Main Line Valves

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Topics for Discussion

- History and application of automatic shut-off valves
- Research related to ASV’s and other technologies
- Future focus
History of Automatic Shut-off Valves

> Concept of early valve closures to reduce the effects of pipeline ruptures dates back to 1940’s
  - Development of pneumatically operated automated control valves.
  - More recently, with advances in communications and automation, remote-controlled mainline valves have been developed and deployed.
    > Provide early valve closure
    > Minimize false closure

> Automated shut-off valves do not prevent leaks from occurring.

> They will not minimize the consequence from the initial rupture.

> Role of a ASV or RCV on pipelines is to mitigate the risk of additional consequences by quicker shut down times.
Research of Automatic Shut-off Valves

> Research included:
  – Assessment of remote and automatic shut-off valve technology through:
    > Field experience
    > Simulation studies

Results indicated that the major source of unreliability with ASV’s and RCV’s lies with the inability to accurately detect a rupture event (false closures).
Research of Automatic Shut-off Valves

Research: (continued)

- Additional efforts focused on the use of computer simulation modeling for the improved application of line break control systems.
  - Field tests validated the use of acoustic wave detectors in detecting the simulated pipeline breaks (promising technology).
  - (Petrobras has been investigating and testing what they call an intelligent or smart line break detection system for both gas and liquid pipelines)

- Need: Develop additional line break detection systems
Research of Automatic Shut-off Valves

Research: (continued)

- A project to investigate the challenges associated with installing ASV’s or RCV’s. These challenges include:
  - Lack of above/underground space for valve placement, especially in urban environments.
  - Costs to install ASV’s or RCV’s on new and existing transmission pipelines. Costs can be greater than $1,000,000 per valve installed.
Research of Automatic Shut-off Valves

>Research: (continued)

– Modeling for Rupture Response (computational fluid dynamics)

> Evaluate the effects of added valves and valve modifications (i.e., ASV and RCV’s)

> Takes into consideration various inputs such as:
  – Valve types
  – Closure times
  – Pressures
  – Ambient temperatures and gas loads
  – HCA’s
Research of Automatic Shut-off Valves

> Research (Modeling continued)
  
  ─ Modeling for Rupture Response
  
  > Various scenarios are then modeled using randomly generated and selected rupture locations (based on risk and consequences of a pipeline rupture).

  ─ Results of model runs will provide determining factors that have the greatest influence on rupture blow down times and BTU release. Which allows for:

  > Number and type of valves required  
  > Placement of valves  
  > Number and placement of sensors and flow measurement points  
  > Etc.
Research of Automatic Shut-off Valves

> Research (continued)

- Design and development of an in-situ installation valve.

> The goal of this project is to develop a valve that can be installed on existing pipelines without shutting off the flow of gas.

> Issues with installing valves on an existing pipeline are:
  - High cost
  - Large excavations
  - Installation of several fittings to allow for flow stopping
  - By-pass of pipeline is often required
  - Space requirements
  - Etc.
Research of Automatic Shut-off Valves

Research (in-situ valve continued)

Various lab and field evaluations performed to evaluate an in-situ valve on distribution natural gas piping systems.
Emergency Stop Off Stations

> Need:
  - In the event of a “gas emergency,” the need exists to have the ability to quickly stop-off gas flow on piping systems, especially in urban areas.

> Objective:
  - Create the capability to achieve a rapid shutdown of gas flow in large diameter, low-pressure mains in the event of an emergency without having to make an emergency excavation and tap the pipe during the emergency.
Emergency Stop Off Stations
Needs

Based on research and current operator experience, additional needs exist for:

- Improved valve automation and communication signals.
- More accurate pipeline sensing (line break detection) systems to minimize unintended valve closures.
- Enhanced computer modeling to assess pipeline rupture response and placement of valves and associated sensors.
- New valve designs to address various types of systems and reduce cost of installation.
- Flow control options (especially in urban settings)
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