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As many pipeline operators have unfortunately discovered, the 'unexpected' often happens. The following recommendations can help provide some of that peace of mind this industry has been seeking.

In 2008, an explosion damaged a natural gas pipeline in South America. This particular pipeline is vital to Brazil's economy, delivering an average of 31 million cubic meters each day. When the explosion occurred, everything from the safety of the workers to the surrounding environment was at great risk. Had the fire from the explosion spread, it would have continued for several pipeline segments. Repairs would have ranged from hundreds of thousands to millions of U.S. dollars, potentially driving up the cost of natural gas and leaving millions of people without power. Fortunately, a number of safety systems, including line-break detection systems and automated valve controls designed for a "fail to close" condition, did exactly what they were installed to do: isolate the damage to a single section and prevent fire from spreading through the pipeline (see Sidebar).

Challenges to pipelines today

In today's world, pipelines can be vulnerable to countless threats—*i.e., natural disasters such as earthquakes, floods or fires, harsh environmental factors, excavations, vandalism, even terrorist attacks.* The fact that oil and gas providers are producing from increasingly remote locations often necessitates longer pipelines to link producing regions with consuming regions. These remote locations and miles of pipeline exacerbate vulnerability.

The potential for problems highlights the critical need for certified safety equipment on pipelines. Strategically placed, carefully maintained and continually monitored, safety systems protect people, infrastructure and the environment while safeguarding the resource supply. Over the years, the industry has investigated and developed a series of standards such as the DIN 19250 (AK-classes), IEC 61508 and the ISA-S84, which are all aimed at increasing safety and thereby improving the reliability of production facilities. These standards, however, were established primarily for electric and electronic devices like pressure transmitters, rather than valves. This is an oversight by the industry, since valves, actuators and/or solenoids can be more susceptible to failure than electric and electronic devices.

Should a valve fail during an emergency, it could contribute to damage instead of preventing it. The pipeline example mentioned in the opening of this article—*by no means an isolated incident*— illustrates the essential need for valves to operate without fail in a crisis situation. Indeed, ensuring that valves are reliable and working properly is one of the easiest ways to contain damage from the surrounding communities and environment. Valves that are part of the safety system, and are non-active components, can remain in the open position for two years or more without movement until needed. When an emergency happens and these valves are called into service, it is essential that they operate immediately and open or close as designed.

Preventing future damage: safety products

No matter what the incident is that puts a pipeline at risk, there are precautions sites can take to help ensure that when a disruptive event occurs, the situation is contained and controlled. Safety products and solutions are readily available to help pipeline operators prepare for and mitigate the effects of crisis or emergency situations.

For example, Tyco Flow Control has launched a Safety Integrity Level (SIL)-capable top-entry ball valve that can be provided with a detailed certification package. This unique valve maintains sealing integrity even under extremely harsh conditions. Combining in-line maintenance capabilities with robust construction, it tolerates high-bending moments like those that can occur in earthquakes and blasts. An SIL-capable high-pressure direct gas actuator, with reduced size and visibility, is also available. Featuring a compact control system and manual hydraulic emergency operation, it's suitable for sour gas service and doesn't need a pressure reducer. As a further precaution, many operators also use pneumatic and electronic line-break controls at most valve sites on larger pipelines. These products can ensure isolation valves close in the event of a large leak or break in the pipeline, which in turn, can limit any loss of gas from small sections between valve sites.

Preventing future damage: mitigating the risk of attacks
In addition to using SIL-certified products, companies can help protect their sites by identifying the most vulnerable points along a pipeline. Specific solutions and steps to improve security against all types of safety threats include:

Securing power supplies that extend to the control devices and actuators…
It's recommended that companies use anti-climbing towers, forced inclinations and protection grids for solar panels to reduce visibility. Moreover, fuel cells that are either hidden or located underground have an added level of protection and reliable power supply.

Implementing fireproof and bulletproof enclosures and blast-resistant shelters…
These enclosures and shelters can protect actuator controls and fittings from fires, explosions and other attacks to the controls' LCD display and push buttons. Look for enclosures that have been designed and built to allow easy maintenance without compromising fireproofing capabilities.

Creating barrier layers…
Barrier layers in the form of visual and physical barriers, as well as bunkers, make accessing a pipeline difficult, which can help ward off access or attack from unauthorized approach.

Conducting ongoing tests of emergency operations…
Ongoing testing via Partial Stroke Test (PST) devices and diagnostics can improve the safety integrity level of pipelines by providing early detection of potential problems that could lead to failure. Such problems include the sticking of a disc or seat, sticking of stem/gland packing, jamming or damage of the actuator and clogging and damage of the pneumatic control system. The PST offers many benefits, including extending the intervals for a full stroke test and preventing fluid from sticking to both the valve and actuator.

Enhancing capabilities of local control systems…
To take protection one step further, it's recommended that pipeline operators use expanded local control panels that can offer acoustic monitoring, "drop" level leakage detection surveillance and intrusion alarms and seismic sensors and controls.

Ensuring communication redundancy…

Using redundant communications tools, including OF links and wireless tools such as radio, satellites or GPRS can add an additional level of security to the site.

Plan wisely for the unexpected

While it may not be possible to prevent every potential threat, a strategy con-sisting of multiple protection layers—*coupled with highly reliable equipment and sensible precautions*—can significantly reduce the consequences from an event. Such a strategy minimizes the likelihood of pipeline failure and the resulting disastrous impact on life, nature and economy.

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Finding Peace of Mind

As customers expand to more remote locations, they face a new set of challenges, both operational and technical. Offering one of the broadest ranges of flow-control and pressure-management products available from industry-lead-ing brands, including Anderson Greenwood, Clarkson and Biffi, Tyco Flow Control meets customers' needs. Its experts have designed safety devices to withstand the unexpected and operate as required no matter where they're located, when they're needed most to help operations run reliably, efficiently and with

less downtime. Many operators turn to Tyco for end-to-end solutions and deep industry experience to ensure they are using the right product for the right application, to protect equipment and assets.

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