PG&E Installing New Technology to Enhance Pipeline Safety During Seismic Activity

With fault lines traversing the length of its service area in Central and Northern California, PG&E has taken many important steps to safeguard its gas system in the event of seismic activity. From its 24/7 Gas Control Center that monitors nearly 8,000 points on its system to automated or remote-controlled shut-off valves, PG&E is committed to the safety of the communities it serves and is working every day to enhance gas pipeline safety throughout northern and central California.

One key issue for the utility is being able to assess the impact of seismic activity on its natural gas system. Traditionally, this has meant excavating to enable direct inspection of the pipe and using leak survey or inline inspection to measure the pipeline bending strain. But in partnership with Paulsson Incorporation, UC Berkeley and a grant from the Pipeline and Hazardous Materials Administration (PHMSA), PG&E is installing next-generation technology on its gas transmission lines to be able to more accurately determine the full-length strain profile on the affected pipelines from seismic activities, without having to excavate the line and in a manner more cost efficient than traditional in-line inspections. This work fits PG&E's overall strategy of improving safety at reduced cost and ranks as one of the high priorities in the company’s Transmission Integrity Management Program (TIMP) Fault Crossing Program.

The technology, distributed fiber optic sensing (DFOS), has been used in civil engineering infrastructure monitoring for years and more recently has been deployed for water pipeline monitoring. The project is the first direct pipeline full-length strain profile monitoring in the North American oil and gas industry. The success of the project will provide a new reliable, accurate and economically viable solution for pipelines under seismic conditions and will also confirm and calibrate the related pipeline strain modeling that the industry currently relies upon.

Fiber Optic technology is sensitive to changes in temperature, strain, and vibrations, and it provides real-time data on both pipeline and soil strain along the installed length, improving insight into how seismic activity impacts gas pipelines. In addition, the technology is immune to radiation and electromagnetic interference and functions as a passive sensor that does not rely on a power supply outside of the monitor location. Lastly, fiber optic is made from highly refined silica (glass) that is relatively inert and can be ideal for long-term monitoring.

To demonstrate the feasibility of the technology in its operations, PG&E Gas Research and Development (R&D) in late 2019 funded a field installation trial on a small-scale distribution pipeline at a Hayward fault-crossing site in Union City with support from Geoscience and Distribution Integrity Management Program (DIMP) Risk. Upon the success of that installation work, Gas R&D collaborated with Paulsson Inc., an innovative fiber optic sensing technology provider, and UC Berkeley resulting in the team successfully receiving PHMSA grants in 2019-2021. The Phase-I lab test was successfully

completed in early 2021, demonstrating the reliable attachment of fiber optic sensing cables for high sensitivity direct monitoring of the pipeline's full length strain profile.

With the success of the initial installation along the Hayward Fault in Union City, a gas transmission pipeline was identified for the next installation that crossed the Calaveras Fault near Gilroy, California. Partnering with Paulsson Incorporation, UC Berkeley and field construction vendor Snelson, PG&E worked on this installation starting in May 2023. Installation took approximately one week and was coordinated to occur within a 1200-ft pipeline re-routing construction schedule. The system is expected to provide monitoring data for years to come.