Efficient Pigging of Gathering Lines

Lessons Learned from Natural Gas STAR

Processors Technology Transfer Workshop

Gas Processors Association,
Devon Energy, Enogex
Dynegy Midstream Services, and
EPA's Natural Gas STAR Program

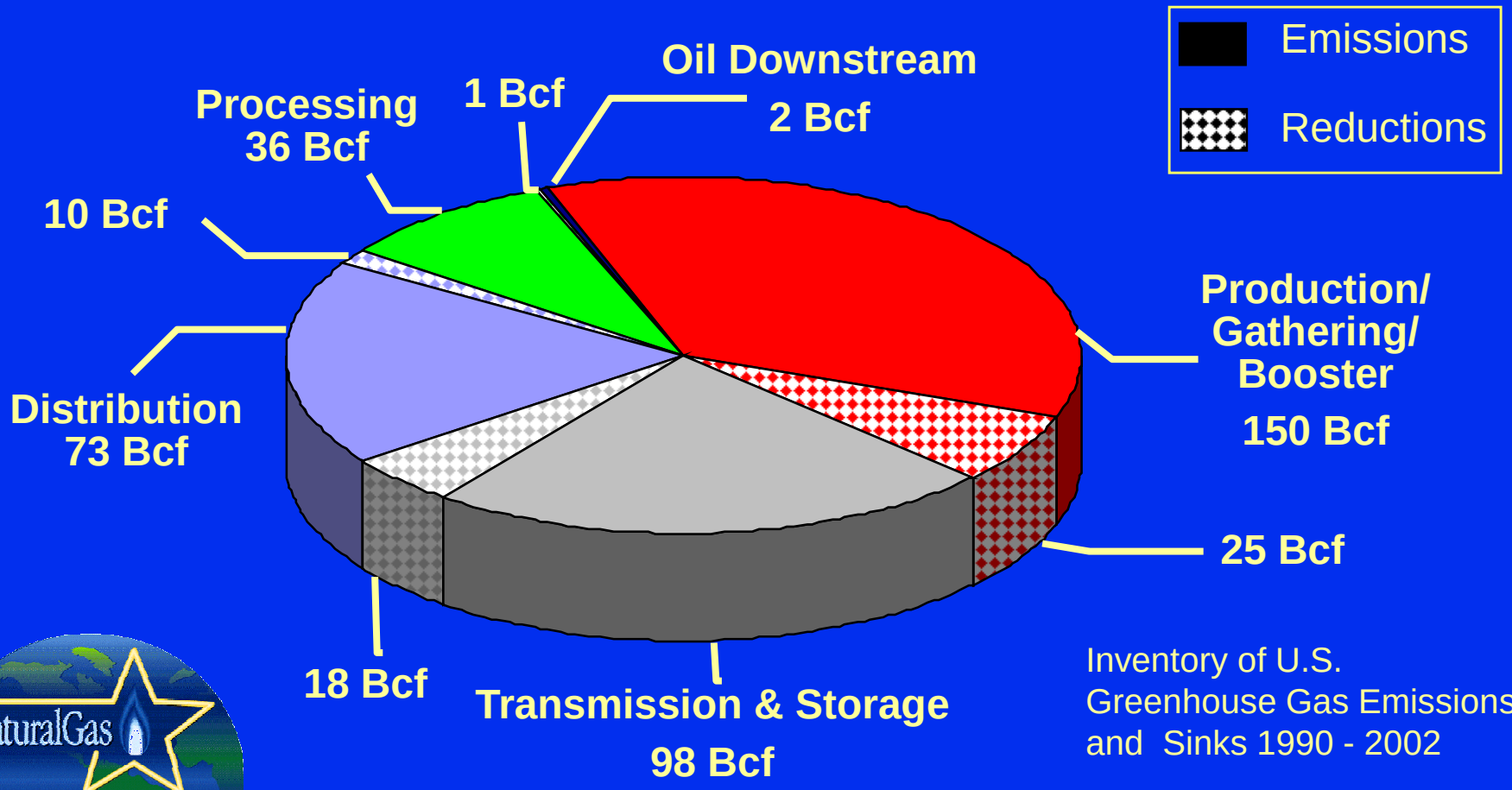
April 22, 2005

Agenda

- Methane Losses from Pipeline Pigging
- Methane Recovery
- Industry Experience
- Is Recovery Profitable?
- Discussion Questions

Natural Gas and Petroleum Industry Emissions

- Processing plants responsible for 36 Bcf of methane emissions annually, and gathering/ booster stations contribute >22 Bcf



Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2002

NaturalGas
EPA POLLUTION PREVENTER

Pigging Gathering Lines

- Hydrocarbons and water condense inside wet gas gathering lines, causing pressure drop and reducing gas flow
- Periodic line pigging removes liquids and debris to improve gas flow
- Efficient pigging:
  - **Keeps pipeline running continuously**
  - **Keeps pipeline near maximum throughput by removing debris**
  - **Minimizes product losses during launch/capture**

http://www.girardind.com/

Pigging Applications

- Pipeline pigs come in a variety of shapes and sizes for different applications
  - **Cleaning pigs**
    - **Have brushes or blades to help remove debris**
  - **Sealing pigs**
    - **Make tight seal for removing liquids from the pipe**
  - **Inspection pigs**
    - **Specialized pigs outfitted with instruments to monitor the pipeline integrity**

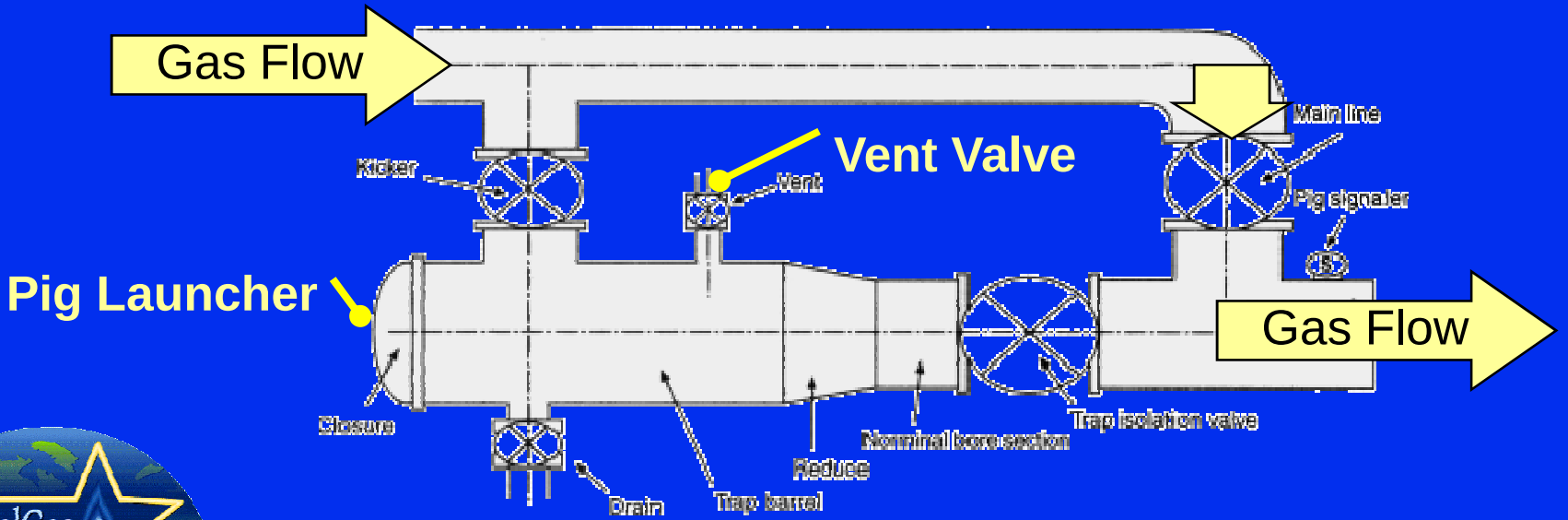
www.westernfilterco.com

Pigging and Methane Losses

- Gas lost when launching and receiving a pig
- Fugitive emissions from pig launcher/receiver valves
- Gas lost from storage tanks receiving condensate removed by pigging
- Gas vented from pipeline blowdowns

How Does Pigging Vent Methane?

- Gathering lines have built-in pig launchers
- Pig launchers have isolation valves for loading pigs, pressurizing pigs, and launching pigs with gas bypassed from the pipeline
- Launcher pressuring/depressuring loses methane out the vent valve



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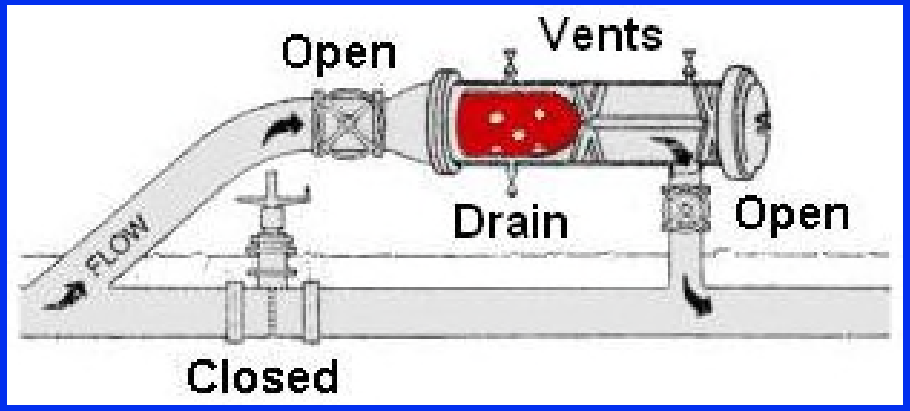
Pigging Vents Methane Twice!

- Methane lost through vent valve on the launcher and again through vent valve on the receiver
  - **Once receiver is isolated from the line, it must be depressured to remove the pig**
  - **Liquids ahead of the pig drain to a vessel or tank**
- Isolation valve leaks cause excessive venting to depressure



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Estimating Pigging Vents

- E = P * V / 14.7 * n * f

  where:

  E = methane emissions (cubic feet)

  P = Gathering line pressure (psia)

  V = Launcher and receiver volume (cubic feet)

  n = % methane

  f = number of piggings

- Pig trap isolation valve leakage increases this minimum amount of gas venting

Estimating Emissions from Pigging

- Estimating V

Line Diameter (inches)	V (cf)
6	0.9
12	4.6
18	11.5
26	27.7
34	65.2
48	170.7

Adapted from http://www.pigsunlimited.com

- Estimating P
  - **Default: 315 psia**
- Estimating n
  - **Default: 78.8**

Gas Recovery from Pipeline Condensate Storage Tanks

- Pressurized condensate collected from pigging is sometimes stored in atmospheric tanks
- Gas released during atmospheric flashing can be recovered using a vapor recovery unit (VRU) rather than venting the gas
- Facilities with existing pigging and liquid storage capabilities can install an electric or gas powered VRU compressor to recover flashed gasses

Industry Experience

- One partner pigged gathering lines 30 to 40 times per year, collecting several thousand barrels of condensate per application
- Partner reported saving 21,400 Mcf/yr from recovering flash gases
- Dedicated VRU was installed with an electric compressor

Is Recovery Profitable?

- Partner reported installation cost of $24,000 for electric VRU compressor
- Annual operating cost of $40,000 mostly electricity
- Large gas savings and increasing gas prices will offset costs

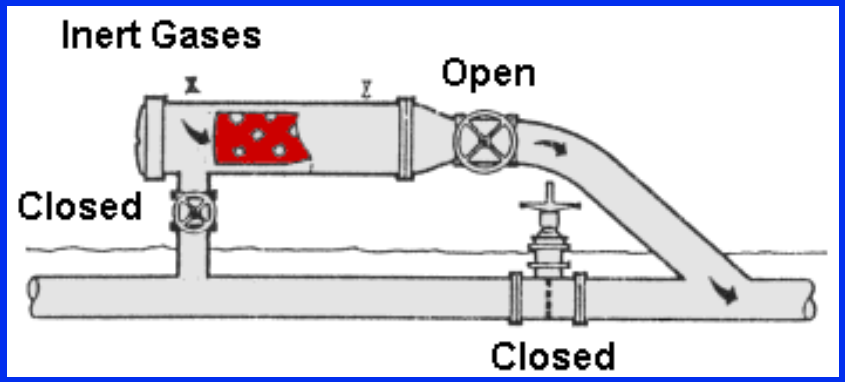
Gas Price ($/Mcf)	$ 2.00	$ 3.00	$ 4.00
Gas Saved (Mcf/yr)	21,400	21,400	21,400
Annual Savings ($/yr)	$ 42,800	$ 64,200	$ 85,600
Installed Cost	$ 24,000	$ 24,000	$ 24,000
Operating Cost	$ 40,000	$ 40,000	$ 40,000
Payback Period (years)	8.6	1.0	0.5

Use Inert Gases and Pigs to Perform Pipeline Purges

- Pipeline maintenance requires pipe section blowdown before work can begin
- Gas in pipeline is usually vented to the atmosphere
- Inert gas can be used to drive a pig down the section of pipe to be serviced, displacing the natural gas to a product line rather than venting
- Inert gas is then blown down to the atmosphere, avoiding methane loss

Inert Gas Setup

- Existing pig launcher can be used, set up to work with inert gases
- Portable nitrogen supply connected to the pig launcher vent
- Close valve on the main pipeline, pressurize launcher with inert gas, open launcher to main pipeline
- Supply nitrogen until pig reaches receiver



http://www.girardind.com/

Industry Experience

- One partner reported using inert gas to purge six pipelines for maintenance
- Gas savings from these applications was 538 Mcf
- These savings correspond to a typical application of:
  - **2 miles of 10” diameter pipeline**
  - **Nitrogen at 280 psi**

Is Recovery Profitable?

- No capital costs with existing pigging facilities
- Labor costs are estimated at eight hours for two operators
- Nitrogen costs are roughly $8/Mcf
- Increased safety is the primary benefit of this opportunity
- Gas savings are a secondary benefit, as the labor and nitrogen costs outweigh the gas value

Discussion Questions

- What opportunities do you have to reduce methane emissions from your pigging operations?
- How can this presentation be made more useful to help you identify and evaluate opportunities?
- What are the barriers to your implementing the technologies and practices in this presentation?