Partner Reported Opportunities for Small and Medium Sized Producers

Lessons Learned from Natural Gas STAR

Small and Medium Sized Producer Technology Transfer Workshop

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Producer PROs: Agenda

- Introduction to Partner Reported Opportunities (PROs) and Lessons Learned
- Selected PRO Overviews
- DI&M
- DI&M Industry Experience
- Discussion Questions

Why Are Partner Reported Opportunities Important?

- Partner Annual Reports document Program accomplishments
  - **Best Management Practices (BMPs): the consensus best practices**
  - **PROs: Partner Reported Opportunities**
- Simple vehicles for sharing successes and continuing Program's future
  - **Lessons Learned: expansion on the most advantageous BMPs and PROs**
  - **PRO Fact Sheets**
  - **Technology Transfer Workshops**
  - **Posted on www.epa.gov/gasstar**

Why Are Partner Reported Opportunities Important?

- Many production facilities have identified practical, cost effective reduction practices
- Production partners report saving 187 Bcf since 1990, 80% from PROs
  - **Vapor recover units (VRUs) account for 30% of PRO emissions reductions**
  - **Plunger lift installations account for 16%**
  - **Flare installations account for 13%**

Production Best Management Practices

- BMP 1: Install and replace high-bleed pneumatics
- BMP 2: Install flash tank separators (FTS) on glycol dehydrators
- BMP 3: Partner Reported Opportunities

Lessons Learned

- 11 applicable to small and medium sized producers
  - **2 focused on operating practices**
  - **9 focused on technology**

- All 16 Lessons Learned studies on the EPA web site
  - **www.epa.gov/gasstar/lessons.htm**

Technology Focused Lessons Learned for Small and Medium Producers

- Installing Vapor Recovery Units on Crude Oil Storage Tanks
- Optimize Glycol Circulation and Installation of Flash Tank Separators in Dehydrators
- Options for Reducing Methane Emissions from Pneumatic Devices in the Natural Gas Industry
- Convert Gas Pneumatic Controls to Instrument Air
- Reducing Methane Emissions from Compressor Rod Packing Systems
- Replacing Gas-Assisted Glycol Pumps with Electric Pumps
- Installing Plunger Lift Systems in Gas Wells
- Composite Wrap for Non-Leaking Pipeline Defects
- Replace Glycol Dehydrators with Desiccant Dehydrators

Gas STAR PRO Fact Sheets

- 16 applicable to small and medium sized producers
  - **38 PROs applicable to production**
    - **12 focused on operating practices**
    - **26 focused on technology**
- PRO Fact Sheets from Annual Reports 1994-2002
  - **Total 56 posted PROs at epa.gov/gasstar/pro/index.htm**

PROs

- Replace Gas Starters with Air
- Replace Ignition – Reduce False Starts
- Install Electric Starters
- Rerouting of Glycol Skimmer Gas
- Convert Gas-Driven Chemical Pumps to Instrument Air
- Pipe Glycol Dehydrator to Vapor Recovery Unit
- Convert Pneumatics to Mechanical Controls
- Install Electronic Flare Ignition Devices
- Use ClockSpring® Repair

More PROs

- Inspect Flowlines Annually
- Install BASO® Valves
- Use Ultrasound to Identify Leaks
- Connect casing to VRU
- Lower Heater-Treater Temperature
- Begin DI&M at Remote Facilities
- Install Compressors to Capture Casinghead Gas
- Install Pumpjacks on Low Water Production Gas Wells
- Replace Glycol Dehydration Units with Methanol Injection

Examples of PROs Applicable to Small/Medium Producers

- PROs enabled by instrument air
  - **Replace Gas Starters with Instrument Air**
  - **Convert Gas-Driven Chemical Pumps to Instrument Air**
- PROs enabled by glycol dehydrators
  - **Reroute Glycol Skimmer Gas**
  - **Reroute Glycol Dehydrator to Vapor Recovery**
- PROs enabled by electric power
  - **Install Electric Starters**
  - **Install Compressors to Capture Casinghead Gas**

Replace Gas Starters with Air

- What is the Problem?
  - **Pressurized gas used to start engines is exhausted to atmosphere**
- Partner Solution
  - **Replace gas with compressed air**
- Methane Savings
  - **Based on one 3,000 HP reciprocating compressor with 10 start-ups per year**
- Applicability
  - **Natural gas pneumatic starter motors**
  - **Needs electric power to run air compressor**

Methane Savings

1,356 Mcf/yr

Project Economics

Project Cost	**< $1,000**
Annual O&M Costs	**$100 - $1,000**
Payback	**< 1 yr**

Convert Gas-Driven Chemical Pumps to Instrument Air

- What is the Problem?
  - **Chemical pumps powered by pressurized natural gas vent methane**
- Partner Solution
  - **Replace natural gas with instrument air to power pumps**
- Methane Savings
  - **Based on glycol unit pump**
- Applicability
  - **Use excess capacity of existing instrument air**
  - **Needs electric power to run air compressor**

Methane Savings

2,500 Mcf/yr

Project Economics

Project Cost	**$1,000 - $10,000**
Annual O&M Costs	**$100 - $1,000**
Payback	**< 1 yr**

PROs Enabled by Glycol Dehydrators

Dehydrators present an excellent place to reduce emissions

- How much methane is emitted?
  - **A 1 MMcf/d dehydrator with vent condenser, no flash tank separator and gas pump can produce 460 Mcf/yr of losses**

- How can these losses be reduced?
  - **BMP 2: install flash tank separator**
  - **Many PROs**

Reroute Glycol Skimmer Gas

- What is the Problem?
  - **Gas from condensate separator vented to atmosphere**
- Partner Solution
  - **Reroute condensate separator gas for fuel use**
- Methane Savings
  - **Based on 20 MMcf/d dehydrator w/o FTS, circulating 300 gph**
- Applicability
  - **All dehydrators with vent condensers**
  - **Condensate separator must operate at higher pressure than gas destination**

Methane Savings

7,600 Mcf/yr

Project Economics

Project Cost	**<$1,000**
Annual O&M Costs	**$100 - $1,000**
Payback	**< 1 yr**

Pipe Glycol Dehydrator to Vapor Recovery

- What is the Problem?
  - **High pressure gas used to drive gas pumps in dehydrators are vented**
- Partner Solution
  - **Reroute gas vent to VRU**
- Methane Savings
  - **Based on a 10 MMcf/d gas dehydration unit with FTS and gas assist pump**
- Applicability
  - **Sufficient spare capacity in existing VRU**
  - **Capacity of VRU outlet**

Methane Savings

3,300 Mcf/yr

Project Economics

Project Cost	**$1,000 - $10,000**
Annual O&M Costs	**> $1,000**
Payback	**< 1 yr**

Install Electric Starters

- What is the Problem?
  - **Pressurized gas used to start engines is exhausted to atmosphere**
- Partner Solution
  - **Replacing starter expansion turbine with electric motor starter**
- Methane Savings
  - **Based on one engine starter, ten start-ups per year and methane leakage through gas shut-off valve**
- Applicability
  - **All sectors of the gas industry**
  - **Requires access to power supply**

Methane Savings

1,350 Mcf/yr

Project Economics

Project Cost	**$1,000 - $10,000**
Annual O&M Costs	**< $100**
Payback	**1- 3 yrs**

Install Compressors to Capture Casinghead Gas

- What is the Problem?
  - **Casinghead gas vented to atmosphere**
- Partner Solution
  - **Install compressor to capture casinghead gas and pump to sales line**
- Methane Savings
  - **Based on 180 Mcf/d associated gas containing 50% methane, 30 HP electric rotary compressor, 100 psig sales line**
- Applicability
  - **Oil wells that produce significant volume of casinghead gas**
  - **Access to electricity for compressor**

Methane Savings

32,850 Mcf/yr

Project Economics

Project Cost	**> $10,000**
Annual O&M Costs	**> $1,000**
Payback	**<1 yrs**

Directed Inspection & Maintenance

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**
  - **OELs contribute half these emissions**
- Fugitive methane emissions depend on operating practices, equipment age and maintenance

How Can These Losses Be Reduced?

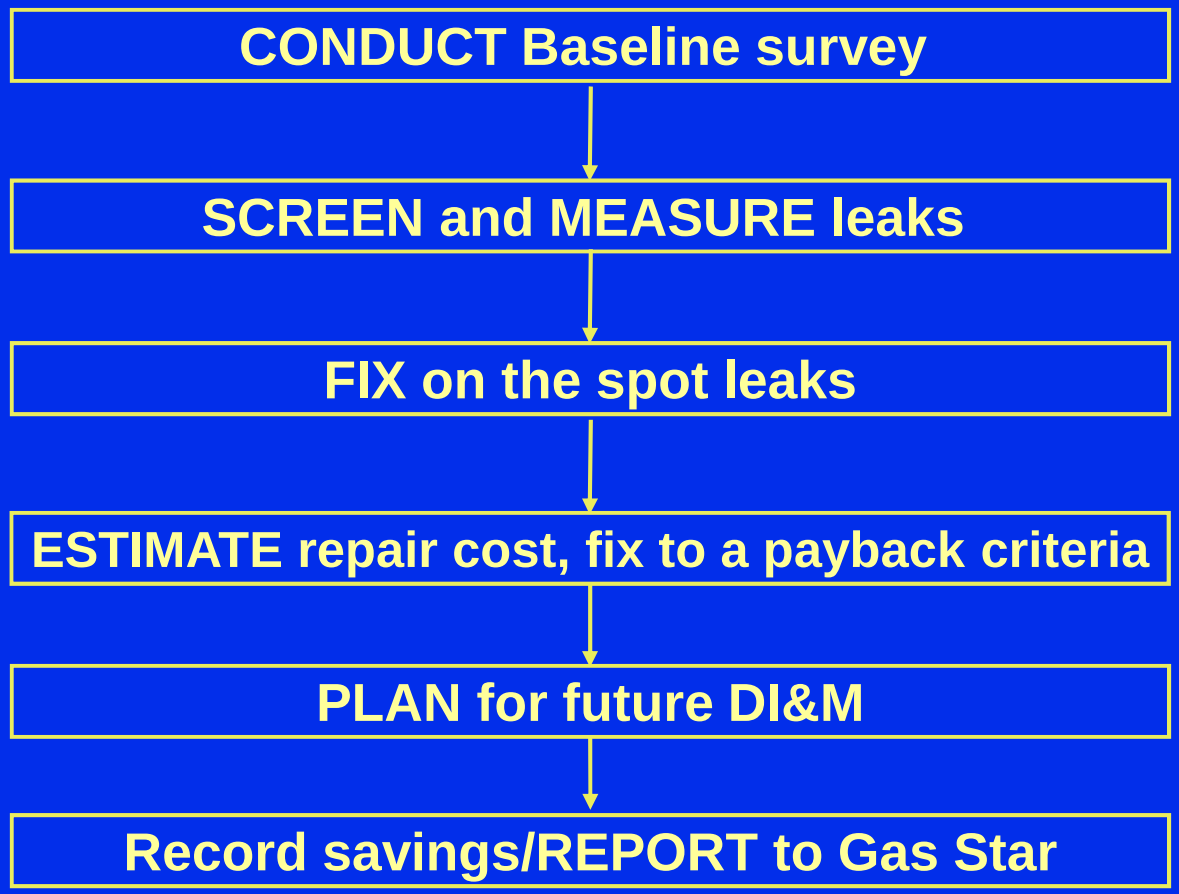
- Implementing a Directed Inspection and Maintenance (DI&M) Program

Source: CLEARSTONE ENGINEERING LTD

What is a DI&M Program?

- Implementing a Directed Inspection and Maintenance Program
  - **Voluntary program to identify and fix leaks that are cost-effective to repair**
  - **Outside of mandatory Leak Detection and Repair (LDAR)**
  - **Survey cost will pay out in the first year**
  - **Provides valuable data on leakers**

How Do You Implement A DI&M Program?



Reducing Emissions, Increasing Efficiency, Maximizing Profits

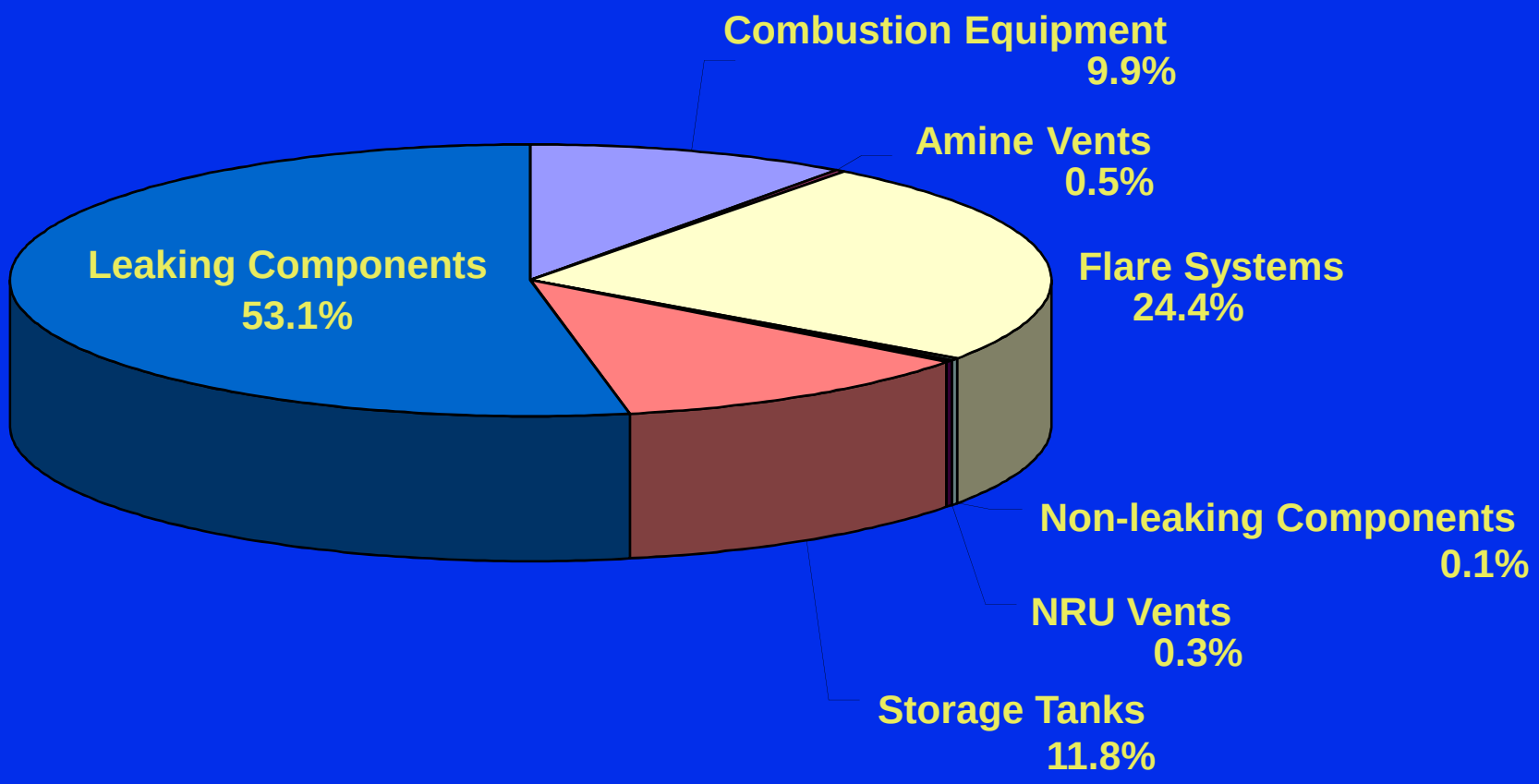
One of the New PROs

- Begin Directed Inspection and Maintenance at Remote Facilities
  - **SAVES: 362 Mcf/yr**
  - **PAYOUT: < 1 yr**
- Enables several PROs
  - **Inspect and Repair Compressor Station Blowdown Valve**
  - **Use Ultrasound to Identify Leaks**
  - **Test and Repair Pressure Safety Valves**

Bubble test on leaking valve

Source: CLEARSTONE ENGINEERING LTD

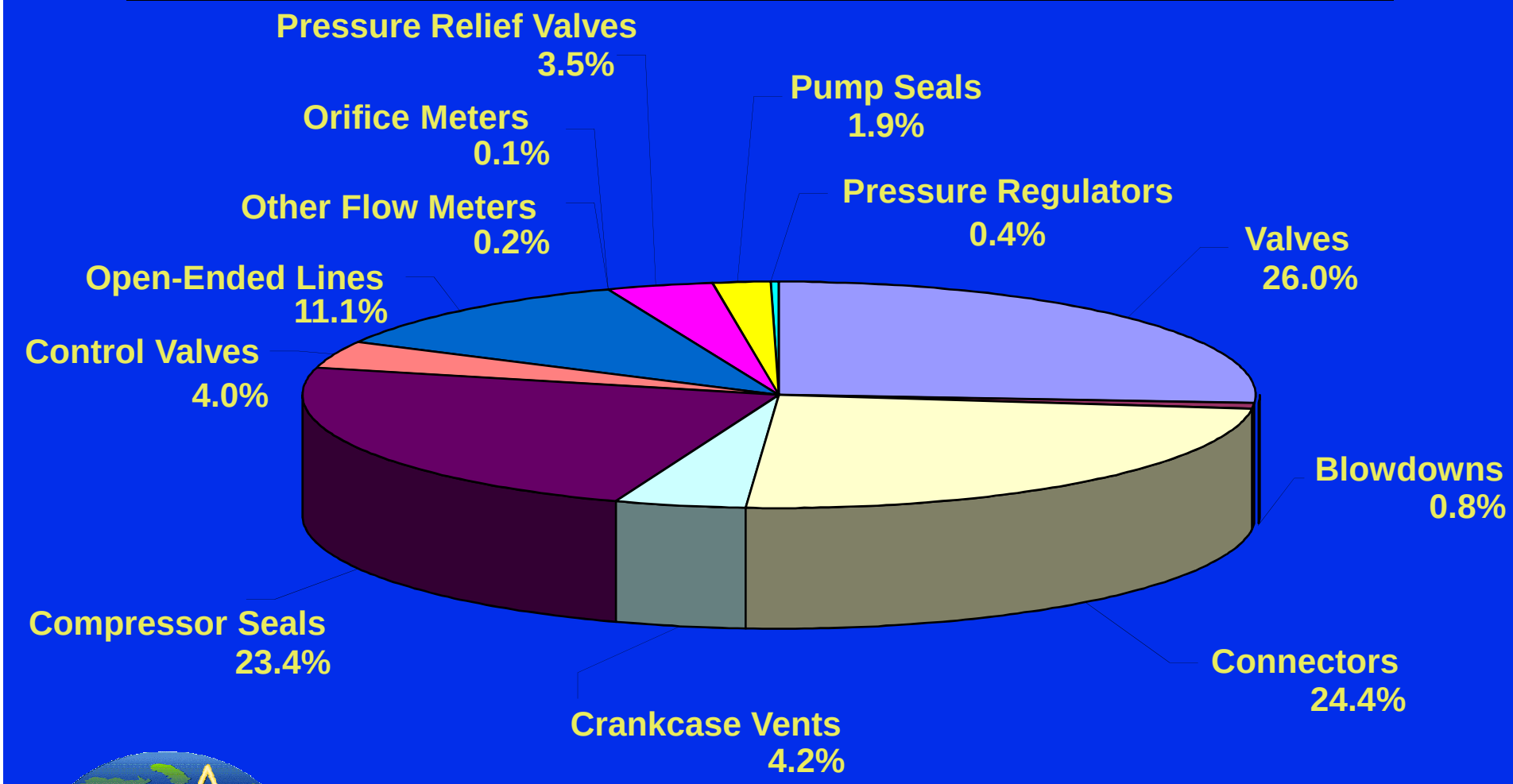
Natural Gas Losses by Source



Source: Clearstone Engineering, 2002

Reducing Emissions, Increasing Efficiency, Maximizing Profits

Natural Gas Losses by Equipment Type



Source: Clearstone Engineering, 2002

How Much Methane is Emitted?

Methane Emissions from Leaking Components at Gas Plants			
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
Compressor Seals	23.4%	8.1%	372
Open-Ended Lines	11.1%	10.0%	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.			

How Much Methane is Emitted?

Summary of Natural Gas Losses from the Top Ten Leakers[1].				
Plant No.	Gas Losses From Top 10 Leakers (Mcf/d)	Gas Losses From All Equipment Leakers (Mcf/d)	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

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	★★★	$$$
Rotameter	★★	$$
Source: EPA's Lessons Learned Study		

Cost-Effective Repairs

Repair the Cost Effective Components			
Component	**Value of Lost gas[1] ($)**	**Estimated Repair cost ($)**	**Payback (Months)**
Plug Valve: Valve Body	12,641	200	0.2
Union: Fuel Gas Line	12,155	100	0.1
Threaded Connection	10,446	10	0.0
Distance Piece: Rod Packing	7,649	2,000	3.1
Open-Ended Line	6.959	60	0.1
Compressor Seals	5,783	2,000	4.2
Gate Valve	4,729	60	0.2
Source: Hydrocarbon Processing, May 2002 [1]Based on $3/Mcf gas price			

DI&M - Partner Experience

- **Partner A**: leaking cylinder head tightened, which reduced methane emissions from almost 64,000 Mcf/yr to 3,300 Mcf/yr
  - **Repair required 9 man-hours labor and annualized gas savings were approximately 60,700 Mcf/yr. At $3/Mcf, the estimated value of gas saved was $182,100/yr**
- **Partner B**: one-inch pressure relief valve emitted almost 36,774 Mcf/yr
  - **Five man-hours labor and $125 materials eliminated leak. The annualized value of gas saved was more than $110,300 at $3/Mcf**

DI&M - Partner Experience

- Partner C: blowdown valve leaked almost 14,500 Mcf/yr
  - **Rather than replace expensive valve, the Partner spent just $720 on labor and materials to reduce emissions to ~100 Mcf/yr**
  - **Gas saved was approximately 14,400 Mcf/yr, worth $43,200 at $3/Mcf**
- Partner D: tube fitting leaked 4,121 Mcf/yr
  - **Very quick repair requiring only five minutes reduced leak rate to 10 Mcf/yr**
  - **Annualized value of gas saved was ~ $12,300 at $3/Mcf**

Discussion Questions

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