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## **Abstract**

Ground movements such as landslides, subsidence, and settlement can pose serious threats to the integrity of pipelines. The consequences of a ground movement event can vary greatly. Certain types of ground movements are slow-moving and can be monitored and mitigated before a catastrophic failure. Other forms of ground movements can be difficult to predict. The most effective approach could be hazard avoidance, proactive means to reduce strain demand on pipelines, and/or building sufficiently robust pipeline segments that have a high tolerance to the strain demand.

This paper provides an overview of a Joint Industry Project (JIP) aimed at developing a best-practice document on managing ground movement hazards. The hazards being focused on are landslides and ground settlement, including mine subsidence. This document attempts to address nearly all major elements necessary for the management of such hazards.

The most unique feature of the JIP is that the scope included the hazard management approach often practiced by geotechnical engineers and the fitness-for-service assessment of pipelines often performed by pipeline integrity engineers.

The document developed in the JIP provides a technical background of various existing and emerging technologies. The recommendations were developed based on a solid fundamental understanding of these technologies and a wide array of actual field experiences.

In addition to the various elements involved in the management of ground movement hazards, the JIP addresses some common misconceptions about the adequacy of codes and standards, including:

- The adequacy of design requirements in ASME B31.4 and B31.8 with respect to ground movement hazards,
- The adequacy of linepipe standards such as API 5L and welding standards such as API 1104 for producing strain-resistant pipelines,
- The proper interpretation of the longitudinal strain design limit of 2% strain in ASME B31.4 and B31.8, and
- The effectiveness of hydrostatic testing in “weeding out” low strain tolerance girth welds.

## **Keywords**

Geohazards, landslides, settlement, integrity management, fitness-for-service assessment, strain-based assessment, strain demand, strain capacity