Natural Gas STAR International: An Overview of Pneumatic Valve Emission Reduction Best Practices

Natural Gas STAR International Meeting with Turkmenistan

Sandy Seastream
ICF International
November 9, 2011
Farmington, New Mexico

Agenda

- 2009 U.S. Production Sector Methane Emissions
- What is the Problem?
- Methane Emissions from Pneumatic Devices
- How Gas Pneumatic Devices Work
- Methane Recovery
- Industry Experience
- Lessons Learned
- Contacts and Further Information

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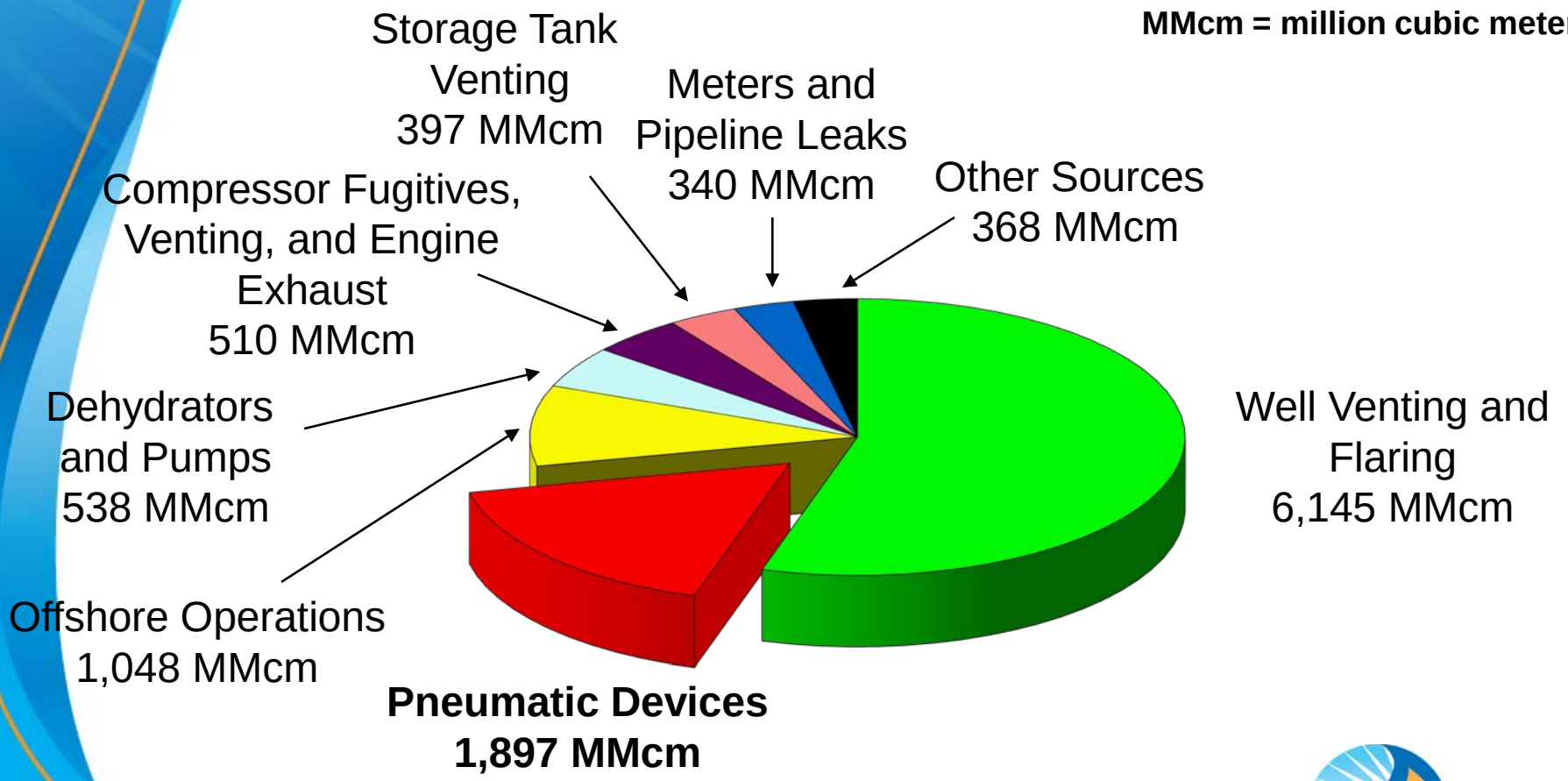
2009 U.S. Production Sector Methane Emissions (11,243 MMcm)

MMcm = million cubic meters



EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2009.* April, 2011. Available on the web at: epa.gov/climatechange/emissions/usinventoryreport.html.

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What is the Problem?

- Natural gas-powered pneumatic devices are used throughout the U.S. oil and natural gas industry
- Pneumatic devices are collectively a major source of methane emissions in the U.S. oil and natural gas industry

	Number of Devices in Natural Gas Systems	Number of Devices in Petroleum Systems
Production and Gathering	478,000	399,000
Transmission and Storage	85,000	-

Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2009.* April, 2011. epa.gov/climatechange/emissions/usinventoryreport.html.

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Pneumatic Devices: Methane Emissions

- As part of normal operations, pneumatic devices release natural gas to the atmosphere
- High-bleed devices are defined as those that bleed in excess of 4 m^3 per day[1]
  - Aggregates to more than 1,416 m^3/year[1]
  - Typical high-bleed pneumatic devices bleed an average of 3,965 m^3/year[1]
- Actual bleed rate is largely dependent on device's design and maintenance

[1]EPA. *Lessons Learned: Options for Reducing Methane Emissions from Pneumatic Devices in the Natural Gas Industry*. October 2006. epa.gov/gasstar/tools/recommended.html

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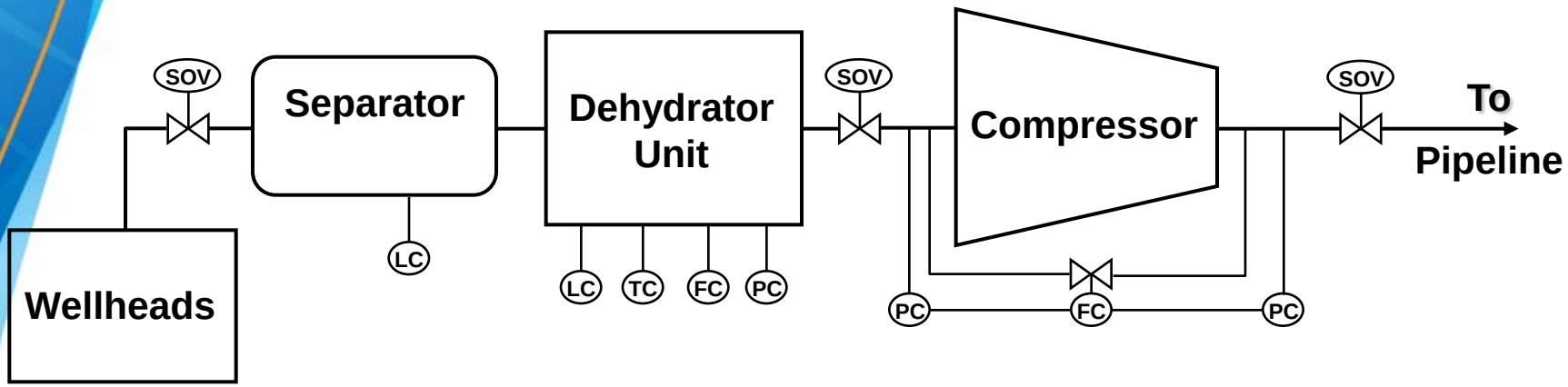
Location of Pneumatic Devices at Production Sites



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)

TEG = triethylene glycol
FTS = flash tank separator

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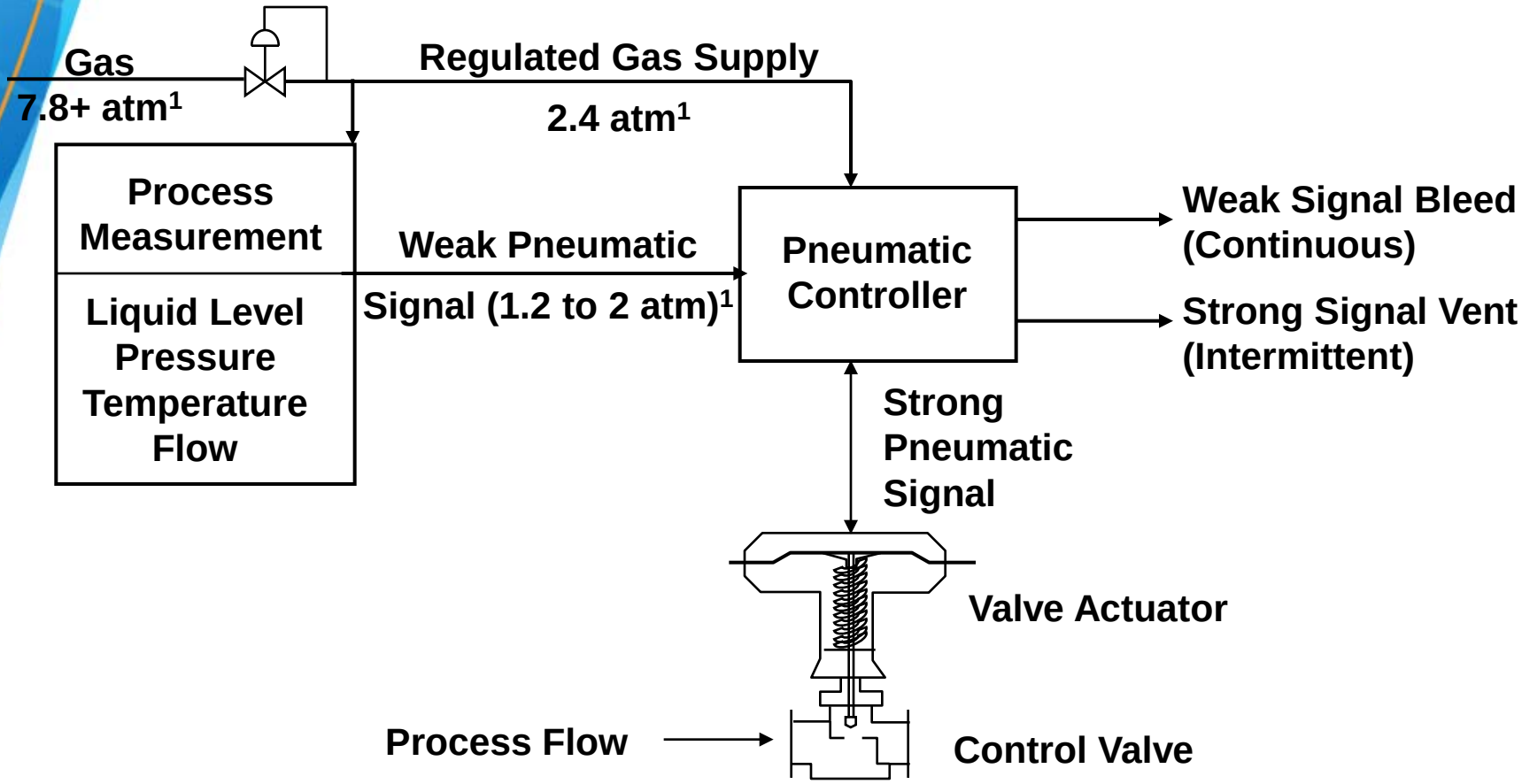
How Gas Pneumatic Devices Work



[1] 1 atmosphere (atm) = 0 pounds per square inch gauge (psig) and 14.7 pounds per square inch atmospheric (psia)

1 atm = 1.013 bar and 101.3 kilopascals (kPa)

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Methane Recovery from Pneumatic Devices

- 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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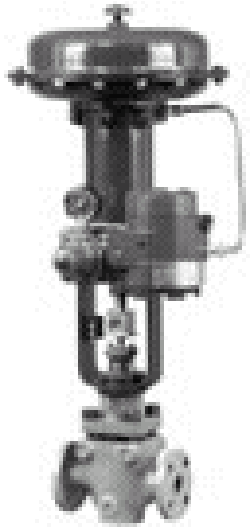
Option 1: Replace High-Bleed Devices

- 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



Fisher
Electro-Pneumatic
Transducer

Source: www.emersonprocess.com

Norriseal
Pneumatic Liquid
Level Controller

Source: www.norriseal.com

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Option 1: Cost to Replace High-Bleed Devices

- Costs vary with size:
  - Typical costs range from TMT 2,000 to TMT 8,550 per device
  - Incremental costs of low-bleed devices are modest (TMT 430 to TMT 710)
  - Gas savings often pay for replacement costs in short periods of time (2 to 8 months)

All data based on Partners' experiences and represented in U.S. economics converted to Turkmen currency.

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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 ~ TMT 1,950
- Payback time ~ 9 months

All data based on Partners' experiences and represented in U.S. economics converted to Turkmen currency.

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Option 3: Maintenance to Reduce Losses

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

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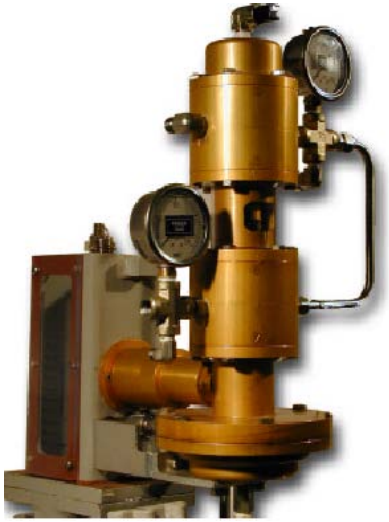
Option 3: Maintenance to Reduce Losses (cont'd)

- 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
- Costs are low

Becker
Single-Acting
Valve Positioner



Source: www.bpe950.com

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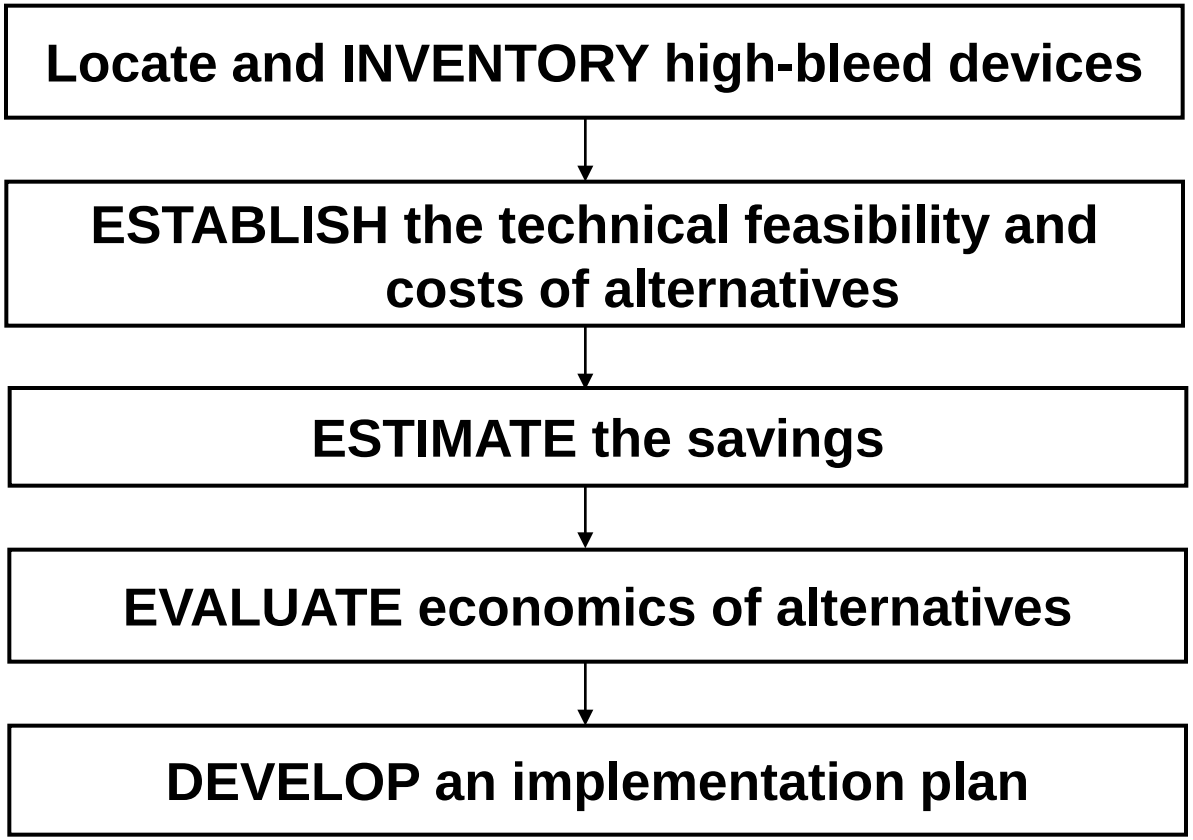
Five Steps for Reducing Methane Emissions from Pneumatic Devices



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Industry Experience: Marathon Oil (U.S. Production Company)

- 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

Industry Experience: Marathon Oil

- Marathon measured gas losses total 145 thousand m^3/year
- Level controllers account for 86% of losses
  - Losses averaged 0.2 m^3/hour/device
  - Losses ranged up to 1.4 m^3/hour/device (11.9 thousand m^3/year)
- Concluded that excessive losses can be heard or felt

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Industry Experience – Chesapeake Energy

- Level controllers retrofitted with Mizer components
- Hi-flow sampler used to measure emissions reductions from retrofits

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

Cemco/WellMark 6900
Retrofit w/ Mizer Valve

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

Industry Experience – Chesapeake Energy

District	Retrofits Done Thru 31-Mar-09	Total Capital (TMT)	Daily Reduction (thousand m^3)	Annual Reduction (million m^3)
Anadarko	1,264	1,952,500	25.1	9.2
Arkansas	100	154,470	2.0	0.7
N. Mid Continent	467	721,375	9.3	2.8
Southern Oklahoma	372	201,264	7.4	2.8
W. Mid Continent	47	573,602	0.9	0.4
Gulf Coast	161	248,697	3.2	1.2
Louisiana	17	26,260	0.3	0.1
N. Permian	93	58,157	1.8	0.7
S. Permian	149	229,647	2.9	0.6
Total	2,670	4,165,972	52.9	18.4

Average Installation Cost = TMT 1,545

Using $3.50/MCF (TMT 350/thousand m^3), the simple payback is 7 months.

All data based on Partners' experiences and represented in U.S. economics converted to Turkmen currency.

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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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Contacts and Further Information

- More detail is available on these practices and over 80 others online at: epa.gov/gasstar/tools/recommended.html
- For further assistance, direct questions to:

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