Internal Corrosion Control

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Incident Trends by Threat (3-Year Rolling Average)

- Excavation
- Weather & Outside Force
- External Corrosion
- Manufacturing
- Construction
- Internal Corrosion
- SCC

All onshore natural gas transmission incidents report to PHMSA; intrastate and interstate
Resident Threats
(3-Year Rolling Average)

Onshore natural gas transmission; intra and interstate
Time Dependent Threats (3-Year Rolling Average)

Onshore natural gas transmission; intra and interstate
Internal Corrosion

- One of the causes of pipeline failures
- Caused by water in the pipeline
- Salts, glycol, black powder, bacteria etc. can accelerate internal corrosion
- Different mitigation measures are needed, depending on the pipeline system and the quality of gas being transported.
Internal Corrosion Control

• Different plans are needed for piggable and non-piggable pipelines

• The 1\textsuperscript{st} line of defense is not to allow free water to deposit in the pipeline
  o Gas quality controls
  o Monitoring and sampling

• The 2\textsuperscript{nd} line of defense is cleaning the line, if possible.
  o Laboratory analysis of collected deposits

• The 3\textsuperscript{rd} line of defense is to inspect the pipeline with an MFL tool
Internal Corrosion Control – Monitoring & Sampling

• Gas Quality:
  o Enforce gas tariff for H$_2$O, CO$_2$, and H$_2$S
  o Do not allow more than 7 Lbs/mmcf water content
  o On-line analyzers
  o Automatic Shut-in valves

• Monitoring and Sampling:
  o Coupons
  o ER Probes
  o Laboratory Analysis of deposits
Internal Corrosion Control – Piggable lines

• Maintenance pigging is essential in controlling internal corrosion.
  o Collect samples of deposits removed
  o Adjust cleaning frequency based on laboratory analysis of deposits

• Chemical treatment may be needed based on gas being transported
  o Chemical treatment (corrosion inhibitors)
  o Biocide treatment (bacteria)

• In-Line-Inspection
  o Identifies location and severity of internal corrosion for repairs / analysis of possible sources of water
Internal Corrosion Control – Piggable lines

- Maintenance pigging is essential in controlling internal corrosion (removes water and deposits).
  - Collect samples of deposits removed
  - Adjust cleaning frequency based on laboratory analysis of deposits
Chemical treatment may be needed based on gas being transported

- Chemical corrosion inhibitors form a protective film on the metal surface (line must be clean)
- Biocides (bacteria control)
Internal Corrosion Control – Piggable lines

- In-Line-Inspection
  - Identifies location and severity of internal corrosion for repairs
  - Analysis of possible sources of water

MFL Tool

UT

X-Ray
Internal Corrosion Control – Non-piggable lines

- Non-piggable pipelines are more challenging from an internal corrosion control standpoint.
  - Cannot clean the pipeline
  - Cannot ILI the pipeline

- What can be done:
  - Controlling gas quality is essential
  - Identify locations where water may be present (sags, downstream of receipt points, critical angles)
  - Inspect select locations (X-ray, UT)
  - Install monitoring probes (coupons, ER probes)
  - Develop a long term plan to render the pipeline piggable for future cleaning and inspection
Internal Corrosion – Storage Fields and Stations

- Consider developing Site Specific Internal Corrosion plans for storage fields and compressor stations
  - Each facility has a unique infrastructure / operation
    - Pipelines and vessels
  - Site Specific Plans would address areas of concern specific to each facility
  - Monitor, Analyze, Inspect, Adjust, Repeat.
Internal Corrosion Control – Final Thoughts

• For piggable pipelines, internal corrosion control is advanced. With a robust internal plan, monitoring and maintenance measures, internal corrosion can be controlled.

• For non-piggable pipelines, fewer tools in the toolbox are available. These are typically older pipelines, with little historical internal corrosion data. With monitoring, gas quality controls, and strategic inspections, internal corrosion can be controlled, until these pipelines are replaced or made piggable.
Questions ?