Best Management Practices and Key Issues for Small and Independent Producers

Lessons Learned from the
Natural Gas STAR Program

Source Reduction Training

Interstate Oil and Gas
Compact Commission

Charleston, West Virginia
February 27, 2009

epa.gov/gasstar

Key Issues for Small Producers: Agenda

- What technologies work for your production?
- What are Natural Gas STAR Partners implementing?
- What economic barriers prevent you from implementing technologies and practices?
- Additional best management practices:
  - Pneumatic devices
  - Directed inspection and maintenance (DI&M)

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Production in the Appalachians

- Conventional production
  - Describe what type of gas your company produces
  - What equipment is in operation at a typical wellhead?
- Unconventional production
  - Are you producing gas from any unconventional sources?
    - Coalbed methane?
  - Are you hydraulic fracturing reservoirs?
  - What are some of the differences between conventional and unconventional production?
    - Low pressure compressors?
    - Dehydration?

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Where are your opportunities for emissions reductions?

- Common methane emission sources:
  - Wellhead venting
  - Pneumatic devices
  - Dehydrator vents
  - Storage tank vents
  - Compressor fugitives
  - Gathering pipeline fugitives
- Where should you focus your efforts?

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What are Natural Gas STAR Partners implementing?

Recommended Technologies and Practices	Number of Gas STAR Partners Reporting this Mitigation Option
Install vapor recovery units (VRUs)	23
Install flash tank separators on glycol dehydrators	21
Identify and replace high-bleed pneumatic devices	20
Perform reduced emissions completions	14
Artificial lift: install plunger lifts	14
Convert to instrument air systems	12
DI&M: survey and repair leaks	10
Convert gas-driven chemical pumps to electric, mechanical, or solar pumps	9
Install condensers on glycol dehydrators	7
Route casinghead gas to VRU or compressor	5
Replace gas starters with air	5
Reduce glycol circulation rates in dehydrators	5
Consolidate crude oil and water storage tanks	5

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What economic barriers prevent you from implementing technologies and practices?

- Wellhead gas price, price outlook?
- What payback criteria do you use to evaluate project feasibility?
- Have you looked into possible carbon credit projects?

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Additional barriers to implementation

- What other barriers may prevent you from implementing emission reduction technologies and practices?
  - Man-power
  - Engaging management
  - Lack of information

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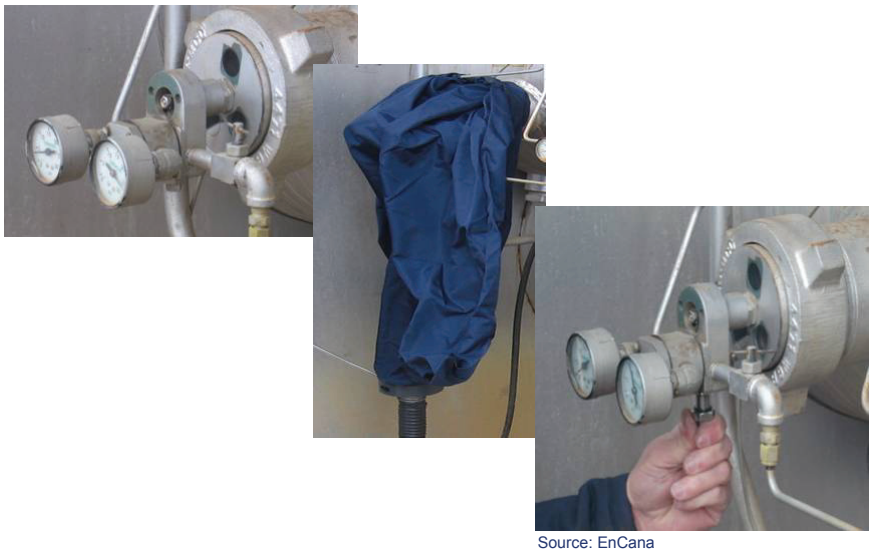
Pneumatic Devices



Source: EnCana

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What is the Problem?

- Pneumatic devices are major source of methane emissions from the natural gas industry
- Pneumatic devices used throughout the natural gas industry
  - Over 400,000 in production sector[1]
  - About 13,000 in processing sector[1]
  - Over 85,000 in transmission sector[1]

1 - Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2004

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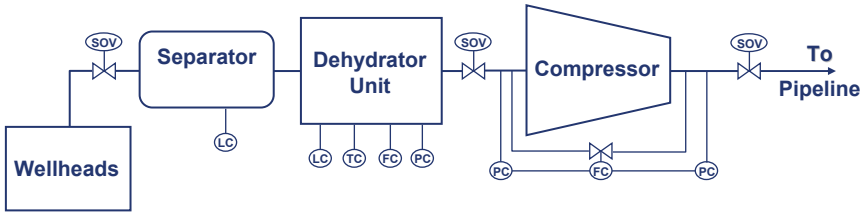
Location of Pneumatic Devices at Production Sites



SOV = Shut-off Valve (Unit Isolation)
LC = Level Control (Separator, Contactor, Flash Tank Separator, TEG Regenerator)
TC = Temperature Control (Regenerator Fuel Gas)
FC = Flow Control (TEG Circulation, Compressor Bypass)
PC = Pressure Control (FTS Pressure, Compressor Suction/Discharge)

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Methane Emissions

- As part of normal operations, pneumatic devices release natural gas to atmosphere
- High-bleed devices bleed in excess of 6 cf/hour
  - Equates to >50 Mcf/year
  - Typical high-bleed pneumatic devices bleed an average of 140 Mcf/year
- Actual bleed rate is largely dependent on device's design

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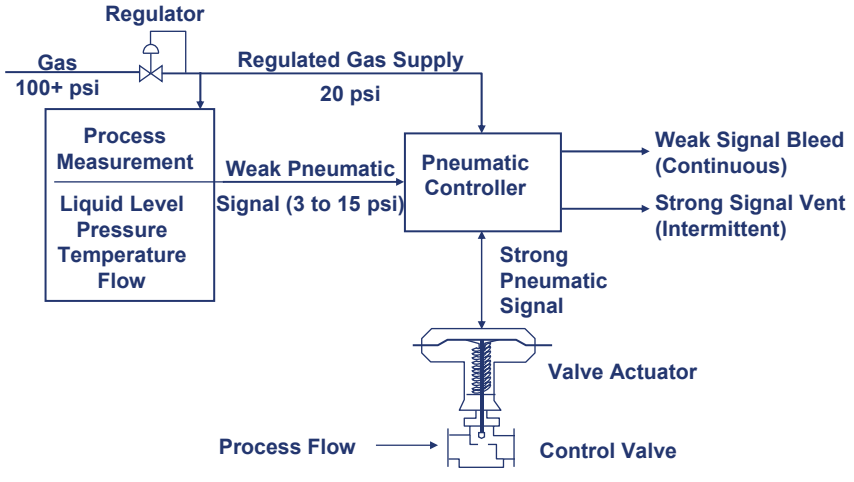
Pneumatic Device Schematic



psi = pounds per square inch

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How Can Methane Emissions be Recovered?

- Option 1: Replace high-bleed devices with low-bleed devices
- Option 2: Retrofit controller with bleed reduction kits
  - Field experience shows that up to 80% of all high-bleed devices can be replaced or retrofitted with low-bleed equipment
- Option 3: Maintenance aimed at reducing losses

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Economics of Replacement

Implementation[1]	Replace at End of Life	Early Replacements	
		Level Control	Pressure Control
Cost ($)	150 – 250[2]	380	1,340
Annual Gas Savings (Mcf)	50 – 200	166	228
Annual Value of Saved Gas ($)[3]	350 – 1400	1162	1596
IRR (%)	138 – 933	306	117
Payback (months)	2 – 9	4	10

1 - All data based on partners' experiences. See *Lessons Learned* for more information
2 - Range of incremental costs of low-bleed over high bleed equipment
3 - Gas price is assumed to be $7/Mcf

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Directed Inspection and Maintenance

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What is the Problem?

- Methane gas leaks are invisible, unregulated, and go unnoticed
- Natural Gas STAR Partners find that valves, connectors, compressor seals, and open-ended lines (OELs) are major methane fugitive emission sources
  - In 2006, 3.59 Bcf of methane was emitted as fugitives by reciprocating compressor related components alone
  - Production and processing fugitive methane emissions depend on operating practices, equipment age, and maintenance

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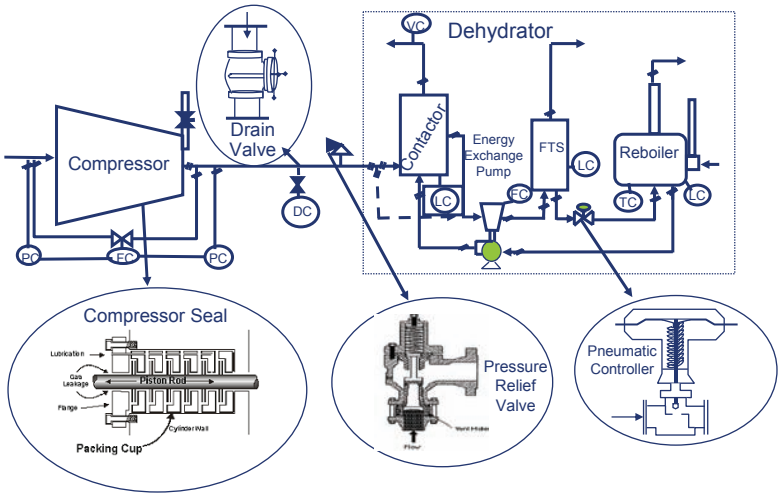
Sources of Methane Emissions



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What is Directed Inspection and Maintenance?

- Directed Inspection and Maintenance (DI&M)
  - 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 leak detection and repair (VOC LDAR) program

Source: Targa Resources

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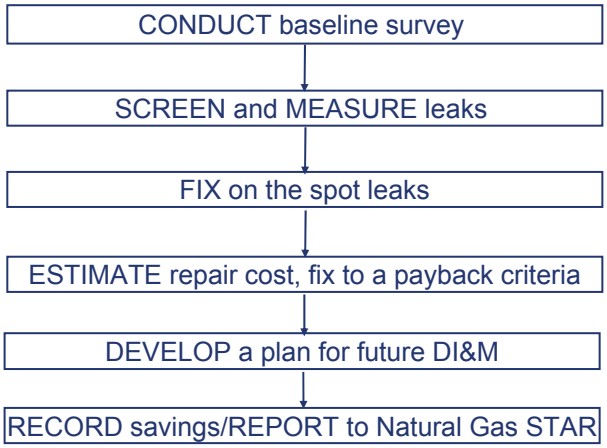
How Do You Implement DI&M?



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How Do You Implement DI&M?

Summary of Screening and Measurement Techniques		
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	★★★	$$$
Source: EPA's Lessons Learned		

* - Least effective at screening/measurement

*** - Most effective at screening/measurement

$ - Smallest capital cost

$$$ - Largest capital cost

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Infrared Methane Leak Detection

- Video recording of fugitive leaks detected by various infrared devices

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Partner Experience - EnCana

- DI&M implemented as part of EnCana's energy efficiency initiative in all US production and midstream facilities in 2007
- Surveyed components in 1,860 production sites and 35 compressor stations using FLIR camera and Hi Flow Sampler
- Identified leaking rates as high as 17 Mcf/day/station
- Annual methane emissions reduction of 358,000 Mcf/year
- Annual savings: $2,506,000/year (at $7/Mcf)

Source: EnCana

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