Agenda

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

- Pipeline pigging contributes to
  - the 4,060 Mcf methane per year vented by an average processing plant
  - the 2,886 Mcf methane per year of fugitive methane emissions at an average processing plant

Mcf = thousand cubic feet
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

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/depressurizing 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
Estimating Pigging Vents

- $E = \frac{P \times V}{14.7 \times n \times f}$
  where:
  - $E$ = methane emissions (cf)
  - $P$ = Gathering line pressure (psia)
  - $V$ = Launcher and receiver volume (cf)
  - $n$ = % methane
  - $f$ = number of piggings

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

$cf = \text{cubic feet}$
$psia = \text{pounds per square inch absolute}$
Estimating Emissions from Pigging

- Estimating V

<table>
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<th>Line Diameter (inches)</th>
<th>V (cf)</th>
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<tr>
<td>6</td>
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Adapted from www.pigsunlimited.com

- Estimating P
  - Default: 315 psia

- Estimating n
  - Default: 78.8 % methane
Methane Recovery: Use Inert Gases

- 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

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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 inch diameter pipeline
  - Nitrogen at 280 psia
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 project
- Gas savings are a secondary benefit, as the labor and nitrogen costs outweigh the gas value
Discussion Topics

- Identify other opportunities to reduce methane emissions from pigging
- Discuss further information required to identify and evaluate opportunities
- Any barriers to implementing the technologies and practices in this presentation
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