

THOUGHT LEADERSHIP

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Unexpected Shutdown, Unexpected Damage

Mitigating the Corrosion Consequences from Oil and Gas Pipeline Shutdowns During COVID-19

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The COVID-19 pandemic currently poses risks to the structural integrity of oil and gas pipelines around the world. Both the pandemic-induced oil glut and the lack of additional storage capacity at terminals have necessitated the unscheduled shutdown of oil transmission pipelines and process piping. Prolonged idling of crude oil and refined products in piping can have unexpected corrosion consequences that compromise structural integrity. By proactively preparing for pipeline restarts, oil and gas pipeline owners and operators can help minimize the environmental safety, regulatory, legal, and financial risks that can result from corrosion damage during an unexpected shutdown.

Hazards Associated with Oil and Gas Corrosion Damage

The sudden and extended shutdown of an oil or gas pipeline can increase the risk of leaks or ruptures on restart. Liquids that are normally well mixed while flowing can separate into distinct phases when stagnant. Gases such as carbon dioxide and hydrogen sulfide can evolve from shut-in crude oil and form gas pockets at local high points, and water can separate from the hydrocarbon phase. When the gases combine with water, they form corrosive liquids that attack pipeline steel. Likewise, water vapor can condense from natural gas in an idled pipeline as a result of a flow stoppage, and the resulting liquid can accumulate at local low points. These stagnation-related events can cause unexpected corrosion with potentially severe consequences at restart. Gas pocketing in stagnated liquid lines can lead to hydraulic hammer, and accumulated liquids in idled gas pipelines can result in slug flow, both of which can damage pipelines and piping.

In addition to health and safety risks, large pipeline leaks and ruptures can lead to fines from the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA). Substantial financial losses may result from not only litigation costs but also environmental remediation and prolonged down time for repairs and implementation of remedial measures to meet regulatory requirements for a safe and reliable restart following a pipeline leak or rupture.

Anticipating and Mitigating Hazards Upon Restart

We recommend that oil and gas transmission pipeline owners and operators prepare for pipeline restarts now. If lines have experienced prolonged shutdowns, operators will want to consider what might have occurred during the outage, what potential problems may arise on start up, and how to avoid them. Developing proactive restart plans including targeted post-shut-in condition assessment can help

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owners and operators address those areas that are most susceptible to corrosion damage during shut-in. Proactively scheduling in-line-inspection (ILI) resources can also be of benefit, as demand for ILI resources may be high and availability limited once pipelines begin to restart operations. Those owners and operators seeking specialized assistance can contact Exponent for a comprehensive audit of a pipeline's current state and assistance building restart plans that help mitigate the risks of unexpected corrosion damage.

How Exponent Can Help

Exponent's multi-disciplinary team of electrochemists, metallurgists, and fracture mechanics, fluid dynamics, and corrosion engineers has decades of experience performing failure analysis and risk assessment and mitigation for oil and gas pipelines. We help clients navigate the ever-changing pipeline regulatory environment and enhance their integrity management programs to meet or exceed the latest standards.



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