Methane to Markets

Replacing High Bleed Pneumatic Devices

IAPG & US EPA Technology Transfer Workshop

November 5, 2008
Buenos Aires, Argentina

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Pneumatic Devices: Agenda

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

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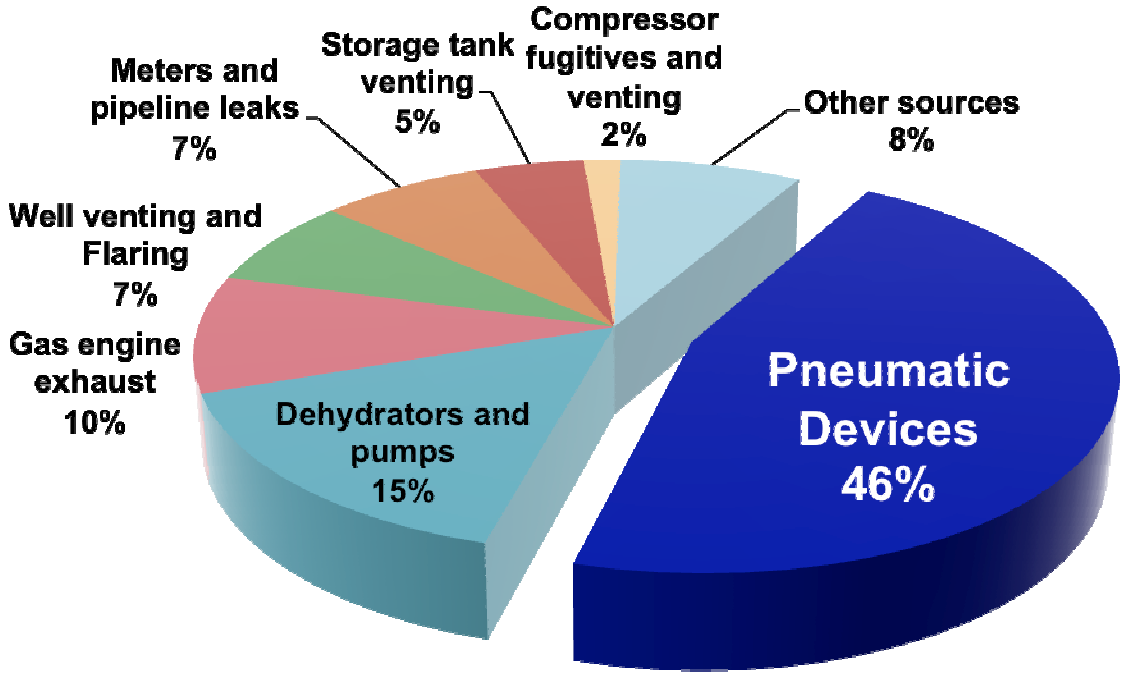
Methane Losses from Gas Operated Pneumatic Devices

- Pneumatic devices account for:
  - 46% of methane emissions in the U.S. production, gathering, and boosting sectors (excl. offshore operations)



EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2005.* April, 2007. Available on the web at: http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsGHGEmissions.html
Natural Gas STAR reductions data shown as published in the inventory.

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What is the Problem?

- Pneumatic devices are a major source of methane emissions from the O&G industry
- Pneumatic devices are extensively used throughout the O&G industry
- Gas operated devices are common in many O&G facilities worldwide, Argentina not being the exception

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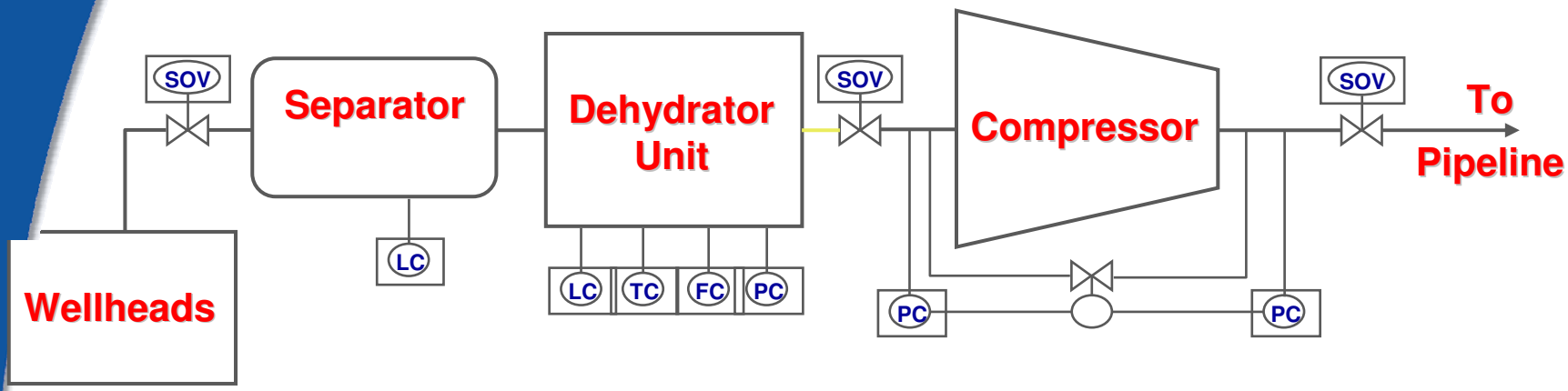
Location of Pneumatic Devices at Production Sites



SOV = Shut-off Valve (Unit Isolation)

LC = Level Control (Separator, Contactor, 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 into the atmosphere
- High-bleed devices bleed in excess of 2,9 lpm
  - Equates to >1,45 Mm^3 per year
  - Typical high-bleed pneumatic devices bleed an average of 4 Mm^3 per year
- The actual bleed rate is largely dependent on the device's design

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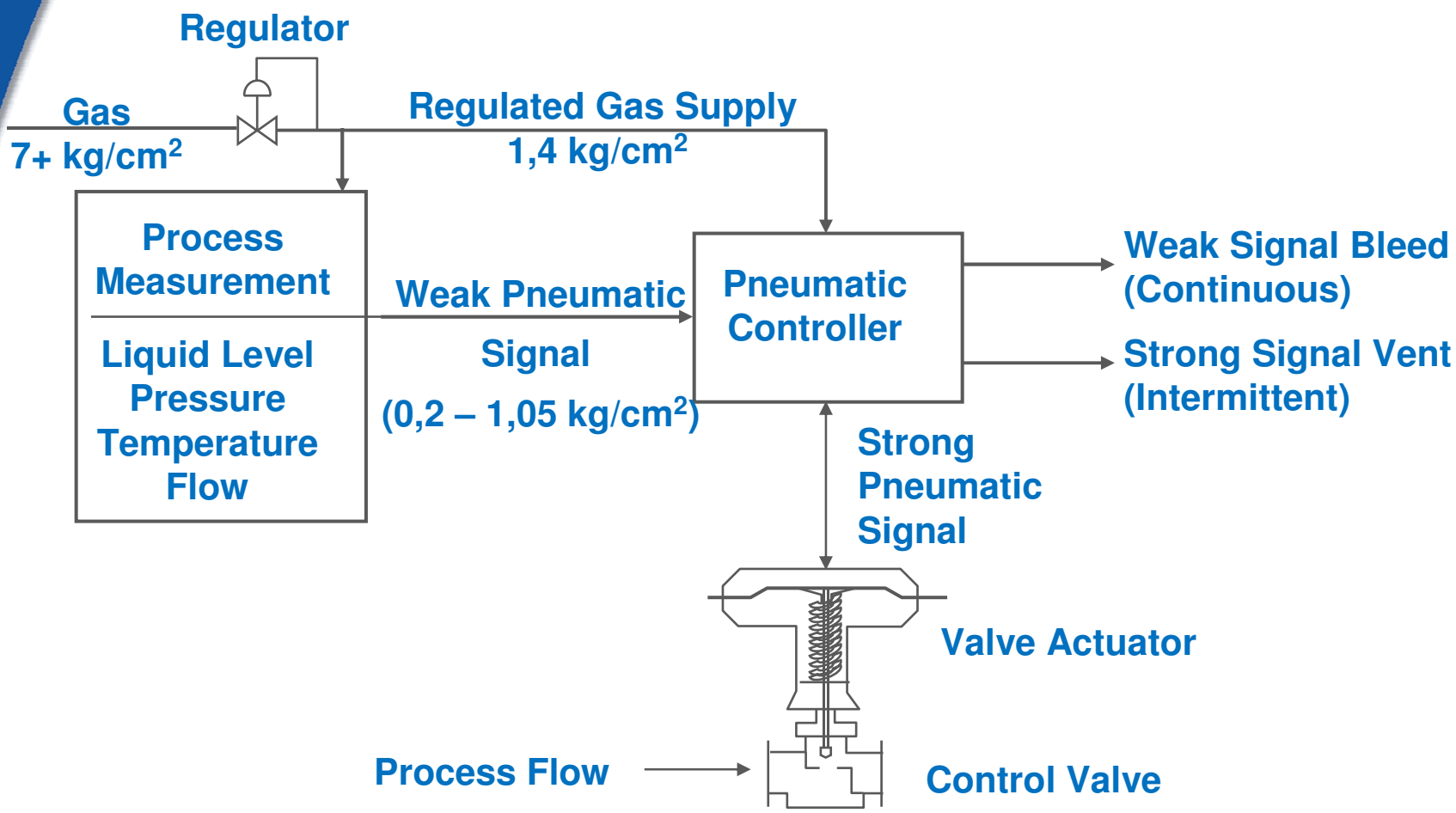
Pneumatic Device Schematic



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How Can Methane Emissions be Reduced?

- Option 1: Replace high-bleed devices with low-bleed devices
- Option 2: Retrofit controller with bleed reduction kits
- Option 3: Maintenance aimed at reducing losses

  – Field experience shows that up to 80% of all high-bleed devices can be replaced or retrofitted with low-bleed equipment

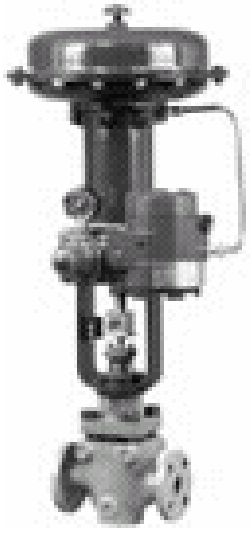
Option 1: Replace High-Bleed Devices

- Most applicable to:
  - Controllers: liquid-level and pressure
  - Positioners and transducers
- Suggested Action: Evaluate replacements
  - Replace at end of device's economic life
  - Early replacement

Norriseal
Pneumatic Liquid
Level Controller

Source:
www.norriseal.com

Fisher
Electro-Pneumatic
Transducer



Source: www.emersonprocess.com

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Option 1: Replace High-Bleed Devices (cont'd)

- Costs vary with size
  - Typical costs range from US$700 to US$3.000 per device
  - Incremental costs of low-bleed devices are modest (US$150 to US$250)
  - At US$ 70,63/Mm^3, gas savings often pay for incremental replacement costs in short periods of time (5 to 12 months)
  - Paybacks for outright replacement are longer, more than 2 years

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Option 2: Retrofit with Bleed Reduction Kits

- Applicable to most high-bleed controllers
- Suggested action: Evaluate cost effectiveness as alternative to early replacement
- Retrofit kit costs ~ US$ 500
- Typical bleed rate of 4,7 Mm^3/y @ US$70,63/$Mm^3$
- Payback time ~ 1,5 years

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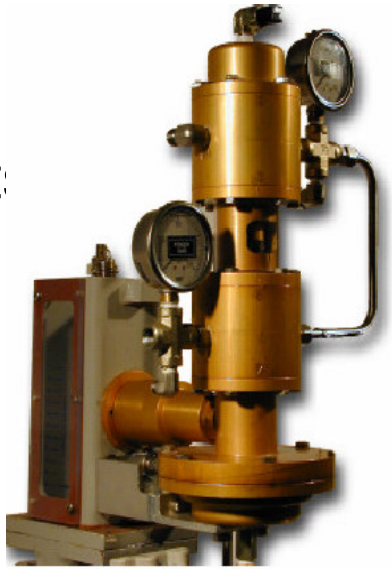
Option 3: Maintenance to Reduce Losses

- Applies to all pneumatic devices
- Suggested action: Enhance routine maintenance procedures
  - Field survey of controllers
  - Where process allows, tune controllers to minimize bleed

Option 3: Maintenance to Reduce Losses (cont'd)

- Suggested action (cont'd)
  - Re-evaluate the need for pneumatic positioners
  - Repair/replace airset regulators
  - Reduce regulated gas supply pressure to minimum
  - Routine maintenance should include repairing/replacing leaking components
- Cost is low



Becker
Single-Acting
Valve Positioner

Source: www.bpe950.com

Typical Emissions & Mitigation Options: Pneumatic Devices

Anticipated emissions:

- **Typical crude oil treatment facility has 20 control loops (200 pneumatic devices)**
- **Typical emissions: 5 Mm^3/y per control loop for total of 100 Mm3 of gas emitted per year per facility**
- **Emissions affected by:**

  - Type of pneumatic device: intermittent, throttling, high bleed, low bleed

Mitigation Option:
Replace gas operated pneumatics with electric/ low loss/compressed air pneumatics

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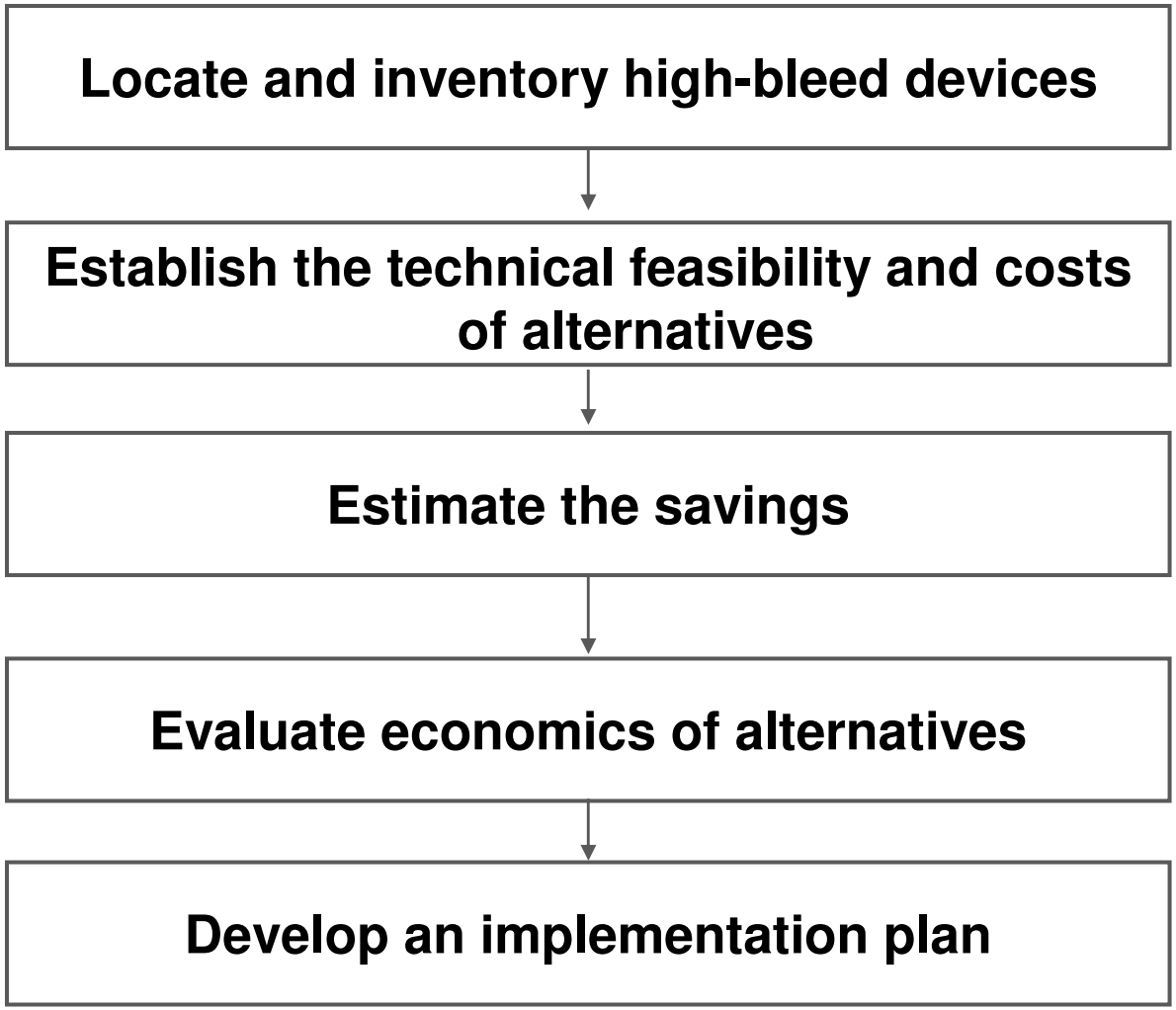
Five Steps for Reducing Methane Emissions from Pneumatic Devices



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Suggested Analysis for Replacement

- Replacing high-bleed controllers at the end of economic life
  - Determine incremental cost of low-bleed device over high-bleed equivalent
  - Determine gas saved with low-bleed device using manufacturer specifications
  - Compare savings and cost
- Early replacement of high-bleed controllers
  - Compare gas savings of low-bleed device with full cost of replacement

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Economics of Replacement

Implementation[a]	Replace at End of Life	Early Replacements	
		Level Control	Pressure Control
Cost (US$)	150 – 250[b]	380	1.340
Annual Gas Savings (Mm^3)	1,5 – 5,5	4,7	6,5
Annual Value of Saved Gas (US$)[c]	100 – 400	332	456
IRR (%)	60 – 140	80	25
Payback (months)	8 – 18	14	36

[a] All data based on Partners' experiences. See Lessons Learned for more information.
[b] Range of incremental costs of low-bleed over high bleed equipment
[c] Gas price is assumed to be US$ 70,63/Mm^3 (US$2/mcf)

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Suggested Analysis for Retrofit

- Retrofit of low-bleed kit
  - Compare savings of low-bleed device with cost of conversion kit
  - Retrofitting reduces emissions by an average of 90 percent

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Economics of Retrofit

	Retrofit[a]
Implementation Costs[b]	US$ 500
Bleed rate reduction (Mm^3/device/year)	6,2
Value of gas saved (US$/yr) [c]	438
Payback (months)	14
IRR	79%

[a] On high-bleed controllers
[b] All data based on Partners' experiences. See Lessons Learned for more information.
[c] Gas price is assumed to be US$ 70,63/Mm^3 (US$2/mcf)

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Suggested Analysis for Maintenance

- For maintenance aimed at reducing gas losses
  - Measure gas loss before and after procedure
  - Compare savings with labor (and parts) required for activity

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Economics of Maintenance

	Reduce supply pressure	Repair & retune	Change settings	Remove valve positioners
Implementation Cost (US$)[a]	153	23	0	0
Gas savings (Mm^3/yr)	5	1,25	2,5	4,5
Value of gas saved (US$/yr)[b]	350	88	176	316
Payback (months)	5	3	2	2
IRR	201%	380%	--	--

[a] All data based on Partners' experiences. See Lessons Learned for more information.
[b] Gas price is assumed to be US$ 70,63/Mm^3 (US$2/mcf)

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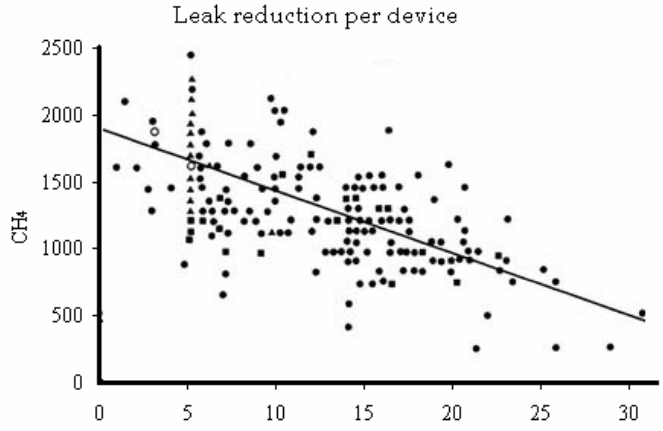
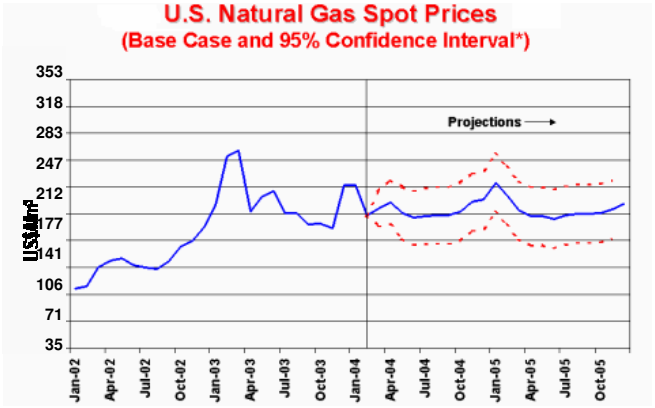
Pneumatic Devices

- Factors affecting economics of replacement
  - Operating cost differential and capital costs
  - Estimated leak rate reduction per new device
  - Price of gas





Source: www.eia.doe.gov

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Lessons Learned

- Most high-bleed pneumatics can be replaced with lower bleed models
- Replacement options save the most gas and are often economic
- Retrofit kits are available and can be highly cost-effective
- Maintenance is low cost and reduces gas loss

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Case Study – Marathon

- Surveyed 158 pneumatic devices at 50 production sites
- Half of the controllers were low-bleed
- High-bleed devices included
  - 35 of 67 level controllers
  - 5 of 76 pressure controllers
  - 1 of 15 temperature controllers

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Marathon Study: Hear It? Feel It? Replace It!

- Measured gas losses total 129 Mm^3/yr
- Level controllers account for 86% of losses
  - Losses averaged 3,6 lpm
  - Losses ranged up to 22 lpm
- Concluded that excessive losses can be heard or felt

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Recommendations

- Evaluate all pneumatics to identify candidates for replacement and retrofit
- Choose lower bleed models at change-out where feasible
- Identify candidates for early replacement and retrofits by doing economic analysis
- Improve maintenance
- Develop an implementation plan

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Discussion Questions

- To what extent are you implementing this BMP?
- How can this BMP be improved upon or altered for use in your operation(s)?
- What are the barriers that are preventing you from implementing this technology?
  - technological,
  - economic, regulatory,
  - lack of information, etc.