Emission Management Process

- Regulation Corporate
- Inventory / Measurement Field
- Regulatory Risk Analysis
- MACC Analysis
- Projects Field

MRRCP & Production Accounting Corporate
# 1st Stage Inventory & Measurement

<table>
<thead>
<tr>
<th>Facility #1</th>
<th>Facility #2</th>
<th>Facility #3</th>
<th>Facility #4</th>
<th>Facility #5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fugitives</td>
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<tr>
<td>Tanks</td>
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<tr>
<td>Compressor</td>
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<tr>
<td>Pneumatics</td>
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<tr>
<td>Venting</td>
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</tr>
</tbody>
</table>

- **Facility Inventory**
  - Active?
  - D056 License Type?
- **Fugitives**
  - OGI / Method 21
- **Tanks**
  - Controlled?
  - Vent rate?
- **Compressors**
  - Controlled?
  - Vent rate / throw
- **Pneumatics**
  - Fuel Gas?
  - Device ID details
  - Function?
- **Venting**
  - Routine vent rate?
Fugitive Emissions

- Leak survey method
- Engineering Calculation and Direct Measurement
- Measurement
  - Budget vs. Speed vs. Accuracy
  - Volumetric sampling
  - Quantifiable Optical Gas Imaging (QOGI)
- Fugitive challenges
  - Repair tracking
  - FEMP reporting bottom up vs. top down
  - Emission Technologist training & process knowledge
Storage Tanks

• FLIR Gfx320 provides quid ID of heavy, continuous and controlled losses

• Tank controlled?

• Engineering Calculation and Direct Measurement

• Direct Measurement Challenges
  • Backpressure
  • Safety
  • Multiple vent sources?
  • Budget and speed?
  • Working & breathing loss – length of test?

• Consideration
  • Undersized separators
  • Dump valve malfunction
  • Controlled tank losses. Fugitive, VRU process, etc
Compressors

- Screen w/ FLIR GFx320 and/or Direct Measurement
- Measurement challenges
  - Measurement process connection?
  - Working at heights
  - Multiple vent sources?
  - Emission Technologist Training & process knowledge
- Considerations
  - Non-operating & pressurized compressor may still vent
  - Screen control devices w/ OGI to ensure full capture
  - Engine start vent rate and fate of gas
Pneumatics

- Emission factor or Direct Measurement
- Vent Side & Supply Side Measurement
  - Backpressure
  - Case seal leaks
  - Budget and speed
- Why 15 minutes for level?
  - 10 tones vs 100 tones?
- Inventory challenges
  - Annual pump utilization rate?
  - Acquisition, divestment and shut in sites
  - Delineating production?
  - Bottom up vs. top down
  - Age of previous inventory
  - Training & process knowledge
- LDAR identify malfunction devices
Pneumatics
Step 1 – Regulatory Risk Analysis

• Compile site emission source inventory & measurements
• Compare each emission sources against site emission regulations
• Any emission sources outside of compliance moves to MACC process
• Foundation for AER Methane Reduction Retrofit Compliance Plan (MRRCP)
## Step 1 – Regulatory Risk Analysis

<table>
<thead>
<tr>
<th>Location</th>
<th>Pneumatic (m³/hr)</th>
<th>Fugitives (m³/hr)</th>
<th>Compressor Seals (m³/hr)</th>
<th>Venting (e³m³/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility #1</td>
<td>0.10</td>
<td>1.5</td>
<td>2-Throw = 5.1</td>
<td>1.75</td>
</tr>
<tr>
<td>Facility #2</td>
<td>0.30</td>
<td>1.25</td>
<td>2 Throw = 4.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Facility #3</td>
<td>0.00</td>
<td>0.00</td>
<td>2 Throw = 0.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Facility #4</td>
<td>0.20</td>
<td>1.0</td>
<td>2 Throw = 0.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Facility #5</td>
<td>0.50</td>
<td>0.75</td>
<td>2 Throw = 1.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Company Total</td>
<td>1.1</td>
<td>4.5</td>
<td>11.7</td>
<td>15.25</td>
</tr>
<tr>
<td>Fleet Average</td>
<td>0.22</td>
<td>0.90</td>
<td>2.34 or 0.98 /throw</td>
<td>3.05</td>
</tr>
</tbody>
</table>

Annual Inventory, Measurement Production Accounting
Step 2 - MACC

MACC
• Based on inventory and measurement of site assets
• Costs of technology
• Economics
• Lowest cost pathway to regulatory compliance
• Avoid stranded capital in delineated assets
• Capital compliance cost
Step 2 - MACC

REMVUE 7042 AFR 4150 and Equivalent to C1
L2 Retrofits
16-17-038-23W3
Electrification

05-09-34-09W4
06-06-049-12W5
I2p Retrofit

LDAR
Norriseal 1001a and Equivalent
07-04-38-07W4
04-05-60-07W5
01-33-44-05W6
01-11-22-33W4

Slipstream 546 to I2p-100
07-04-38-07W4
04-05-60-07W5
01-33-44-05W6
01-11-22-33W4

2 Methanol Pump Systems
Small VRU
Moderate VRU
Methanol Pumps

GreenPATH ENERGY LTD
Thank You