

Directed Inspection and Maintenance & High Bleed Pneumatic Device Conversion

EPA Gas STAR Production Technology
Transfer Workshop. State College, PA.
November 18, 2009

Milton W. Heath III
Heath Consultants Incorporated



Environmental Stewardship, Emission Reductions, Improved Safety and Profitability

Agenda

1. Industry Research Findings
2. DI&M with Advanced Leak Detection and Measurement Technologies
3. Chesapeake Energy Experience/Gas STAR Partner Savings
4. Leak Measurement Examples
5. Rod Packing Leak Rates



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What is the Problem?

- Gas leaks are invisible, unregulated and go unnoticed
- STAR Partners find that valves, connectors, compressor seals and open-ended lines (OELs) are major sources
 - 27 Bcf methane emitted per year by reciprocating compressor seals and OELs
 - Open ended lines contribute half these emissions
- Facility fugitive methane emissions depend on operating practices, equipment age and maintenance



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Industry Research on Leakage From Compressor Stations

- Indicates gas losses at compressor stations average 35,000 Mcf/station/year
- Equivalent to a loss of \$140,000/year at \$4/Mcf.
- Cost of Service + Repairs = \$50,000
- Payback Period = 4.0 months
- Profits Increase with Time



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Approach to Reducing Leakage

- Institute a measurement program that accurately measures all leaks
- Station personnel then have the information necessary to weigh the cost of the leak repair versus the value of the lost gas for each leak.



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Partial List of Potential Leak Sources

- Compressor Unit Valves
- Relief Valves
- Unit Blowdowns
- Compressor Packing
- Meter Tubes
- Valve Stems
- High Bleed Pneumatics
- Fuel Valves
- Various Piping & Vessel Flanges
- Online Gas Analyzers
- Centrif. Comp. Seals
- Pipeline Damage
- Winterization Pumps
- Chemical Pumps



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Top 4 Typical Fugitive Sources

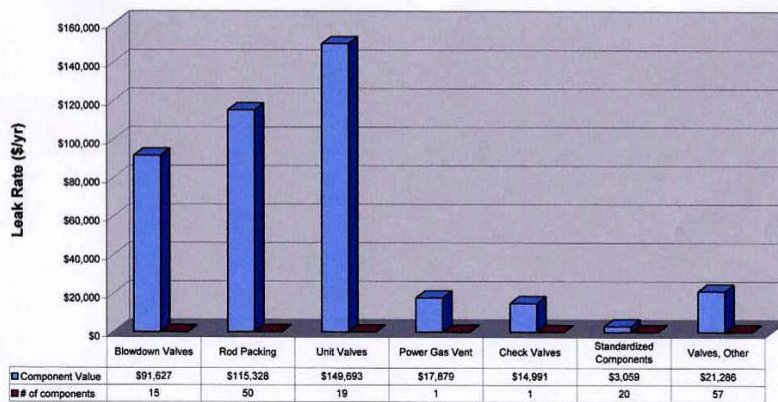
- Reciprocating Compressor Packing
- Blow Down Valves
- Unit Valves
- Scrubber Dump Valves

“Find The Needle In The Haystack”



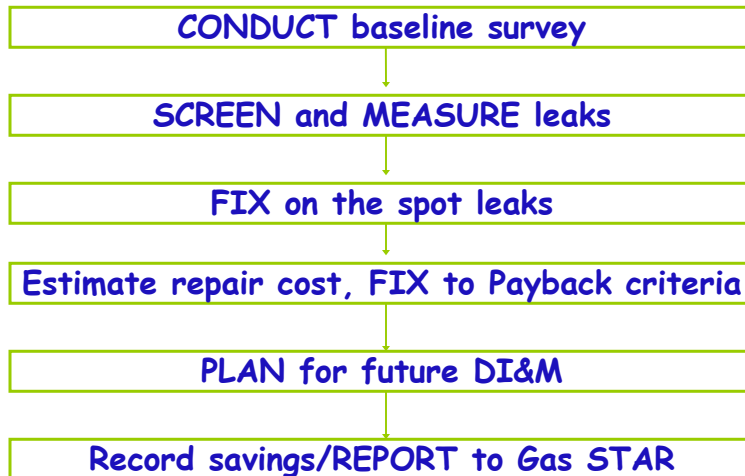
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Figure 2: Leakage by Major Component Category



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Implementing DI&M Program The Process



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Leak Survey Methods

● Leak Detection Tools

- Remote Methane Leak Detector (RMLD)
- Soap solution
- Flame Ionization
- Heath Detecto-Pak Infrared
- Catalytic oxidation/thermal conductivity
- Gas Imaging Camera
- Ultrasonic
- Visual



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Gas Imaging Camera



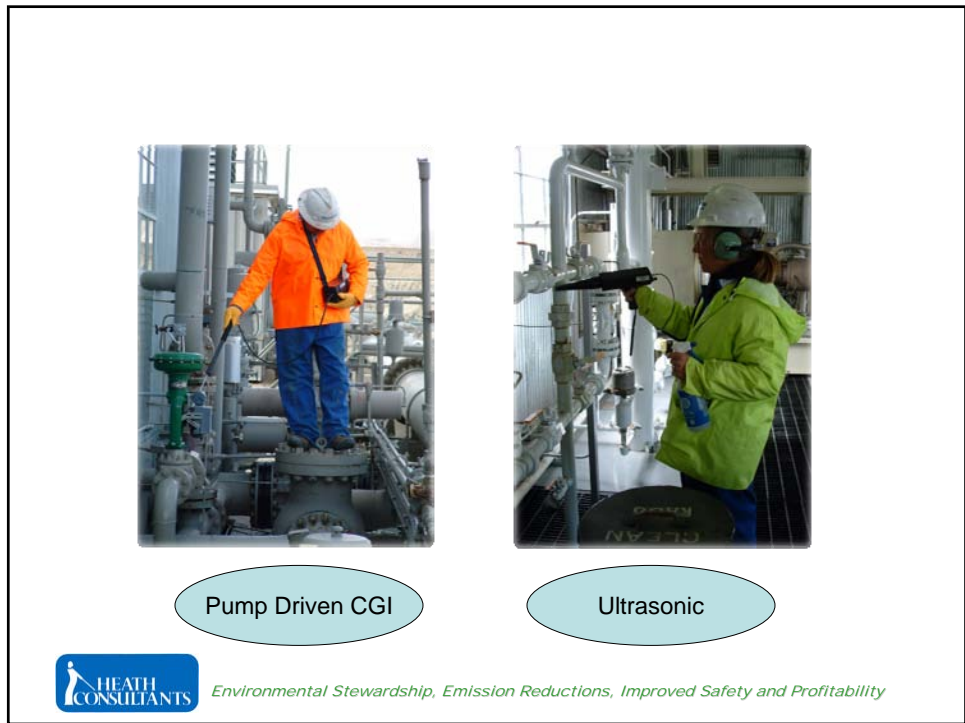
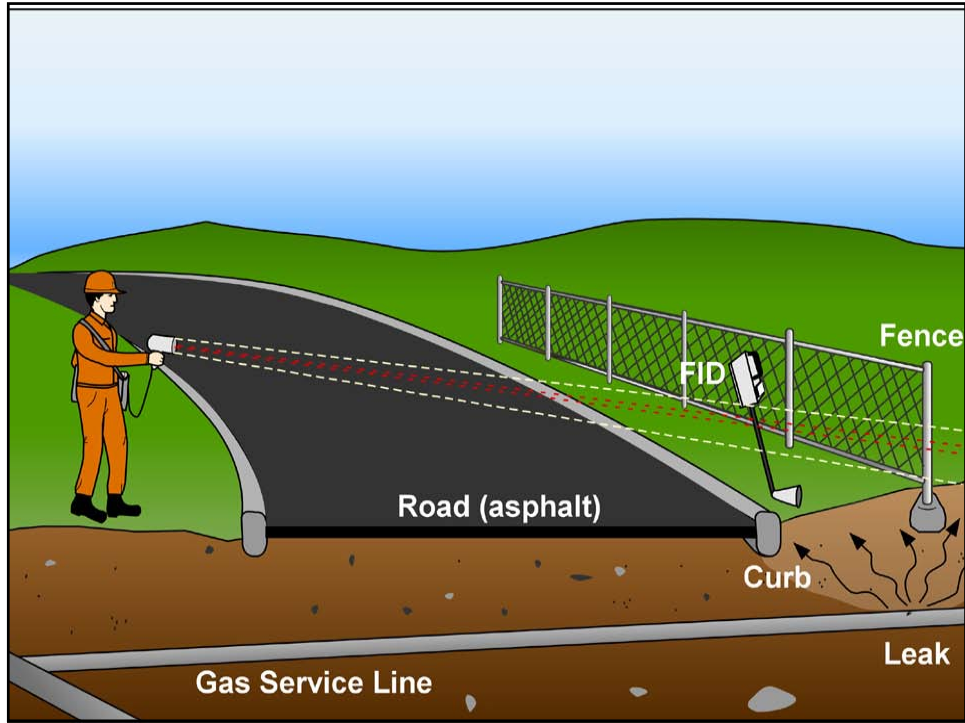
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RMLD

Remote Methane Leak Detector



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Measuring Fugitive Methane Emissions

Commercially Available Measurement Tools

- Hi Flow Samplers
- Vent-Bag
- Hot Wire Anemometer
- Rotameter



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Measurement / Quantification of Hydrocarbon Emissions

- For leaks up to 10 cfm – Hi Flow Sampler

10.5 cfm @ \$5/Mcf = \$27,594

Hi Flow Sampler Cost = \$17,640



- For leaks 10 – 240 cfm – Vent-Bag Method

50 cfm @ \$5/Mcf = \$131,400

100 cfm @ \$5/Mcf = \$262,800

Calibrated Vent Bag Cost = \$75



- For leaks >180 cfm – Anamometer

- Used only on vertical open ended line
- Much more subjective, requires experience.



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Hi Flow Sampler Applications



Advantages:

- Total Leak Capture
- Measures Leak Rate Directly
- Can Measure 30 components per hour
- Repair Decision Based on Leak Rate & Repair Costs



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Hi Flow Sampler Technology

- Captures Entire Leak
 - Measures Flow Rate (F) and Concentration (sample)
 - Subtracts the background (back) Concentration
 - Leak Rate = $F \times (\text{sample} - \text{back})$

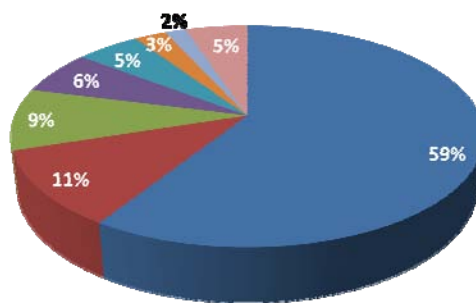


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2008 Chesapeake Energy Reductions by BMP

Methane Reduction Activity	% Reductions
RECs	59%
Pipeline Leak Repair	11%
Low Bleed Pneumatic Level Controllers	9.0%
Recover Dehy Flash Gas	6.4%
Plunger Lifts	5.2%
No-Bleed Chem Pump	2.6%
Optimize Glycol Circ Rate	1.7%
Replace Prod Unit w/Mech Dump Sep	1.3%
Workover - Green Re-Completion	0.9%
VRU	0.7%
De-Water/Unload with Foaming Agents	0.6%
Pressure/Hydraulic SWAB	0.5%
Install Elec Glycol Pump	0.3%
Vert Seps - Install Mech Dumps	0.1%
De-Water/Unload with Cap String	0.1%
Snubbing Operations	0.1%
Replace Gas Driver w/ Elec Motor - Compressors	0.1%
Flir Camera Leak Repair	0.1%
Remove/Bypass Prod Unit or Sep	0.1%
Low Bleed Pressure Controllers	0.1%
Recover Dehy FG to Suction	0.1%
Replace Gas Driver w/ Elec Motor - Pumping Units	0.07%
Blow Down to Sales	0.04%
No-Vent Gathering System Tie-In	0.03%
Engine Starter Change	0.02%
Pipeline Hot Tap	0.01%
De-Water/Unload with CVR String	0.004%
De-Water/Unload with Pumping Unit	0.004%
De-Water/Unload with Compression	0.001%
De-Water/Unload with Gas Lift	0.001%
Total	100%



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Low Bleed Pneumatic Level Controllers



■ Low Bleed Pneumatic Level Controllers ■ Retrofits



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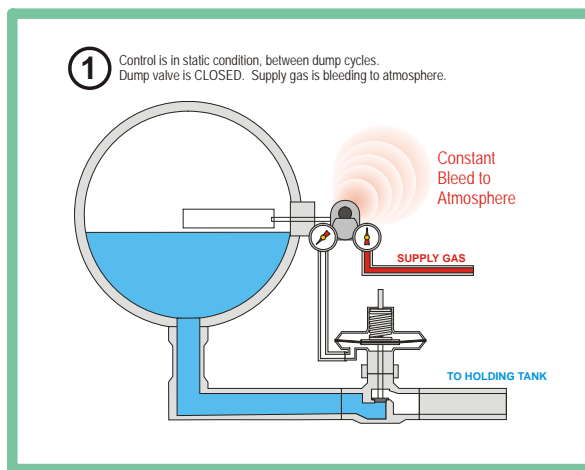


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Typical Hi-Bleed Cycle Pneumatic Level Control

Dump Valve Closed

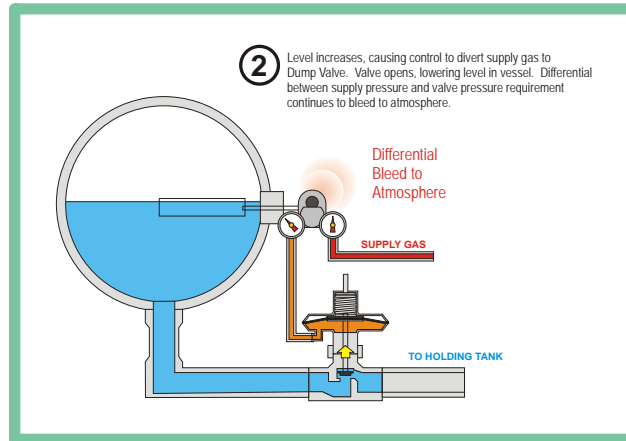
- ① Control is in static condition, between dump cycles.
Dump valve is CLOSED. Supply gas is bleeding to atmosphere.



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Typical Hi-Bleed Cycle Pneumatic Level Control

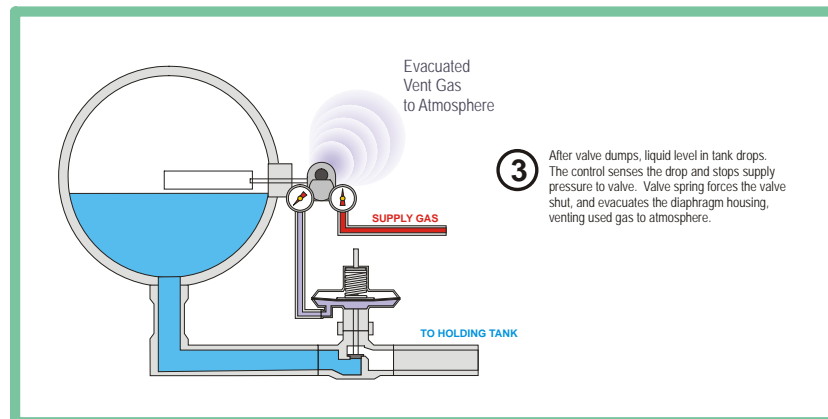
Dump Valve Opens



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Typical Hi-Bleed Cycle Pneumatic Level Control

Dump Valve Vents



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Mizer Technology

No-Bleed Pilot Valve For FMC Invalco Controllers



Other MIZER® Models Are Available

Being Environmentally Responsible Is Now Easier Than Ever Before With WellMark's MIZER® Pilot Valve. Guaranteed To Improve Air Quality And Your Bottom Line, for Generations To Come.
A Green Idea From The WellMark Company

THE 10 MINUTE SOLUTION:
Install WellMark's Patented MIZER® Pilot Valve in your controllers and never lose another penny. Plus, improve the air quality for generations to come.



MIZER®
Pilot Valve

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CEMCO member
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Level Controller Retrofits



Invalco 415, 215, 402
Retrofit w/ Mizer valve, block & gauges



WellMark Flexlever
This is the "old style" WellMark
Replace/Retrofit with the entire
Cemco head



Fisher 2500, 2506
Retrofit w/ Mizer, bracket,
tubing & relay plug



Cemco/WellMark 6900
Retrofit w/ Mizer Valve



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Mizer Retrofits 2008 - 2009

District	Done Thru March 31, 2009	Total Capital	Daily Reduction (MCF)	Annual Reduction (MMCF)
Anadarko	1,264	685,088	885	324
Arkansas	100	54,200	70	26
Arkoma	0	0	0	0
N. Mid Continent	467	253,114	327	98
Southern Oklahoma	372	201,624	260	99
W. Mid Continent	47	25,474	33	13
Barnett	0	0	0	0
Gulf Coast	161	87,262	113	41
Louisiana	17	9,214	12	4
N. Permian	93	50,406	65	24
S. Permian	149	80,758	104	22
E. Texas	0	0	0	0
Total	2,670	\$1,447,140	1,869	651

Average Installation Cost = \$542



Using \$3.50/MCF, the simple payback is 7 months.

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Wilden winterization pump bleed measurement using vinyl containment bag and Hi Flow Sampler



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Condensate Tank Leakage Identified Loses/Savings



Estimated Annual Loss
with 3 CFM Anti-Static
Measurement Bag

13,515 Mcf/yr
Or
\$54,060 @ \$4/Mcf



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Calibrated 3 Cubic Foot Measurement Bag

Three Cubic Foot Anti-Static Measurement Bag

Description:

The largest emissions observed at compressor stations are typically from open ended lines (2" to 12" ID) that are used as vents for blow down valves, unit valves, scrubber dump valves, pressure relief valves and rod packing systems. Some of the largest leaks from these vents occur when compressors are blown down and the blow down valve is open, allowing leaks across the suction and discharge block valves to vent through the blow down line. For scrubber dump valves, large leakage can occur after valve actuation when dirt and debris get caught in the valve seat allowing high pressure gas to leak through the unsealed valve to the condensate tank and then vented to open atmosphere. Unchecked compressor rod packing systems can leak substantial amounts of gas when running or idle because of several contributing factors which typically go unnoticed. It is under these conditions, we have measured leaks as large as 240 scfm of natural gas. To make measurements on leaks of this magnitude, we have fabricated calibrated bags of anti-static plastic of various sizes with a special neck to fit over vent openings. This allows a low-pressure drop measurement of vented systems that may not tolerate significant backpressure. The use of these "Vent-Bags" has been calibrated in our laboratory against rotameter measurements and been found accurate to within 10%. Given proper training while observing strict safety guidelines, this technique for measuring large natural gas leaks can be safe, expedient and affordable.

Please contact a representative from Heath's Professional Services Division for further information about this product.

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How Much Was That Leak?

Leaking Valve Actuator. Leak measured at 6.74 scfm or \$14,170/yr. Estimated to have been leaking at current leak rate for last three years or more. Successfully repaired next day and reduced to zero emissions.

\$\$\$\$\$

Entire Survey Paid
For in recovered
gas, Including
investment of new
Hi Flow Sampler

\$\$\$\$\$



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How Much Was That Leak?

Leaking Actuator on Methanol Injector Pump. Leak Rate at 3.5 cfm or \$7,358/yr. Estimated repair <\$500.



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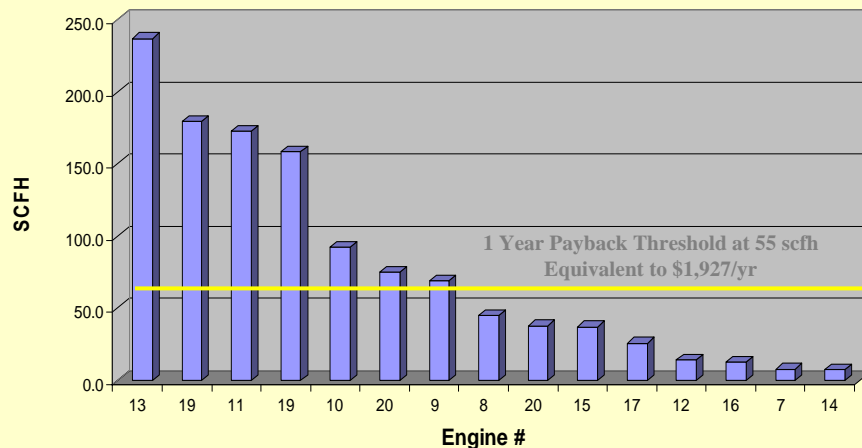
About Rod Packing Leakage

- Under best conditions leak rate can be expected at a minimum of 11.5 scfh
- Leakage can be reduced through proper monitoring and a cost effective schedule for replacing packing rings & piston rods.
- Step one is to monitor and record baseline packing leakage and piston rod wear.
- Establish a replacement threshold



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Rod Packing Leak Rates at Oklahoma Compressor Station



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Questions?



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