the Energy to Lead

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

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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

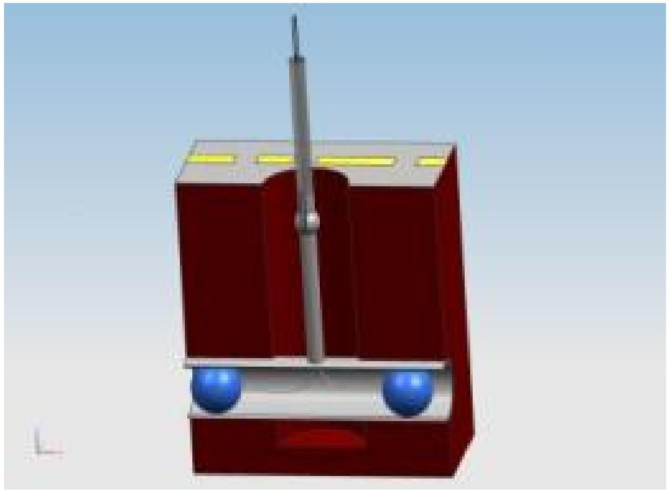
- Research (in-situ valve continued)
  - Various lab and field evaluations performed to evaluate an in-situ valve on distribution natural gas piping systems.

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)

Solving **important** ***problems*** **facing the energy industry and its consumers …**

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