Natural Gas STAR

Natural Gas STAR 15th Annual

Implementation Workshop

Identifying Top Methane Emission Sources in Gas Processing Plants

Clearstone Engineering, Ltd

Reducing Methane Emissions from Gas Processing Plants - Outline

- Emission Reduction
  - Opportunities
  - Barriers
- Conduct a Facility Review
- Field Measurement Results
- Conclusions and Findings

Opportunities to Reduce Methane Emissions

- There are significant opportunities to address major leak sources and cost-effectively reduce methane emissions
  - Improvements in energy efficiency
    - up to 15%
  - Reduce fugitive emissions
    - up to 70%
  - Reduce venting and flaring emissions
    - between 50 to 70%
- Significant gas savings and marketable carbon credits offset implementation costs

Barriers and Challenges to Successful Implementation

- Lack of measurement data needed to assess opportunities and develop a business case
- Competition with other more traditional investment opportunities for available capital resources
- Operational constraints (declining throughput, age and condition of facilities)
- Ability to measure and track success (Key Performance Indicators)

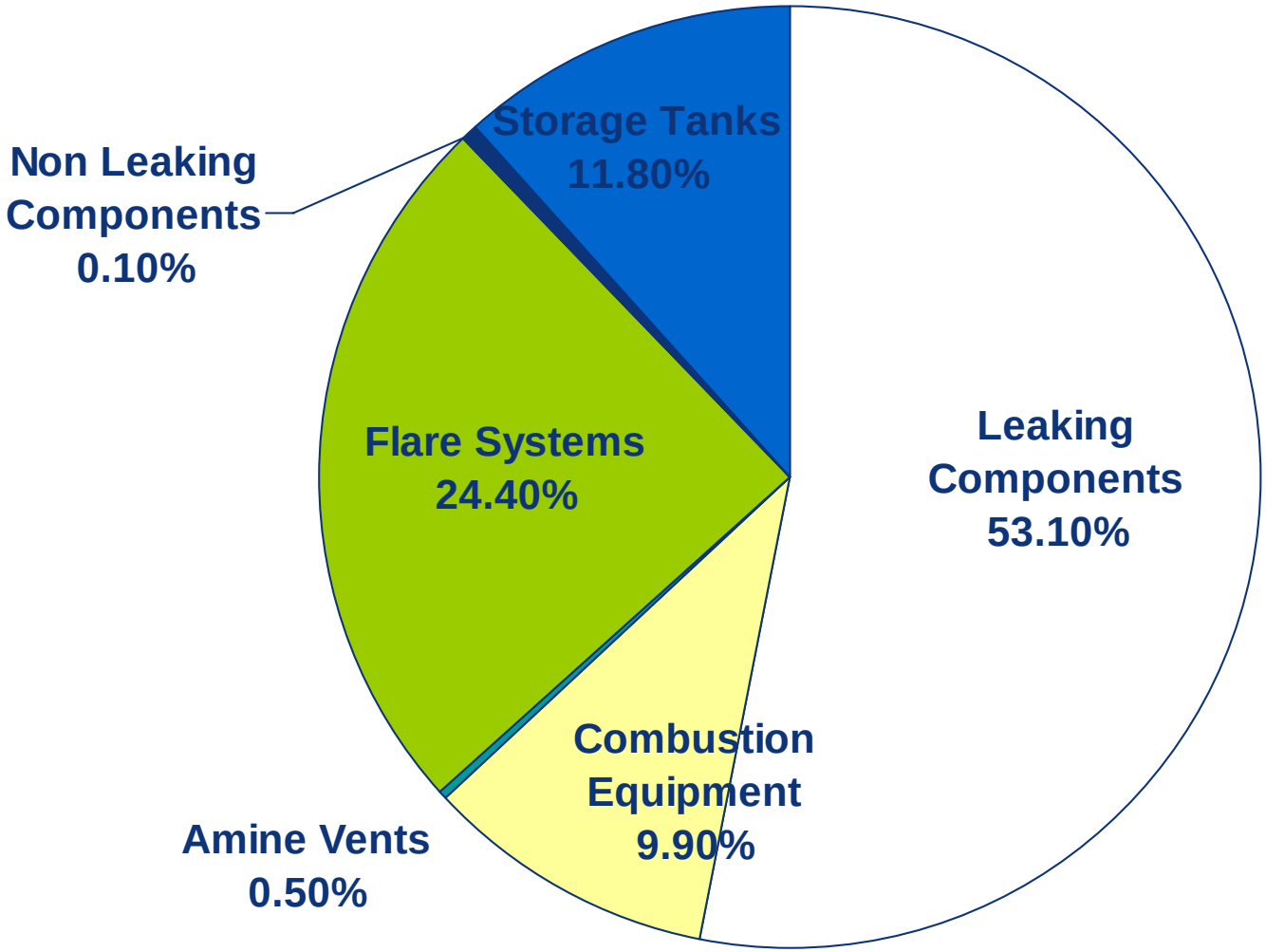
How To Conduct a Facility Review?

- Target facilities likely to offer significant opportunities
  - Older facilities
  - Natural gas facilities with compression
  - Facilities with high energy intensities and/or process shrinkage
- Use a multi-disciplinary team approach to quantify all emission sources (equipment and process)
  - Take full advantage of the team while they are at the site
- Evaluate, select and prioritize technologies and practices to reduce methane emissions

How To Conduct a Facility Review?

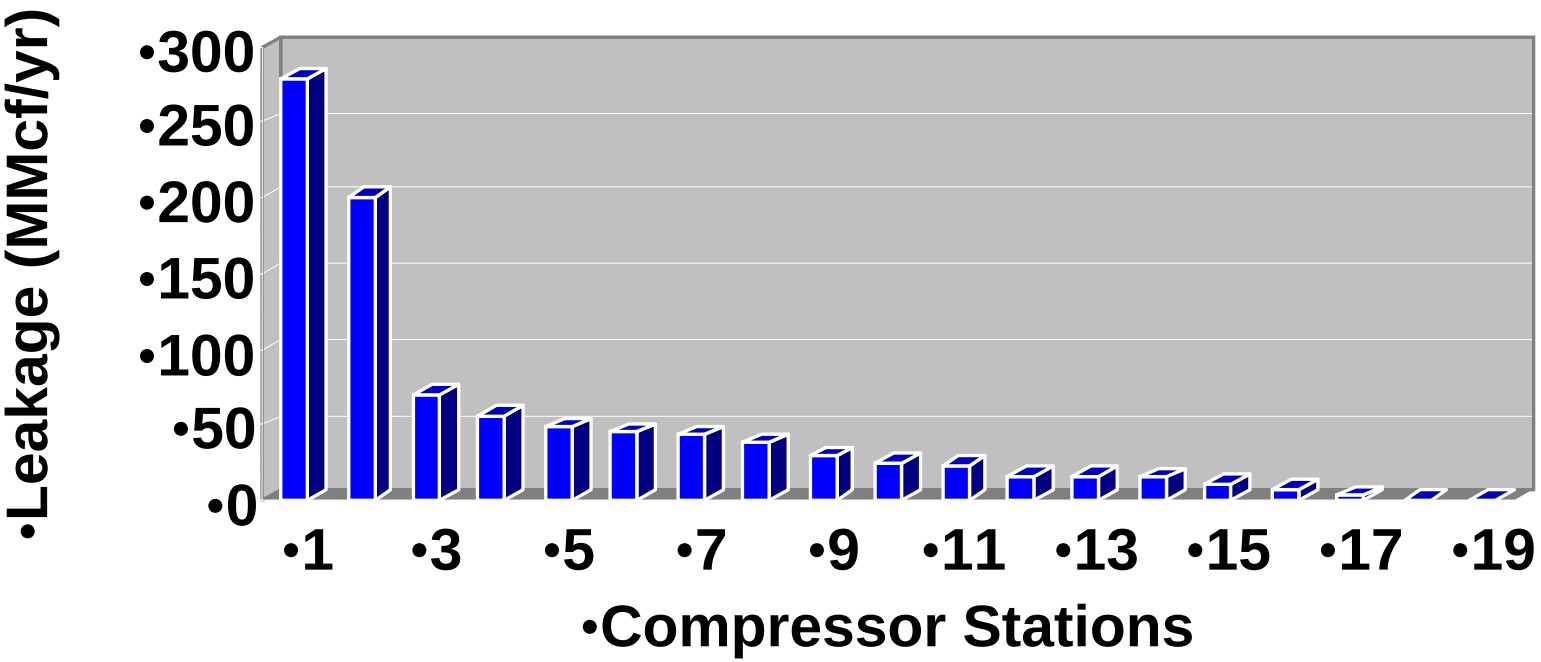
- Conduct baseline survey/field Measurement
- Identify and document reduction opportunities
- Prioritize and implement solutions
- Conduct confirmatory field measurement
- Develop a long term plan to monitor performance
- Record activities and report annually to Natural Gas STAR

Distribution of Losses by Source Category

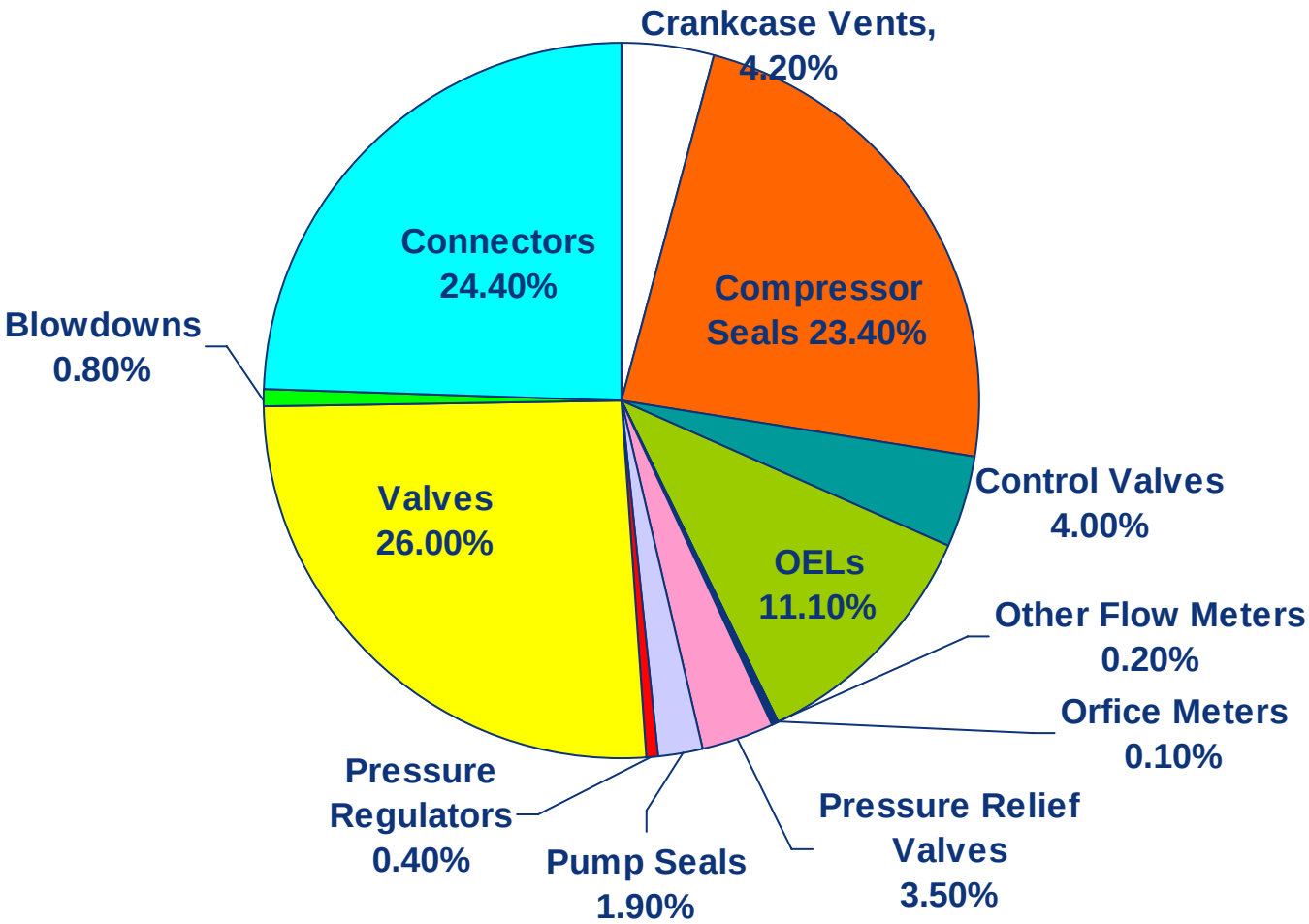


Fugitive Emissions

- Distribution of opportunities is skewed
- Few sources are responsible for majority of emissions-focus efforts on these sources first



Distribution of Losses from Equipment Leaks by Type of Component



Fugitive Emissions

- Top Sources
  - Compressor seals (34% leak)
  - OELs (20% leak)
  - Fuel service components (18% leak)

How Much Methane is Emitted?

- Summary of Natural Gas Losses from the Top Ten Leak Sources (excluding leakage into flare systems)

Plant Number	Gas Losses from Top 10 Leak Sources (Mcf/day)	Gas Losses From All Leak Sources (Mcf/day)	Contribution By Top 10 Leak Sources (%)
1	43.8	122.5	35.7
2	133.4	206.5	64.6
3	224.1	352.5	63.6
4	76.5	211.3	36.2
Combined	477.8	892.8	50.02

Storage Tank Emissions

- Top Sources
  - Flashing losses
  - Unintentional gas carry-through to storage tanks
    - Leakage past the seats of drain and dump valves
    - Malfunctioning level controllers
    - Inefficient upstream gas/liquid separation
    - Piping changes resulting in unstabilized product going to tanks
  - Malfunctioning vapor recovery systems
    - Faulty blanket gas regulators or pressure controllers
    - Fouled vapor collection lines
    - Leaking pressure-vacuum valves and thief hatches
    - Undersizing of systems

Storage Tank Emissions

- Field Measurement Results

Facility	Methane Emissions (10^3M^3/year)	Value of Lost Gas (Based on $7/Mcf/year)
Plant C	57	441,371
Plant E	93	24,559
Plant H	2,651	1,880,267
TOTAL	**2,801**	**2,346,197**

Venting and Flaring Emissions

- Top Sources
  - Gas operated devices
  - Still column off gas vents on glycol dehydrators
  - Leakage into vent/flare headers
  - Excessive purge gas rates
  - Inspection and maintenance activities and pipe tie-ins

Venting and Flaring Emissions

- Field Measurement Results

Facility	**Methane Emissions (10^3M^3/year)**	**Value of Lost Gas (Based on $7/Mcf/year)**
Plant A	3	53,765
Plant C	28	227,445
Plant D	18	342.272
Plant E	14	219,000
Plant F	66	1,249.588
TOTAL	**130**	**2,092,070**

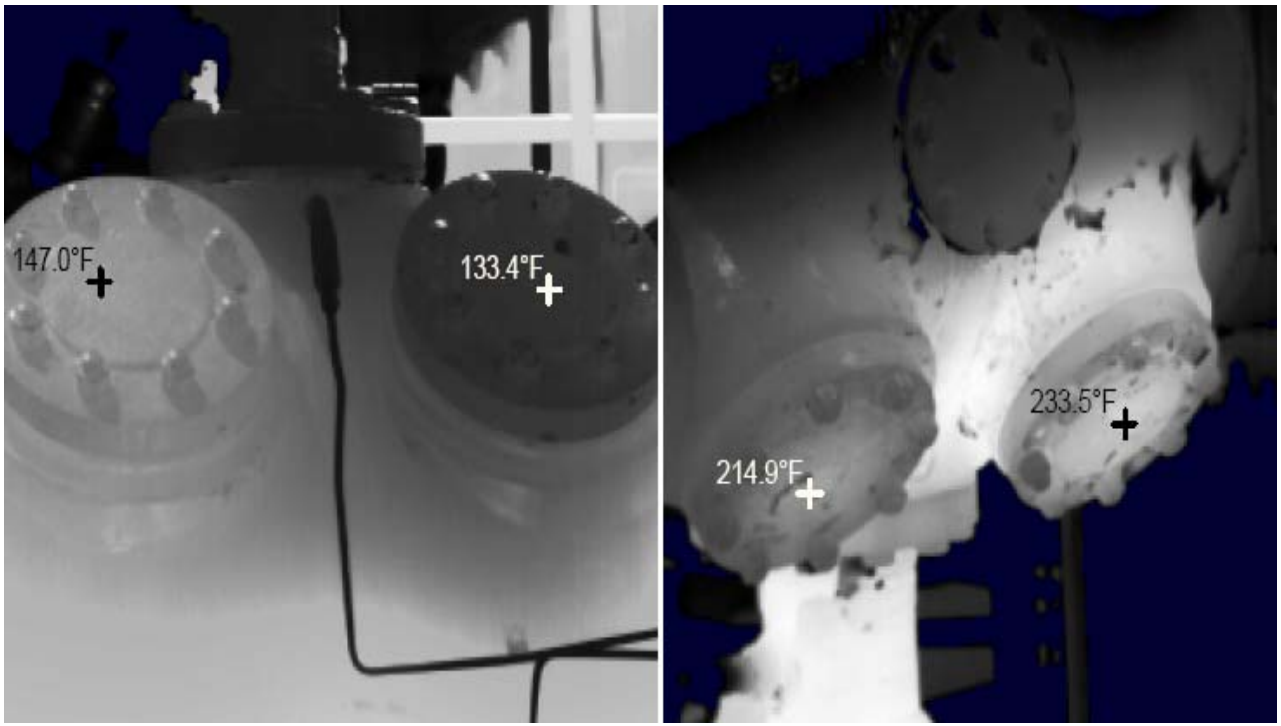
Combustion Equipment Emissions

- Top Sources
  - Oversized engines
  - Heaters and boilers
  - Poor tuning (e.g., air/fuel ratio)
  - Leakage past pistons in engines
  - Waste heat utilization to offset duties on heat medium heaters
  - Fouled or undersized burner tubes
  - Fouled or undersized air intake systems (e.g., fouled flame arrestors)
  - Waste heat recovery

Compressor Emissions

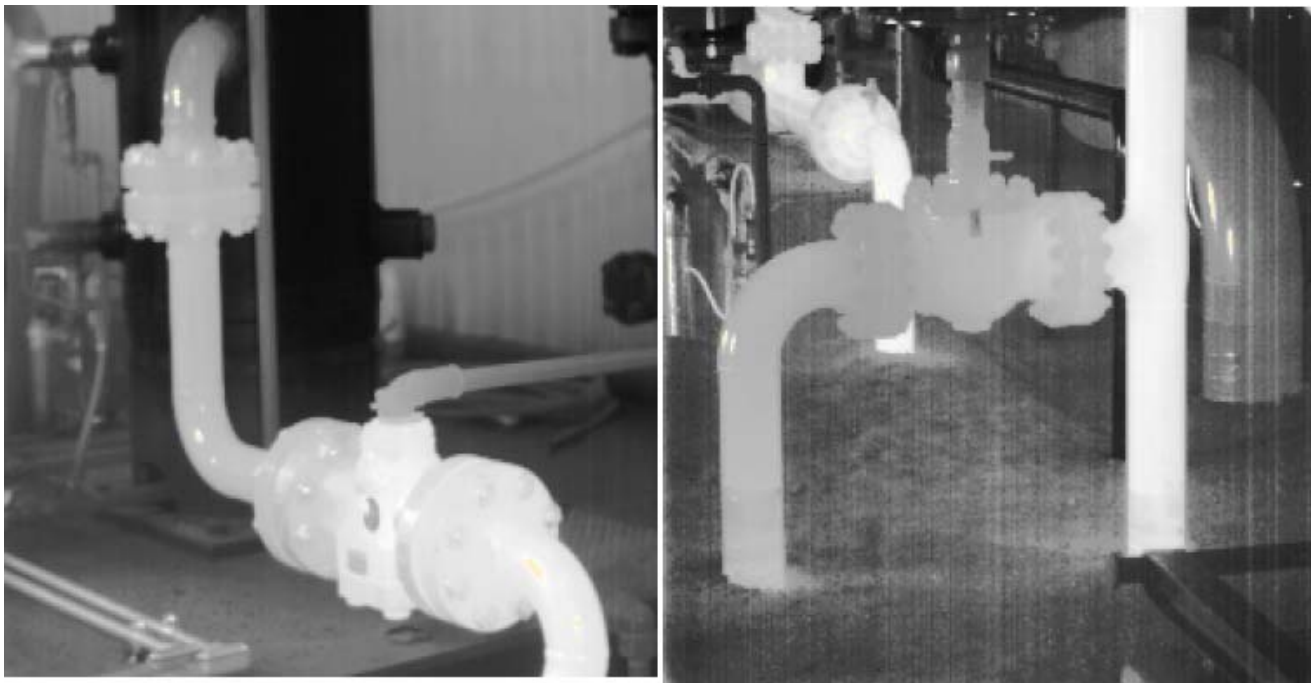
- Top Sources
  - Internal valve and cylinder leakage in reciprocating compressors
  - Pulsation losses
  - Excessive gas recirculation

IR CAMERA Results



Suction valve (left) in the left picture is leaking.
Discharge valve (right) in the right picture is leaking.

IR CAMERA Results



Leaking bypass valve results in leakage from discharge to suction scrubber.

Process Performance Emissions

- Top Sources
  - Lack of waste heat recovery and heat integration
  - Fouled heat exchangers
  - Poor process control resulting in increased re-processing, venting and flaring
  - Use of low efficiency equipment
  - Excessive chemical circulation rates in absorption processes
  - Excessive pressure and heat losses

Conclusions and Findings

- Targeted and holistic screening of facilities is the best approach for identifying and prioritizing methane emission reduction activities
- Opportunities vary dramatically between facilities
- Benefits of reducing methane emissions
  - Increased production through reduced losses and fuel consumption
  - Increased revenues.
  - Reduced operating cost.
  - Generate marketable carbon credits
- Improve environmental performance
  - Associated reduction of other pollutants, e.g., H_2S, VOC, NO_x, SO_2. CO and PM

Wrap up

- Questions?
- Additional Information
  - Natural Gas STAR: epa.gov/gasstar
  - Technologies and Practices: epa.gov/gasstar/tools/recommended

- Thank you
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