INFRASTRUCTURE MODERNIZATION

MONITORING OVERPRESSURE PROTECTION ON LOW-PRESSURE GAS SYSTEMS

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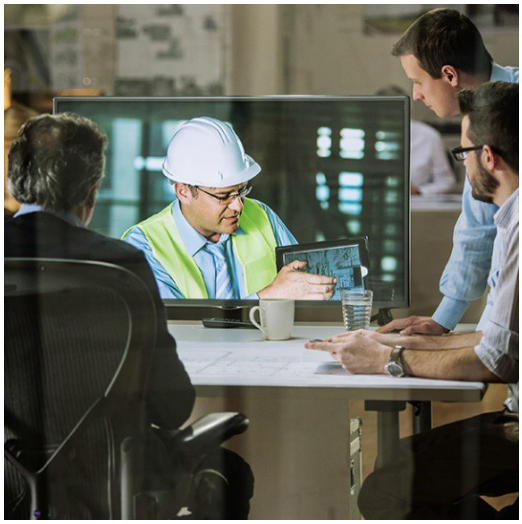
Seconds Count.

In protecting life and property during gas emergency operating conditions, seconds count.



The more quickly a gas operator responds to an emergency, the likelihood of injuries and damage decreases. Real-time detection of pressure anomalies enables rapid response.

This is especially true for operators of low-pressure gas systems.

In August of 2020, the United States Senate passed by unanimous consent S.2299, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2020, to reauthorize pipeline safety programs through FY 2023. One of the key provisions of the PIPESAct of 2020 involves increased requirements for overpressure protection (OPP) of gas systems.

This emphasized focus on OPP follows the tragic events in 2018 in the northeast region of the Merrimack Valley in the Commonwealth of Massachusetts. One person was killed, and 22 individuals, including three firefighters, were transported to local hospitalsbecause of injuries. The fires and explosions damaged 131 structures, including at least five homes that were destroyed in the city of Lawrence and the towns of Andover and North Andover. Most of the damage occurred from fires ignited by natural gas-fueled appliances; several of the homes were destroyed by natural gas-fueled explosions (NTSB, 9/24/2019).

Contributing to the accident was a low-pressure natural gas distribution system designed and operated without adequate overpressure protection (NTSB, 9/24/2019).

In this and other similar incidents,[1] the common denominator is low-pressure gas systems without internal relief service pressure regulators. Under these conditions, an unintentional event that overpressures the gas distribution system also overpressures the piping in the homes of attached customers. This system design was a common practice in past decades when entire systems delivered low-pressure gas. As the demand for natural gas increased and piping system materials improved, operators increased pressures on supply lines and installed district pressure regulating stations. Hence, the risk of overpressure events increased, along with the pressure differential atthe district regulators.

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For these older low-pressure systems, overpressure protection is done through monitoring pressure regulators and pressure relief valves at supply stations. Although failures of this equipment are rare, Merrimack Valley and similar incidents show that failures can occur for various reasons.

The remedy for the conditions described is to upgrade the distribution systems and equip customer service laterals with internal relief service regulators. While this is thelong-term goal of operators of low-pressure systems, this approach is not only expensive but requires significant planning and implementation time because it involves not only the servicelaterals but the distribution mains and supply regulators, as well.

These low-pressure systems are typically older sections of the distribution systems and, as such, are rarely remotely monitored by Supervisory Control and Data Acquisition (SCADA) systems. Remote pressure monitoring provides situational awareness for the system operator and enables response early in an event.

While SCADA monitoring is not always feasible in the short term, other modes of remote monitoring are available to operators, for example, cellular-based systems. Implementation of these detection types can be accomplished at a lower initial cost and speed compared to the increased time to upgrade regulator stations and distribution systems. Remote monitoring doesn't reduce the likelihood or consequence of failure but early detection, with an appropriate response, reduces the overall risk to life and property.

[1] Gary, In – 1969
Burlington, IA – 1969
El Paso, TX – 1977
Boston, MA - 1983

Not All Pressure Exceedances Are Created Equal.

The conditions described above generally represent a worst-case scenario. The overall size of the distribution system, system demand, pipe material type, and the number of supply stations have varying effects on risk-scoring systems. For example, even though a pressure exceedance is a violation of pipeline safety codes, newer steel and plastic systems with internal relief service regulators can withstand pressure exceedances with little to no risk to life and property. Considering the variables between systems and theassociated supply stations yields different risk profiles.

Black & Veatch has developed and applied a risk assessment model based on a Failure Modes and Effects Analysis (FMEA) that considers the system and supply variables to risk-rank pressure systems. High-risk systems should be the first candidates for remote pressure monitoring to lower the system risk score and increase public safety.

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Mike Nushart brings more than four decades of natural gas industry experience and provides data-driven Pipeline Integrity Management and code compliance expertise with a focus on data definition,acquisition, integration and analysis.

Experience includes 32 years of direct utility management of gas distribution and transmission, construction, operations, and maintenance with special emphasis on cost-effective code compliance and system safety and reliability. After a successful utility career, the skills acquired have been applied to a consultancy that has assisted other LDC operators in achieving improved pipeline integrity, cost savings and efficiencies.