Project Profiles

RUPTURE MITIGATION VALVE TOOL OVERVIEW

BACKGROUND

With the adoption of new regulations related to ruptures and Rupture Mitigation Valves (RMVs), gas transmission operators are tasked with updating and coming into compliance for rupture mitigation plans in accordance with 49 CFR 192. With these new regulations, operators should understand where shutoff segments are located to minimize RMV installations in their system. They are also required to evaluate their HCA areas and understand where preventive and mitigative measures can be taken to reduce impacts of ruptures in high risk HCA areas. The rule applies to on-shore transmission lines, which have diameters of 6 inches or greater in any class location, pipelines in class 1 and 2 locations with a PIR less than 150 feet are exempt. While requirements are triggered by construction of new or replaced line segments, an upfront analysis enables a cohesive programmatic approach to future valve upgrades.

One method of selecting areas for upgrading existing valves to RMVs involves performing a manual review of applicable class locations and High Consequence Areas (HCAs), to select the isolation valves locations. When updates to existing valves are not feasible to meet compliance, new valves are installed. This method serves well for smaller, less complex systems and is more than capable of meeting compliance in those cases. For larger and more diverse systems, ENTRUST's has developed a Rupture Mitigation Valve Tool to effectively locate the potential locations where the RMV needs to be installed.

ENTRUST SOLUTIONS GROUP

ENDATA SOLUTIONS

The Rupture Mitigation Valve Tool is an automated tool developed by ENTRUST Solutions Group that can be tailored to client data to identify locations potentially requiring RMVs. Once areas are identified the tool optimizes the sections to install RMVs. This is done to minimize the total number of valves which meet conditions for an upgrade. The application works by inputting formatted GIS data, identifying, and then optimizing potential RMV locations and outputting the selected upgrades as a new GIS layer. The automated tool can significantly decrease the effort and time to identify locations for potential RMVs and decreases non-conformity in the selection process. Viewed as a whole, the RMV Tool is able to cope with large and complex data sets than the standard method can and deliver optimization and uniformity of the results.

THE PROBLEM

The tool was developed to help operators determine areas of their pipeline network that do not comply with PHMSA regulations. The new regulations require RMVs capable of closing in the event of a rupture to the pipeline. A rupture can be defined as any of the following events occurring in relation to gas pipelines, see 49 CFR 192.635:

1. A release of gas that can be reported to or is capable of being observed to represent an unintentional and uncontrolled release of gas.

2. An unintentional pressure loss of 10 percent or greater within 15 minutes or less.

3. An unexplained flow rate change, pressure change, instrumentation indication or equipment function that could indicate the previous event.

An RMV is defined as an automatic shut-off valve, or a remote-control valve used to minimize the volume of gas released and consequences of a rupture event. The role of an RMV may also be fulfilled by a manually operated valve which can isolate the segment in a timely manner. Manually operated valves may be used in locations that are continuously manned and only when the valve in question can be closed within 30 minutes of rupture identification. Locations will need additional RMVs if current RMVs do not satisfy the valve spacing requirements according to class location. The spacing for RMVs are as follows:

Class 4: No further than 8 miles apart

Class 3: No further than 15 miles apart

Class 1 and 2: No further than 20 miles apart

PHMSA also states that new lines or any lines which are “entirely replaced” must comply with RMV spacing. Here “entirely replaced” refers to any transmission pipeline that has any 2 or more miles in any stretch of 5 contiguous miles replaced with new pipe in the last 24 months.

If a section of pipe meets the above conditions, this would trigger the need for additional RMVs. Valves must either be installed or upgraded so that a section of pipe can be isolated within 30 minutes of rupture identification. This includes crossovers connections, or laterals so that any sources of flow to the rupture location cease. To become compliant, operators will take account of multiple regulations and an often, a non-uniform and complex transmission system, something the Rupture Mitigation Valve Tool can do seamlessly.

THE SOLUTION

The operator's GIS asset data is processed and formatted so that it can be properly integrated into the tool. The tool then interprets the data and determines which sections of the system contain a shut-off segment trigger as determined by RMV Rule Code described in the section above. When a shut-off segment trigger is found, the automated program identifies the nearest set of valves capable of isolating the segment and designates them as isolation points. Once all isolation points are identified, the Rupture Mitigation Valve Tool runs an automated process to optimize the shut-off segment and isolation valve configurations. It does this by removing overlaps and redundancy and combining adjacent shut-off segments and checking corresponding valves for further optimization, efficiency, and that the tested configuration is still compliant. This process automated process continues to run until the system reaches the minimum number of valves recommended for upgrade and/or installation to meet compliance standards.

Once segments have been optimized, there is a prioritization phase which determines which segment are recommended to for their isolating valves to be upgraded first based off industry best practice and client specific priorities. The prioritization method is a modular automated process where the framework exists to efficiently modify the module so that it can be specific to client needs. For example, the prioritization algorithm can be tailored to account for one or multiple inputs such as asset risk scores for gas releases and ruptures, pipeline age, or the likelihood of change in class location due to population growth. The resulting data is tailored to both the operators input and the assets compliance and safety.

The Rupture Mitigation Valve Tool outputs results in the form of two GIS layers. The first layer contains a record for each isolation segment including its trigger, the number of valves needed to isolate it, and its priority for upgrade. The second layer is composed of selected isolation valves slated for upgrade. The two GIS layers make it possible for operators to view and interpret the RMV results using the power of GIS to make enhanced business decisions.