Directed Inspection and Maintenance and IR Leak Detection

Lessons Learned from Natural Gas STAR

Producers and Processors Technology Transfer Workshop

ConocoPhillips and EPA's Natural Gas STAR Program
Kenai, AK
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Directed Inspection and Maintenance (DI&M): Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions

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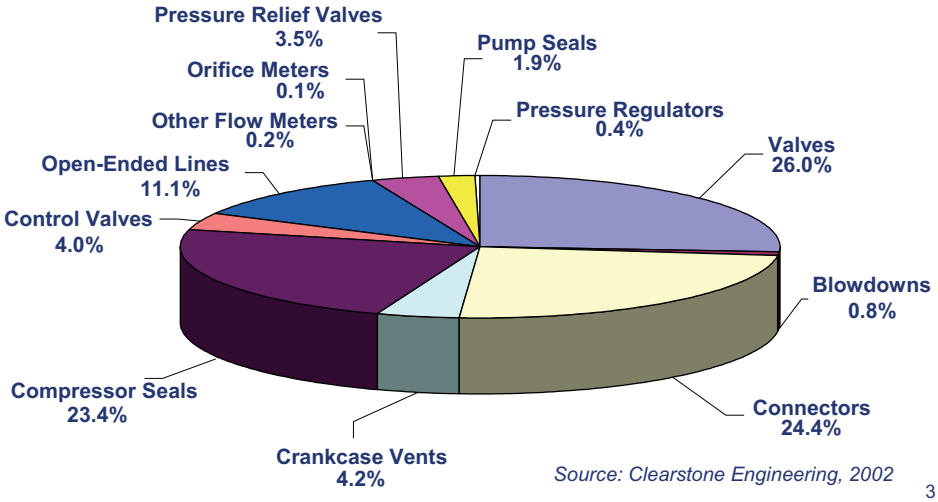
Methane Losses by Equipment Type



Source: Clearstone Engineering, 2002

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What is the Problem?

- Gas leaks are *invisible*, *unregulated* and *go unnoticed*
- Gas STAR Partners find that valves, connectors, compressor seals and open-ended lines (OELs) are major sources
  - 27 Bcf of methane emitted per year by reciprocating compressors seals and OELs, each contributing equally to the emissions

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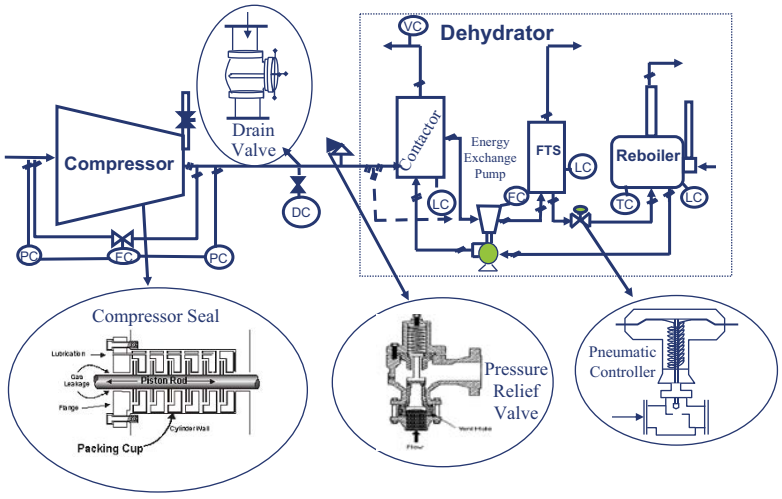
What are the Sources of Emissions?



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How Much Methane is Emitted?

Methane Emissions from Leaking Components			
Component Type	**% of Total Methane Emissions**	**% Leaks**	**Estimated Average Methane Emissions per Leaking Component (Mcf/year)**
Valves (Block & Control)	26.0%	7.4%	66
Connectors	24.4%	1.2%	80
Open-Ended Lines	11.1%	8.1%	186
Pressure Relief Valves	3.5%	2.9%	844
Source: Clearstone Engineering, 2002, Identification and Evaluation of Opportunities to Reduce Methane Losses at Four Gas Processing Plants. Report of results from field study of 4 gas processing plants in WY and TX to evaluate opportunities to economically reduce methane emissions.			

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How Much Methane is Emitted?

- A total of 101,193 components were screened at four processing plants

Summary of Natural Gas Losses from the Top Ten Leakers[1].

Plant No.	Gas Losses From Top 10 Leakers (Mcfd)	Gas Losses From All Equipment Leakers (Mcfd)	Contribution By Top 10 Leakers (%)	Contribution By Total Leakers (%)
1	43.8	122.5	35.7	1.78
2	133.4	206.5	64.6	2.32
3	224.1	352.5	63.6	1.66
4	76.5	211.3	36.2	1.75
Combined	477.8	892.84	53.5	1.85

[1]Excluding leakage into flare system

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Methane Recovery

- Fugitive losses can be dramatically reduced by implementing a DI&M program
  - Voluntary program to identify and fix leaks that are cost effective to repair
  - Survey cost will pay out in the first year
  - Provides valuable data on leakers with information of where to look

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What is DI&M?

- Direct Inspection and Maintenance
  - Cost-effective practice by definition
  - Find and fix significant leaks
  - Choice of leak detection technologies
  - Strictly tailored to company's needs
- DI&M is NOT the regulated volatile organic compound (VOC) leak detection and repair program (LDAR)

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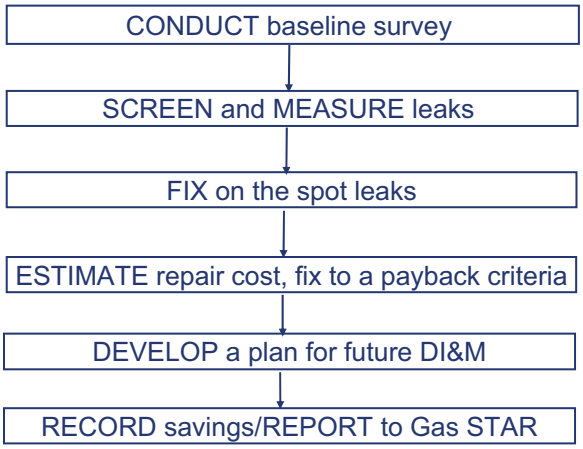
How Do You Implement DI&M?



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Screening and Measurement

Summary of Screening and Measurement Techniques		
Instrument/ Technique	***Effectiveness***	***Approximate Capital Cost***
Soap Solution	* *	$
Electronic Gas Detectors	*	$$
Acoustic Detection/ Ultrasound Detection	* *	$$$
TVA (FID)	*	$$$
Bagging	*	$$$
High Volume Sampler	* * *	$$$
Rotameter	* *	$$
Infrared Detection	* * *	$$$

* - Least effective at screening/measurement
*** - Most effective at screening/measurement
$ - Smallest capital cost
$$$ - Largest capital cost

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How Do You Implement DI&M?

- Evaluate the leaks detected - measure results
  - High Volume Sampler
  - Toxic Vapor Analyzer (correlation factors)
  - Rotameters
  - Calibrated bag

Leak Measurement Using a High Volume Sampler

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Is Recovery Profitable?

Repair the Cost Effective Components			
Component	**Value of Lost Gas[1] ($)**	**Estimated Repair Cost ($)**	**Payback (Months)**
Plug Valve: Valve Body	29,496	200	0.1
Union: Fuel Gas Line	28,362	100	0.0
Threaded Connection	24,374	10	0.0
Distance Piece: Rod Packing	17,847	2,000	1.4
Open-Ended Line	16,238	60	0.0
Compressor Seals	13,493	2,000	1.8
Gate Valve	11,034	60	0.1

[1]Based on $7/Mcf gas price

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DI&M - Lessons Learned

- A successful, cost-effective DI&M program requires measurement of the leaks
- A high volume sampler is an effective tool for quantifying leaks and identifying cost-effective repairs
- Open-ended lines, compressor seals, blowdown, engine-starter and pressure relief valves represent <3% of components but >60% of methane emissions
- The business of leak detection is changing dramatically with new technology

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DI&M - Partner Experience

- Partner A: Leaking cylinder head was tightened, which reduced the methane emissions from almost 64,000 Mcf/yr to 3,300 Mcf/yr
  - Repair required 9 man-hours of labor
  - Gas savings were approximately 60,700 Mcf/yr
  - Value of gas saved was $424,900/year at $7/Mcf
- Partner B: One-inch pressure relief valve emitted almost 36,774 Mcf/yr
  - Required five man-hours of labor and $125 of materials
  - Value of the gas saved was $257,400 at $7/Mcf

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Discussion Questions

- To what extent are you implementing these opportunities?
- How could these opportunities be improved upon or altered for use in your operation?
- Can you suggest other methods for reducing emissions from leaking components?
- What are the barriers (technological, economic, lack of information, manpower, etc.) that are preventing you from implementing these practices?

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