Case study

Baker Hughes, Process & Pipeline Services delivers for a successful Cameron System 41 pipeline decommissioning

"Our team successfully completed the project without incident, all while working with the challenges of COVID-19 safety protocols and weather-related delays.

By taking advantage of the broad Baker Hughes' equipment fleet, the team was able to complete all of the onshore and offshore tasks required for this long-duration complex project, working around the clock to provide excellent collaboration and communication while meeting all mobilization deadlines to fulfill our customer's expectations."

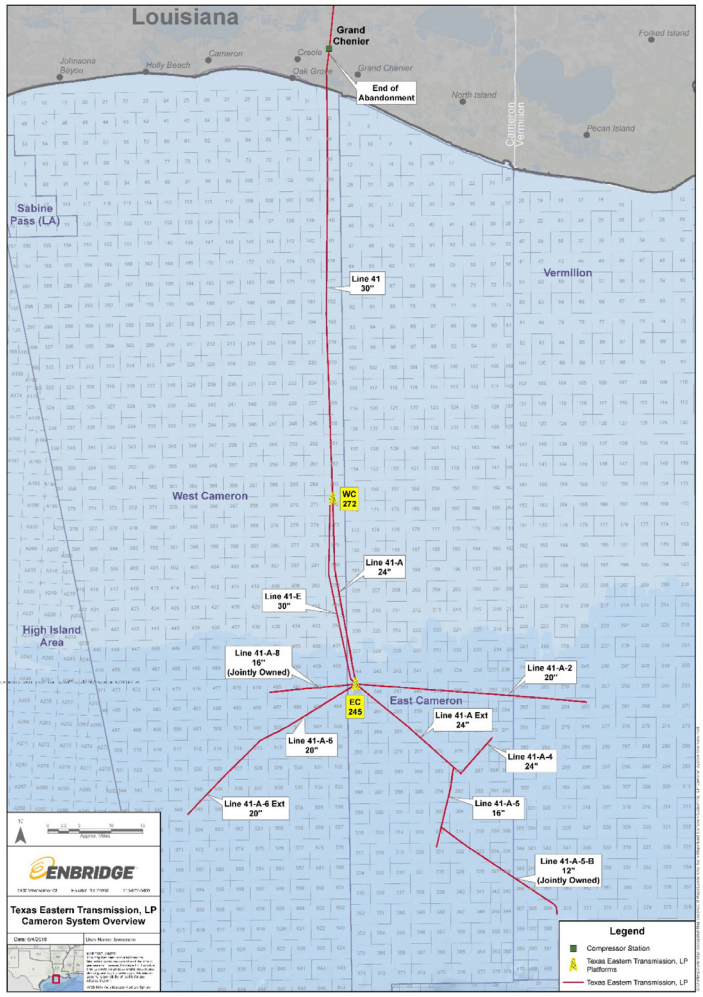
— Stephen Jackson
Baker Hughes PPS Regional Director — USA, Mexico & South America

Background

Decommissioning or abandoning a pipeline is not a simple task, and avoiding potential leaks is paramount. Important considerations include the pipeline's configuration and condition as well as the possibility of severe weather. The safe removal of a pipeline from service requires a complex series of properly planned operations that effectively manage all subcontractors and support vessels that perform multiple scopes of work simultaneously. These daunting challenges were faced by the Texas Eastern Transmission Limited Partnership (TETLP), a subsidiary of Enbridge Inc., as it prepared to decommission its Cameron System 41 pipeline located in the Gulf of Mexico off the coast of Cameron, Louisiana.

The Cameron pipeline system had been in continuous operation since 1974, and over the years numerous producer laterals had been connected to it, but many were abandoned after 2014. The lateral lines converge at Enbridge's East Cameron platform, where gas is gathered into the Line 41-A and Line 41-E trunklines, continuing north for 32 miles to Enbridge's West Cameron platform. The gas is

consolidated into Line 41, flowing 61 miles north and onshore to Enbridge's Grand Chenier Compressor Station (GCCS). The lateral lines' diameters range from 12 to 24 inches, while the Line 41 and Line 41-E trunklines are 30 inches and the Line 41-A trunkline is 24 inches in diameter. From GCCS, the 30-inch diameter Line 41 runs an additional 32 miles north to Enbridge's Iowa, Louisiana, compressor station.



With a design capacity in excess of 850 MMCFD and average throughput in 2018 below 20 MMCFD, the system was no longer viable, and Enbridge decided to shut in the system prior to the start of system abandonment operations in 2019. The pipeline system was full of residual fluids, mainly natural gas.

In addition to the above challenges, protecting the environment while controlling cost given the age and condition of one of the oldest lateral pipelines was a foremost consideration. With the potential for leaks deemed unacceptable, the Enbridge team came up with a solution: Water could be drawn through the pipeline at near-ambient pressure and processed at the receiving end.

Based on previous success working with senior field operations staff from Baker Hughes, Enbridge reached out to our Process & Pipeline Services (PPS) organization to help make its proposed solution a reality.

Solution

Working closely with Enbridge's assembly of contractors, highly skilled and experienced personnel from the PPS team provided the resources needed to complete the difficult project. Using Baker Hughes' Toolbox™ suite of software simulator applications, the team accurately calculated the minimum pig speed requirements. When unfavorable weather in the Gulf of Mexico led to an unsuccessful attempt to identify leaks by pumping filtered seawater with dye, PPS worked with Enbridge's project team and proposed the mobilization of a membrane nitrogen spread to facilitate subsea leak identification.

During the project, the PPS team met and overcame multiple project challenges, including limited Diving Support Vessel (DSV) deck space, restricted access to the control cabin storage compartment, and communications constraints. Through a HAZID risk analysis, the team identified project hazards associated with pipeline over-pressurization including the potential for catastrophic failure if communications were lost during pumping and approved the necessary procedures for successful project completion.

Baker Hughes PPS proposed a reduced footprint and very reliable offshore nitrogen and flooding spreads to meet the space constraints imposed by the DSV.

Sourcing a subsea pump capable of operating safely at the required 138-foot depth while providing flow rates as high as 1,000 gallons per minute allowed pumping operations to be performed without pressure buildup in the pipeline, overcoming the leak issue. Additionally, Baker Hughes supplied a high-pressure, large diameter downline suitable for pumping filtered seawater and membrane nitrogen. The downline was deployed and recovered multiple times.

To accurately collect field data, including pressure, temperature and flowrate parameters, the team used Baker Hughes' Nanoplex™ data acquisition system. Able to receive multiple inputs from various sources, Nanoplex also can send data signals, such as a pump shutdown, allowing it to be used as an over-pressure protection device. The team added JobMaster™ software, also from Baker Hughes, to create a powerful datalogger for the project. Final data reports were developed for each pipeline decommissioned in

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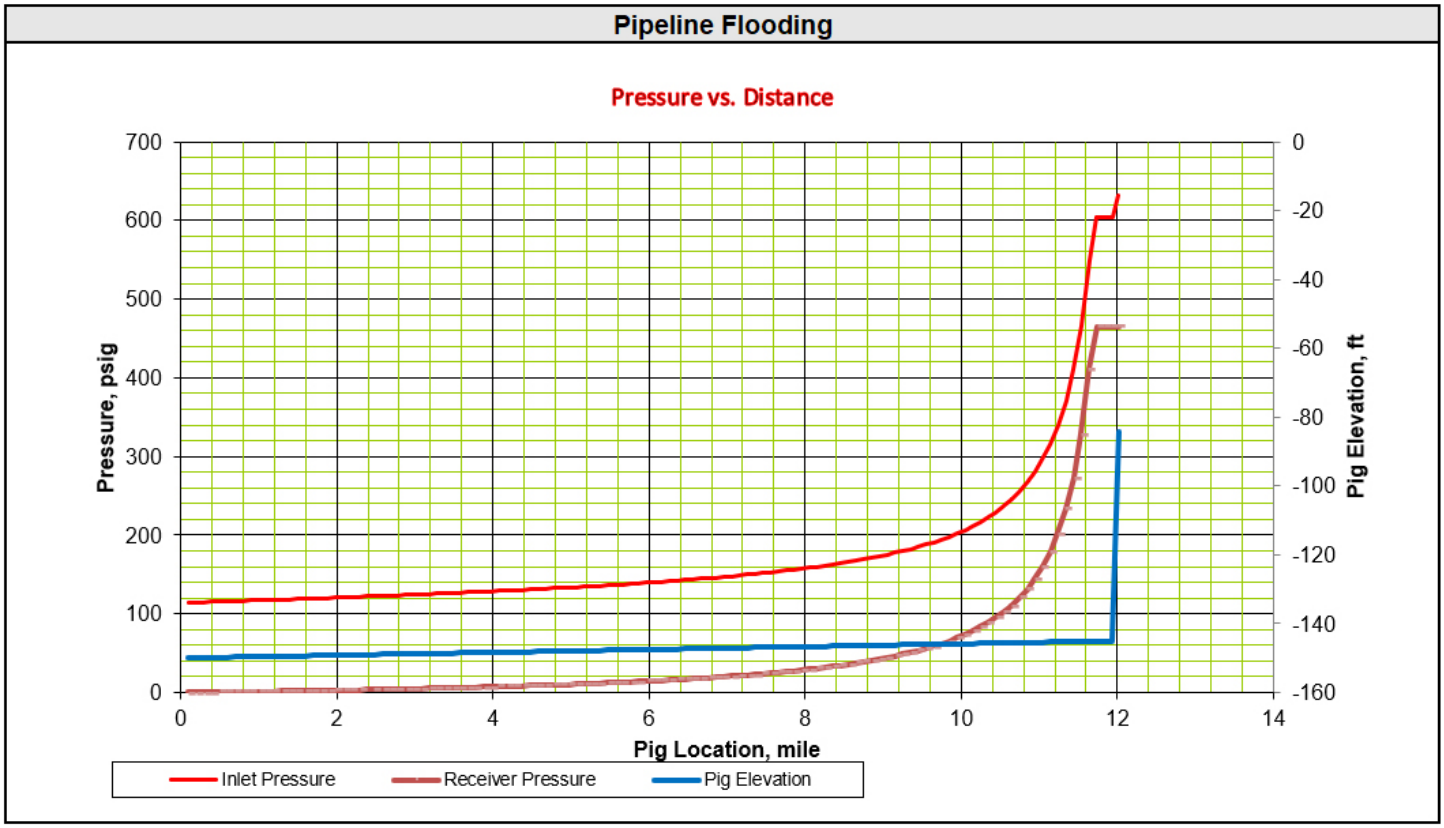


the Cameron System, complete with a summary of events and the collection of all field paperwork generated during pumping operations. Administrative reports also were provided to Enbridge, showing Baker Hughes' Quality and HSE performance as well as daily operations progress throughout the project.

Results

The project's entire decommissioning spread, including the high-pressure pumping spread, the high-pressure flooding and nitrogen membrane spreads, onshore LN_2 pumps and LN_2 tanks were provided by Baker Hughes' existing fleet, significantly reducing procurement times and hastening project completion. The system was successfully pigged, and residual fluids were pushed into downstream laterals and then pushed onshore and north of the Grand Chenier Compressor Station (GCCS). In addition to delivering an effective decommissioning spread along with over-pressure protection and hose/pipe restraint devices, the PPS team provided the data needed to allow Enbridge to safely decommission its Cameron System pipeline.

The PPS team from Baker Hughes was able to meet the project objective: preparing the nearly 245-mile-long Cameron System

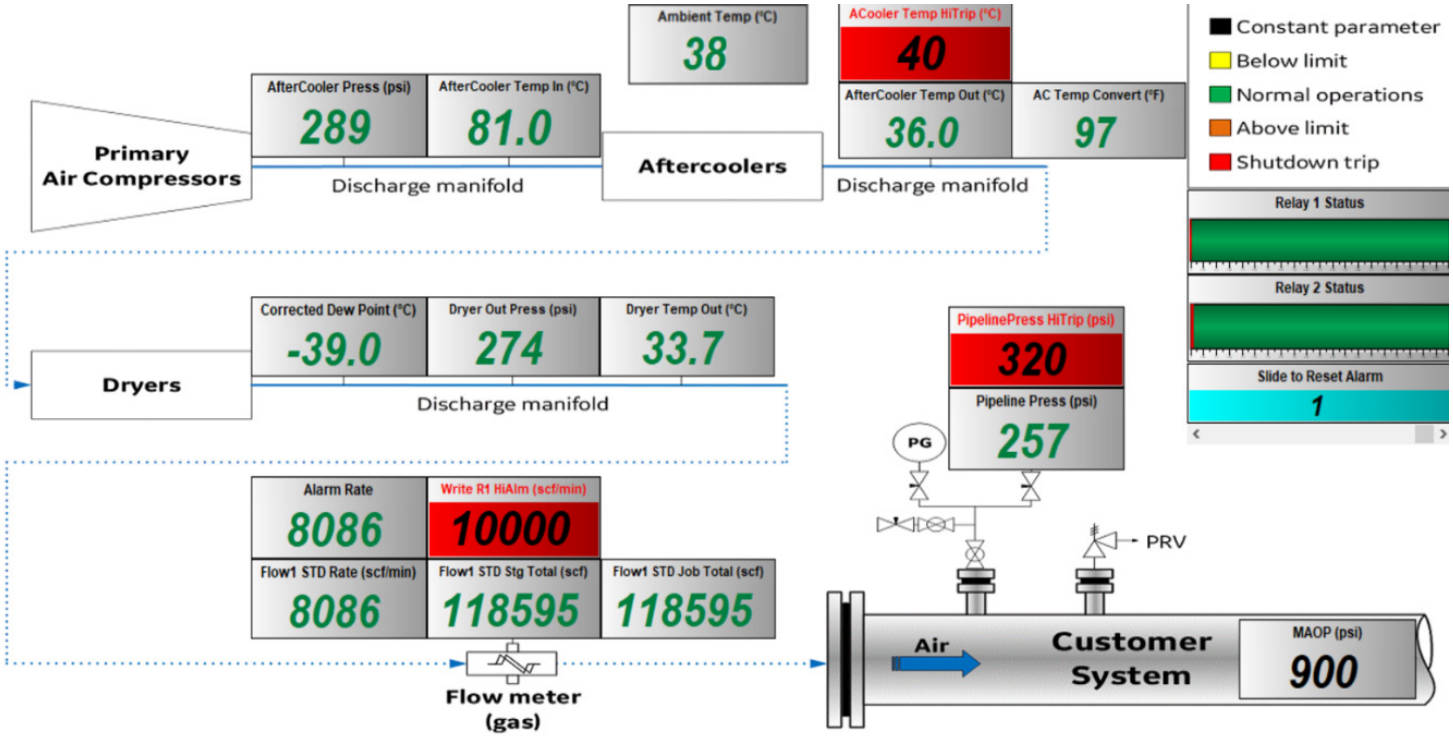
consisting of seven lateral pipelines and three trunklines for abandonment.

According to Stephen Jackson, PPS' Regional Director — USA, Mexico & South America, the successful decommissioning of the Cameron System highlights the exceptional front-end project management and engineering experience that PPS personnel bring to both offshore and onshore operations. "Our team successfully completed the project without incident, all while working

NanoPlex Model II

NanoPlex Model "T"

Comms Bridge



with the challenges of COVID-19 quarantine protocols and weather-related delays," Jackson said. "By taking advantage of the broad Baker Hughes' equipment fleet, the team was able to complete all of the onshore and offshore tasks required for this long-duration complex project, working around the clock to provide excellent collaboration and communication while meeting all mobilization deadlines to fulfill our customer's expectations."

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