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Oil and gas industries including lower carbon energy — Pipeline transportation systems — Pipeline geohazard monitoring processes, systems and technologies

Industries du pétrole et du gaz, y compris les énergies à faible teneur en carbone — Systèmes de transport par conduites — Processus, systèmes et technologies de surveillance des risques géologiques pour la conduite

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Foreword

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This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 2, *Pipeline transportation systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In recognizing that pipelines transverse highly variable environments, this document provides an overview of available technologies and techniques to monitor and manage geohazards rather than providing prescriptive procedures. This document also recognizes that competent and appropriately qualified geohazard and pipeline stress experts are an integral part of the process because they are best suited to assess system-wide or site-specific needs for a geohazard monitoring program (GHMP).

Geohazards can adversely affect the operation or integrity of new and existing pipelines and their right-of-way (RoW), as well as the design and construction of proposed pipelines. Monitoring systems are commonly used for assessing and managing geohazard risk and the impact of geohazards on the integrity of pipelines. In comparison with geohazard engineering mitigation measures, monitoring systems have significant cost-benefit advantages in reducing economic, social, and environmental risks.

With the development of GHMP, this document brings about the following potential benefits:

— technical benefits: it helps operators, regulators, consultants, and third parties determine appropriate practices for monitoring geohazards and provides examples of current and emerging monitoring systems and techniques;

— risk reduction: it helps operators better assess the impact of the geohazard on the integrity of their pipeline asset, which then allows for an assessment of the resulting consequences;

— economic benefits: it helps operators define and develop physical intervention measures to prevent a pipeline integrity incident by making forecasts of impacts and evaluating consequences in cases where a pipeline system faces geohazards; it can help interested parties, especially operators of small- and medium-scale pipelines, to properly use their available economic and operational resources among the inventory of their geohazards;

— social and environmental benefits: it provides the pipeline operators with sufficient time for physical interventions by monitoring with early warning notifications; it can reduce the likelihood of integrity issues or loss-of-containment incidents, avoiding or reducing negative social and environmental impacts by early intervention.

Geohazard monitoring is part of a comprehensive geohazard management and pipeline integrity plan that should be developed as part of operating any buried pipeline. ISO 20074 and ISO 19345-1 provide information on preparing geohazard management plans and pipeline integrity requirements. Monitoring should not be performed in isolation of these plans and requirements.

Geohazard monitoring is typically used to initially identify and characterize geohazards. It is a means to confirm the presence of a geohazard and provide characterization of the feature so that engineering assessment of the geohazard impact to the pipeline can be performed, and engineering mitigations can be developed and implemented in a timely manner.

Geohazards include any natural feature, event, or process that can negatively impact the integrity of the RoW or pipeline. These can include but are not limited to earthquakes, landslides, debris flows, rockfalls, frost heave and thaw settlement, ground subsidence from karst collapse or underground mining, rock indentation, and hydrotechnical hazards, such as lateral or vertical erosion, scour, channel migration or avulsion, and others. Although the information in this document can be used for monitoring most geohazards, the focus herein is on ground movements (e.g. landslides or subsidence) impacting pipelines or their RoW.

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1 Scope

This document provides requirements and guidance on planning, selecting, and implementing methods and strategies for monitoring geohazards that can interact with pipelines.

This document specifies requirements and recommendations for users regarding the development and initiation of monitoring processes throughout the pipeline life cycle, including the following stages:

a) preliminary engineering and route selection phase;

b) detailed design phase;

c) construction phase;

d) operation and maintenance phase.

This document also describes the processes and steps for developing a suitable geohazard monitoring program (GHMP).

This document applies to geohazard monitoring of new and existing onshore gathering and transportation pipelines and the right-of-way (RoW).

This document does not apply to monitoring geohazards that are temporary, such as the stability of spoil piles, temporary cut slopes to facilitate pipeline construction, stability of excavation or trench wall, and access roads.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19345-1, *Petroleum and natural gas industry — Pipeline transportation systems — Pipeline integrity management specification — Part 1: Full-life cycle integrity management for onshore pipeline*

ISO 20074, *Petroleum and natural gas industry — Pipeline transportation systems — Geological hazard risk management for onshore pipeline*

IEC 60529, *Degrees of protection provided by enclosures (IP Codes)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp