Rules of Thumb and Best Practices for Conducting Directed Inspection and Maintenance

Methane to Markets Partnership Expo

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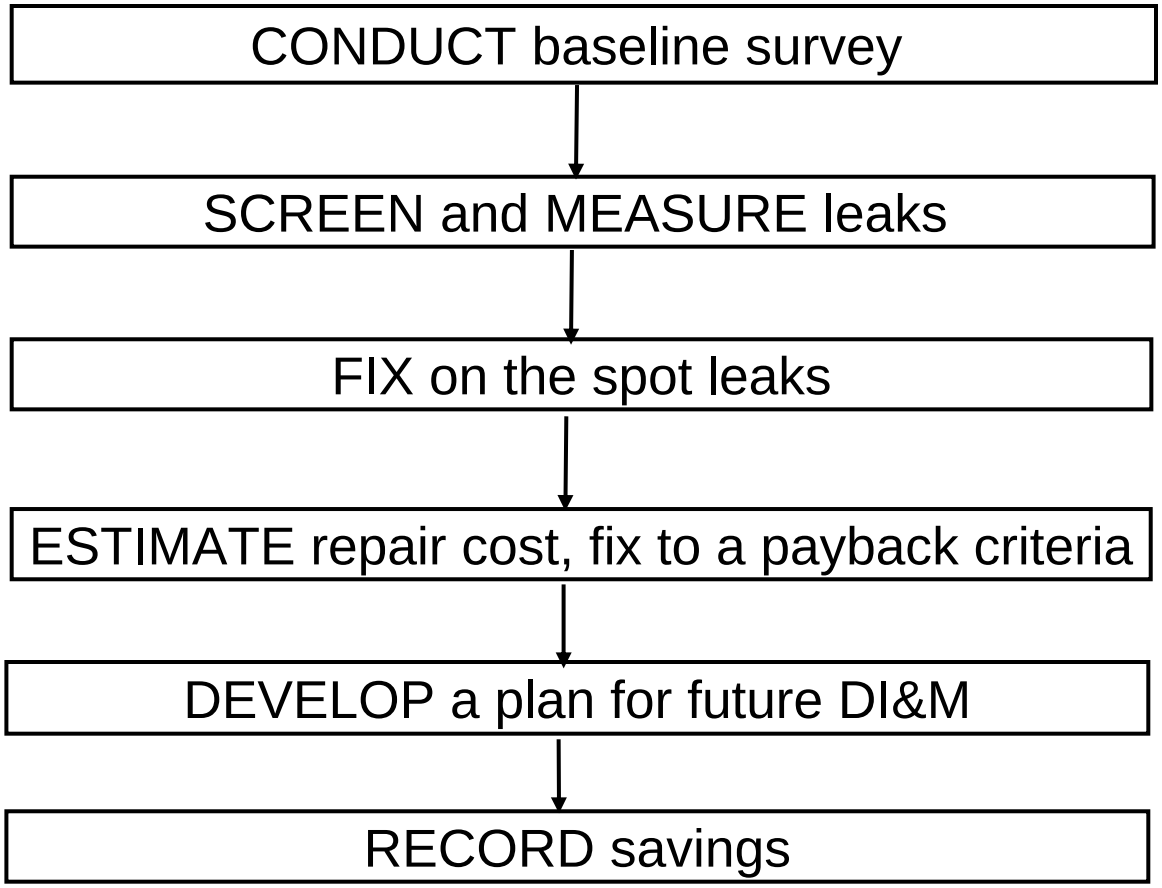
What is the Problem?

- Production, processing and transmission methane gas leaks are *invisible*, *odorless*, and *go unnoticed*
- Natural Gas STAR companies find that valves, connectors, compressor seals, and open-ended lines (OELs) are major methane fugitive emission sources
  - Fugitive methane emissions depend on operating practices, equipment age, and maintenance practices

Where is the leak?

How Do You Implement DI&M?



Summary of Screening and Measurement Techniques

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Instrument/ Technique	**Effectiveness**	**Approximate Capital Cost**
Soap Solution	★★	$
Electronic Gas Detector	★	$$
Acoustic Detector/ Ultrasound Detector	★★	$$$
TVA (Flame Ionization Detector)	★	$$$
Calibrated Bagging	★	$$
High Volume Sampler	★★★	$$$
Rotameter	★★	$$
Infrared Leak Detection	★★★	$$$

* Least effective at screening/measurement

*** Most effective at screening/measurement

$ Smallest capital cost

$$$ Largest capital cost

Leak Detection Study: Key Methane Emission Sources

- Study of 5 natural gas facilities provides insight into key methane sources[1]
  - Screened for all leaks, measured larger leak rates
- Principles of study are relevant to all sectors
  - A relatively small number of large leaks cause most fugitive emissions
  - Fugitive leaks from **valves, connectors, compressor seals, and open-ended lines** are a large source of revenue loss for all sectors
  - Solution is the same – prioritizing and repairing largest leaks is efficient and cost-effective

Source: Hy-bon

[1] Clearstone Engineering, 2006, *Cost-Effective Directed Inspection and Maintenance Control Opportunities at Five Gas Processing Plants and Upstream Gathering Compressor Stations and Well Sites*.

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Study Findings: Quantity of Methane Emitted

Summary of Natural Gas Losses from the Top Ten Leak Sources[1]				
Facility	**Total Number of Components**	**Gas Losses From Top 10 Leak Sources (m^3/day)**	**Gas Losses From All Leak Sources (m^3/day)**	**Contribution By Top 10 Leak Sources (%)**
1	22,290	2,200	7,700	29
2	12,330	370	650	56
3	18,353	1,500	3,300	45
4	16,687	1,700	1,950	87
5	4,478	9,000	12,000	75
Combined[2]	74,438	14,770	25,600	58

Source: Clearstone Engineering, 2006

1 – Excluding leakage into flare system

2 – Combined data includes top 10 leak sources from each plant (50 total)

Estimating Comprehensive Survey Cost

- Cost of complete screening survey (processing plant)
  - Ranges $15,000 to $20,000 per medium size plant
  - Rule of Thumb: $1 per component for an average processing plant
  - Cost per component for remote production sites would be higher than $1
  - Using Infrared camera and high volume sampler as primary tools for survey
- 25 to 40% cost reduction for follow-up survey
  - Focus on higher probability leak sources (e.g. compressors)
- Numerous companies have indicated that surveys conducted with purchased equipment or service providers payback immediately from gas savings

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