Zhou, H., Wang, Y.-Y., Bergman, J., Stephens, M., and Nanney, S., 2018, Burst Pressure of Pipelines with Corrosion Anomalies under High Longitudinal Strains, Proceedings of the 12th International Pipeline Conference, Paper No. IPC2018-78803, September 24-28, 2018, Calgary, AB, Canada.

Abstract

Existing corrosion assessment models were developed and validated under the assumption that internal pressure was the principal driver for burst failure and that longitudinal strain levels were low. The impact of moderate to high levels of longitudinal strain on burst capacity had not been explicitly considered.

This paper summarizes work performed as part of a major effort funded by the US Department of Transportation Pipeline and Hazardous Materials Safety Administration (DOT PHMSA) aimed at examining the impact of longitudinal strain on the integrity of pipelines with corrosion anomalies. This paper focuses on the burst pressure of corroded pipes under high longitudinal strains. It is known that longitudinal tensile strain does not reduce the burst pressure relative to that of pipes subjected to low longitudinal strains. Therefore, existing burst pressure models can be considered adequate when the longitudinal strain is tensile. However, longitudinal compressive strain was found to lead to a moderate reduction in burst pressure. Numerical analyses were conducted to study the effect of longitudinal compressive strain on the burst pressure of corroded pipes. A burst pressure reduction formula was developed as a function of the longitudinal compressive strain.

Full-scale tests were conducted to confirm the findings of the numerical analysis. Guidelines for assessing the burst pressure of corroded pipes under high longitudinal compressive strains were developed from the outcome of numerical analysis and experimental tests. The guidelines are applicable to different types of corrosion anomalies, including circumferential grooves, longitudinal grooves and general corrosion.