Methane to Markets

Directed Inspection & Maintenance and Leak Imaging

Technology Transfer Workshop

PEMEX &
Environmental Protection Agency, USA

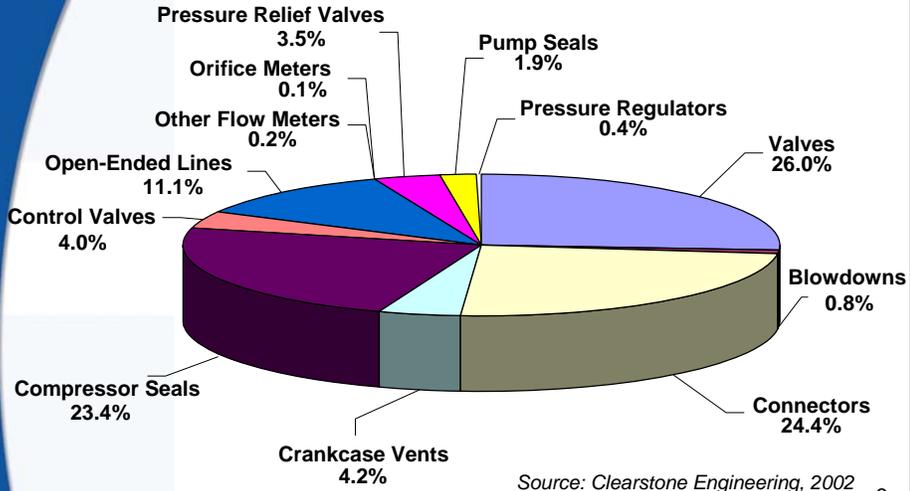April 25, 2006
Villahermosa, Mexico

Methane to Markets

Directed Inspection and Maintenance (DI&M): Agenda

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

Methane Losses by Equipment Type

- Pressure Relief Valves 3.5%
- Orifice Meters 0.1%
- Other Flow Meters 0.2%
- Open-Ended Lines 11.1%
- Control Valves 4.0%
- Compressor Seals 23.4%
- Crankcase Vents 4.2%
- Pump Seals 1.9%
- Pressure Regulators 0.4%
- Valves 26.0%
- Blowdowns 0.8%
- Connectors 24.4%

Source: Clearstone Engineering, 2002

3

What is the Problem?

- Natural gas leaks are *invisible* and *go unnoticed*
- US companies find that valves, connectors, compressor seals, and open-ended lines (OELs) are major sources
  - Estimated natural gas leaks in Mexico

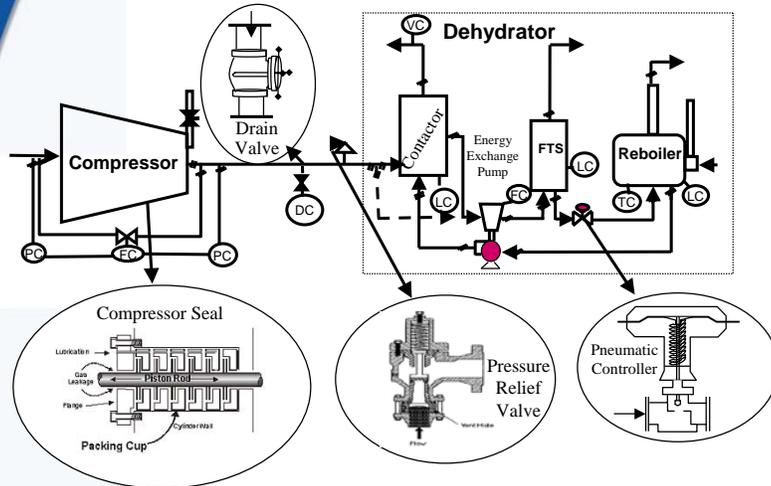| Production:	7.6 Bcf/year
Processing:	1.7 Bcf/year
Transmission:	3.8 Bcf/year
Sources: *US Natural Gas STAR program success points to global opportunities to cut methane emissions cost-effectively*, Oil and Gas Journal, July 12, 2004 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004	

Bcf = Billion Cubic feet

4

Slide 5

What are the Sources of Emissions?

Slide 6

How Much Methane is Emitted?

Summary of Natural Gas Losses from the Top Ten Leakers[1]
Top ten from each plant out of 101,193 components surveyed

Processing Plant Number	Gas Losses from Top 10 Leakers (Mcf/day)	Gas Losses from All Equipment Leakers (Mcf/day)	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
Source: Clearstone Engineering, 2002
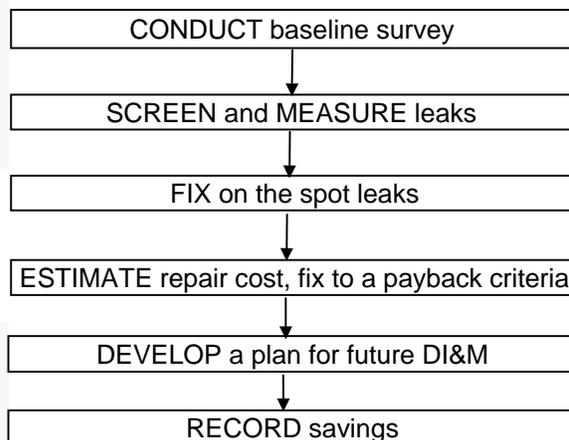
Mcf = Thousand Cubic feet

Methane Recovery

- Fugitive losses can be reduced dramatically 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

Infrared Leak Imaging Camera

7

How Do You Implement DI&M?

CONDUCT baseline survey

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SCREEN and MEASURE leaks

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FIX on the spot leaks

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ESTIMATE repair cost, fix to a payback criteria

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DEVELOP a plan for future DI&M

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RECORD savings

8

How Do You Implement DI&M?

- Screening: finding leaks
  - Soap bubble screening
  - Toxic Vapor Analyzer and Organic Vapor Analyzer
  - Ultrasound leak detection
  - Acoustic leak detection
  - Leak imaging

Acoustic Leak Detection

9

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

10

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	1.3
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

11

DI&M - Industry Experience

- Company A: Leaking cylinder head was tightened, which reduced the methane emissions from almost 64,000 Mcf/year to 3,300 Mcf/year
  – Repair required 9 man-hours of labor
  – Gas savings were approximately 60,700 Mcf/year
  – Value of gas saved was $424,900/year at $7/Mcf
- Company B: One-inch pressure relief valve emitted almost 36,774 Mcf/year
  – Required five man-hours of labor and $125 of materials
  – Value of the gas saved was $257,368 at $7/Mcf

12