NSPS 0000a LDAR Compressor Station Case Study Results

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www.targetemission.com
DETECTION

MEASUREMENT

MANAGEMENT

• OFFICES—Houston, TX, Pittsburgh PA, Calgary AB

• EXPERIENCE – currently perform LDAR and GHG services for over 550 facilities across USA, approx. 800 assessments/year

• EXPERTISE – Optical Gas Imaging and Method 21 Alternative Work Practice for Subpart W GHG and LDAR (OOOO, OOOOa) monitoring using OGI
OVERVIEW

• Review OOOOa requirements

• Present Case Study data

• Explore results, cost/benefits of program
NSPS OOOOa

Midstream
  • No change for LDAR

Compressor Station
  • new or modified after September 18, 2015 - when a compressor is added or if one or more compressors is replaced with a greater total horsepower
  • conduct OGI within 60 days after startup and quarterly

Wellsite
  • Semiannual wellsite OGI inspections
MONITORING PLAN

- monitoring plan must be developed and implemented within a company-defined area (22 well sites, 210-mile radius of a central location)

DATA REQUIREMENTS

- survey date, technician names
- observation path (one time)
- ambient T, sky conditions, maximum wind
- instrument used
- # of leaks, # of DTM, UTM
- # of DOR and reasons
- resurvey instrument
- one or more digital photographs or OGI video (GPS)
- dates of first attempt
NSPS OOOOa

• LEAK REPAIRS
  • Leaks repaired within 30 days up to 2-year DOR extension for certain repairs
  • if an unscheduled or emergency shutdown components would need to be fixed at that time (just changed to planned shutdown)

• REPAIR CONFIRMATIONS
  • resurvey within 30 days of the repair using OGI, Method 21 including bubble tests when applicable
  • Additional 30 days for confirmation
QUESTIONS

1. What are the results of current OOOOa compressor station monitoring?
   1. # and volume of leaks
   2. Duration and cost of monitoring

2. From quarter to quarter what are the differences in results

3. What is the repair performance and costs?
CASE STUDY SCOPE

• Companies: 5 (large transmission companies)
• # of Facilities: 104
• # of Monitoring Events: 224 (2017-158, 2018-66)
• Avg. # of Compressors: 2.4
• Duration: OOOOa 2017 Q1-Q4 and 2018 Q1 (4.5 cycles)
• Locations: OK, PA, TN, LA, TX, OH, NY, SC, WV
TECHNICIAN

• 1-person Crew with min. TARGET Tech L1 (2-10 years experience)
• holds a detailed understanding of the various processes that are involved in the transportation and processing on natural gas.
• is trained (certified) and experienced in the use of fugitive emission detection equipment;
• has a minimum of 1000 hours of experience on the use of optical gas imaging
• maintains required safety training and strong understanding of applicable TARGET Safe Operating Procedures; and
• received performance audits to ensure compliance to our prescriptive fugitive emission assessment protocol
EQUIPMENT

FLIR GF320

Bubble Test Soln.

Data Management
LEAK DATA

- Max Rate: 7.85 cfm
- Min Rate: 0.01 cfm
- Mean: 0.12 cfm
- STDev: 0.31 cfm
- Quantification: 20% HiFlow Sampler, 80% OGI Estimate

<table>
<thead>
<tr>
<th>Severity</th>
<th># of Leaks</th>
<th>% Count</th>
<th>Volume (cfm)</th>
<th>% Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH over 0.5 cfm</td>
<td>56</td>
<td>3%</td>
<td>67</td>
<td>27%</td>
</tr>
<tr>
<td>MEDIUM 0.1 cfm - 0.5 cfm</td>
<td>630</td>
<td>32%</td>
<td>111</td>
<td>45%</td>
</tr>
<tr>
<td>LOW less than 0.1 cfm</td>
<td>1291</td>
<td>65%</td>
<td>68</td>
<td>27%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1977</td>
<td>100%</td>
<td>246</td>
<td>100%</td>
</tr>
</tbody>
</table>
LEAK SAMPLES

RATE: 0.67 cfm
LEAK SAMPLES

RATE: 0.09 cfm
## COUNT & RATES

<table>
<thead>
<tr>
<th>METRIC</th>
<th>AVERAGE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Facilities</td>
<td>1</td>
<td>104</td>
</tr>
<tr>
<td># of Monitoring Events</td>
<td>2.2</td>
<td>224</td>
</tr>
<tr>
<td># of Leaks per Facility</td>
<td>19</td>
<td>1977</td>
</tr>
<tr>
<td># of Leaks per Survey</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Leak Rate (ft³/min.)</td>
<td>2.4</td>
<td>246</td>
</tr>
</tbody>
</table>

![LEAK RATE & COUNT METRICS](image-url)
### QUANTITATIVE COST/BENEFIT

<table>
<thead>
<tr>
<th>METRIC</th>
<th>PER SURVEY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Gas Savings ($/year)</td>
<td>$1,609</td>
<td>$360,484</td>
</tr>
<tr>
<td>Repair Costs</td>
<td>$450</td>
<td>$100,800</td>
</tr>
<tr>
<td>Monitoring Cost</td>
<td>$1,220</td>
<td>$273,280</td>
</tr>
<tr>
<td>Net Present Value of Program</td>
<td>$1,122</td>
<td>$251,328</td>
</tr>
<tr>
<td>Program Payback Period</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

- The Net Present Value using 10% discount rate and 2-year average repair life
- Avg. monitoring time: 3.1 hours
- Avg. costs fully inclusive (onsite monitoring, travel expenses, reporting)
- Repair costs estimated based on leak component/type
QUALITATIVE COST/BENEFIT

• SAFETY
  • 22 leaks identified as potential safety hazard
    • 12 Moderate
    • 7 High
    • 3 Extreme

• EXPOSURE
  • Approx. 60% of leaks found in buildings and common work areas

• ENVIRONMENT
  • 59,000 tonnes CO2e per year emissions
FREQUENCY ANALYSIS

• Average change in leak count between surveys: -18%
• Average change in leak rate between surveys: -23%
• Largest Count Increase: 1066%
• Largest Rate Increase: 3800%
• Largest Count Decrease: -90%
• Largest Count Decrease: -96.9%
• Reoccurring Leaks: 5%

Factors Affecting Changes/Variations

• Turn around
• Weather Conditions
• Operating mode
FREQUENCY ANALYSIS

Leak Count Change

Rate Change (cfm)
LDAR PROFILE

Emission Rates

Baseline Rate

Maintenance Rate

Survey Cycles

Frequency

1st

2nd

3rd

4th...

## Repair Metrics

<table>
<thead>
<tr>
<th></th>
<th>Overdue</th>
<th>DOR</th>
<th>Repaired Onsite</th>
<th>Within 5 Days</th>
<th>Within 15 Days</th>
<th>16-30 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3%</td>
<td>3%</td>
<td>10%</td>
<td>9%</td>
<td>21%</td>
<td>54%</td>
</tr>
</tbody>
</table>

- Repair tracking quite active across numerous companies
- Many repairs done near due date
- Overall impressive responses
CONCLUSIONS

• Significant economic benefit in terms of saved gas
• Auxiliary benefits (safety, environmental)
• Negligible reoccurring leaks
• Repair activities were responsive and tracked well
• Decrease in Leak and Rate amounts consistent with expected LDAR program evolution profile
• Data would tend support quarterly leak inspections to increase the probability of monitoring each compressor in full operation mode when most leaks would be present with a possible reduction in frequency when steady state leak profile is reached
THANK YOU

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