

Emergency Isolation Valves Hazardous Liquid Pipeline Perspective

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Emergency Flow Restrictive Devices

- Some types of EFRDs Used in Hazardous Liquid Pipelines
 - Automatically Operated Valves
 - Remote Operated Valves
 - Manually Operated Valves
 - Check Valves

Locations Where EFRDs May be Used in HL Pipelines

- Near High Consequence Area (HCA) such as a populated area or Commercially Navigable Waterway
- Where potential impact from a pipeline spill to a (HCA) would be reduced or eliminated.
- Where Preventive Measures have been utilized to their fullest and potential consequences can be significantly mitigated by an EFRD

Liquid Pipeline Experience Since IMP Rule EFRD Requirements

- Pipeline Operators employ consistent evaluation of potential spill impacts to HCAs and if additional EFRDs could provide significant impact reduction
- Completed projects to install EFRDs or add EFRD capability to existing Manual Valves on pipeline systems where they have the greatest impact to reduce spill volumes to HCAs
- Evaluation Process has further proved value of spill prevention activities over mitigative measures such as EFRDs

EFRD Evaluations in HL Pipelines

- Liquid pipeline spills occur in 4 phases:
 1. Initial release while pipeline operating before detection
 2. Continued release after detection and Control Personnel are reacting/shutting pipeline down
 3. Liquid de-pressurization – after line is shutdown, before EFRDs fully closed
 4. Liquid Drain down after EFRDs closed
- **EFRDs are only effective during the 4th phase of large releases**

EFRDs, Challenges to Installation

- EFRDs have limitations and add risk to HL pipelines at locations where they are utilized
 - Add potential sources of leaks (seals, fittings)
 - Inadvertent closure introduces dangerous surges potentially leading to pipeline rupture
- They can only mitigate catastrophic release events (not seeps and small leaks)
- They only mitigate risk of a specific portion of the pipeline and typically not the entire pipeline

Costs of EFRDs on Hazardous Liquid Pipelines

- Cost to install a Remote Operated Valve on existing lines would range between \$350M to \$700M
- Costs of installing EFRDs on existing pipelines is 200%-300% the cost compared to new pipelines
- Operating costs would be slightly lower on new pipelines and EFRDs when compared to valves currently installed on existing pipelines.
- Because the frequency of spills is declining due to IMP Preventive activities, the Cost/Benefit of EFRD installation is continually being increased

Environmental and Operating Conditions Affecting HL EFRDs

- Freezing temperatures will affect valves if water is present inside valve preventing EFRD operation or causing valve to leak
- High pressure differentials across a valve require very high forces to open the valve – especially in large diameter valves (this is another risk associated with inadvertent valve closure either during operation or startup of the pipeline)
- Availability of power and communications to ROVs is critical and may be vulnerable to environmental conditions

Valves Add to Risk of HL Leaks

- API PPTS* data from 1999 to 2009 indicates valves were the location of 6.5% of the number of leaks along the onshore pipeline Right-of-Way (second only to the pipe itself)
- Those leaks from valves accounted for 3.9% of the total volume spilled on the Right-of-Way
- While these percentages are relatively low, they are significant obstacles to achieving zero spills
- The potential benefit must exceed the additional risks as well as the capital costs

*API Pipeline Performance Tracking System (PPTS)

HL Pipeline Valves Add Other Risks

- Vandalism/Sabotage of valves, while rare, has occurred
- Due to the remote locations of EFRDs, and the fact many are above ground, tampering with equipment is difficult to prevent – but precautions are put in place to reduce the probability
- Cyber security of Remote Operated Valves must also be considered as a threat from an external attack or internal error

Inadvertent Operation of EFRDs

- Uncommanded operation of Remote Operated Valves present risk of HL pipeline overpressure and subsequent rupture – the very consequence EFRDs are intended to mitigate
- Hydraulic consequences of inadvertent closure of valve **MUST** be accounted for in hydraulic surge safety systems – This may result in Operating Pressures set to a lower setting/flow rate to ensure the pipeline does not rupture due to inadvertent closure of downstream valve

A Few Words About Check Valves in Hazardous Liquid Pipelines

- When installed in the “right” location, meet the definition of an EFRD
- Typically require no power or communication
- Fewer potential sources of leaks
- Do not require human intervention to be activated
- Much lower cost to install and operate
- However, they can cause problems for “Smart Pigs” and pigs may cause damage to the check valve seals

Thank You

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