areas simply by pointing at them

Source: Heath Consultants
Remote Methane Leak Detection: How Does it Work?

- Works using Tunable Diode Laser Absorption Spectroscopy (TDLAS)
- Specific to methane gas only
- Displays gas reading in parts per million metered

Source: Heath Consultants Incorporated
Turkmenistan Project – WYG and Heath Turkmenbasy, 2008
Turkmenistan Project – WYG and Heath Turkmenbasy Region, 2008
Step 3: Measuring Fugitive Methane Emissions

- Leak Measurement
  - Hi Flow Samplers
  - Vent-Bag
  - Hot Wire Anemometer
  - Rotameter
Step 4: Fix Leaks On The Spot

- **Example 1:** Blowdown valve leaked almost 14,500 Mcf/yr
  - Rather than replace the expensive valve, Partner spent just $720 on labor and materials to reduce the emissions to approximately 100 Mcf/yr
  - Value of gas saved was $58,000 at $4/Mcf

- **Example 2:** Tube fitting leaked 4,121 Mcf/yr
  - Very quick repair requiring only five minutes reduced leak rate to 10 Mcf/yr
  - Value of the gas saved was $16,484 at $4/Mcf
Liquid Condensate Dump Tanks
Natural Gas Scrubber Tanks
Condensate Tank Leakage from Faulty Dump Valve

**Storage Tank Emissions**

**Estimated Annual Loss with 3 CFM Anti-Static Measurement Bag**

- 13,515 Mcf/yr
- Or $54,060/Yr @ $4/Mcf

**Scrubber Dump Valve Leakage through Condensate Storage Tank**
Leaking Scrubber Dump Valve at Compressor Station

Leaking Scrubber Dump Valve Closed Manually Reducing Leakage by an estimated >300 scfm.

Estimated Savings = $473,040/year
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
Rod Packing Leak Rates at Oklahoma Compressor Station

1 Year Payback Threshold at 55 scfh
Equivalent to $1,927/yr
Rod Packing Leakage
Step 5: Perform Maintenance and/or Repair and Conduct Post Measurement to Verify Leak Repair/Reduction

- Determine true savings achieved for economic analysis.
- Confirm and verify leak reductions to report your value added to the company or carbon value for future credit
Step 6: Routine Monitoring of Known Culprits and Plan for Future DI&M
OPGAL: EYE-C-GAS Demonstration Fugitive Emissions Detection Camera

- A design formed by the demands of the industry.
- Specially designed for the applicative market of natural gas, oil and petrochemical industries.
- Design for intrinsically safe, allowing the inspection at hazardous places in the plant.
- Current Approvals: Class 1, Division 2 & ATEX.
How The Eye-C-Gas Camera Works

- The leaking gas absorbs reflected infrared light
- The EYE-C-GAS™ camera spectral band coincides with the absorbance spectra of the leaking gas
- The sensitivity of the EYE-C-GAS™ camera enables the measurement of the difference in signal value, caused by the leaking gas
- EYE-C-GAS™ produces images of infrared energy and display it on a screen, similar to how a camcorder displays video.
Adjusting Polarization with Eye-C-Gas Camera

Valve Stem Packing - Enhanced, Black Hot Mode

Valve Stem Packing - Normal, Black Hot Mode

Valve Stem Packing - Normal, White Hot Mode

Source: Heath Consultants Incorporated
Eye-C-Gas Video Recordings

Video recording of fugitive leaks detected by Heath Consultants using the Opgal Eye-C-Gas thermal infrared Gas imaging camera.

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..\..\Gas Imaging\New Folder\Eye-C-Gas Videos\Compressor Station Opgal Videos\Lanham,CS3.wmv
Contacts and Further Information

- More detail is available on these practices and over 80 others online at:
  [epa.gov/gasstar/tools/recommended.html](http://epa.gov/gasstar/tools/recommended.html)

- For further assistance, direct questions to:
  
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