



FINAL DRAFT International Standard

ISO/FDIS 10903

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*

ISO/FDIS 10903

<https://standards.iteh.ai/catalog/standards/iso/c20b0d8b-de05-4ca6-9718-ca8b2d2108b3/iso-fdis-10903>

ISO/TC 67/SC 2

Secretariat: **UNI**

Voting begins on:
2025-07-11

Voting terminates on:
2025-09-05

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT,
WITH THEIR COMMENTS, NOTIFICATION OF ANY
RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE
AND TO PROVIDE SUPPORTING DOCUMENTATION.

IN ADDITION TO THEIR EVALUATION AS
BEING ACCEPTABLE FOR INDUSTRIAL, TECHNO-
LOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT
INTERNATIONAL STANDARDS MAY ON OCCASION HAVE
TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL
TO BECOME STANDARDS TO WHICH REFERENCE MAY BE
MADE IN NATIONAL REGULATIONS.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/FDIS 10903

<https://standards.iteh.ai/catalog/standards/iso/c20b0d8b-de05-4ca6-9718-ca8b2d2108b3/iso-fdis-10903>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	5
4 Key objectives and principles	6
4.1 Objectives of geohazard monitoring	6
4.2 Monitoring process	6
4.2.1 General	6
4.2.2 Monitoring process during the preliminary engineering and route selection phase	7
4.2.3 Monitoring process during the detailed design phase	8
4.2.4 Monitoring process during the construction phase	9
4.2.5 Monitoring process during the operation and maintenance phase	10
4.3 GHMP development	11
4.4 GHMP considerations	12
5 Monitoring geohazards on pipeline projects	12
5.1 Monitoring project category	12
5.2 Pipeline monitoring	13
5.3 Geohazard monitoring	14
5.4 Earth pressure monitoring of pipeline	14
5.5 Geohazard triggering event monitoring	14
6 Geohazard monitoring program (GHMP)	15
6.1 General	15
6.2 Monitoring requirements	16
6.3 Significance grade of monitoring	18
6.4 Monitoring methods	18
6.4.1 Overview	18
6.4.2 General considerations	18
6.4.3 Regional monitoring methods	20
6.4.4 Site-specific monitoring methods	20
6.4.5 Potential strategies for regional monitoring	20
6.4.6 Potential strategies for site-specific monitoring	21
6.5 Monitoring frequency	21
6.6 Program implementation	22
6.7 Threshold and alarm levels	23
6.7.1 General	23
6.7.2 Threshold levels	24
6.7.3 Regional monitoring alert thresholds	25
6.8 Response to threshold exceedance	26
6.8.1 Overview	26
6.8.2 Establishing validity	26
6.8.3 Response to alert threshold exceedance	26
6.8.4 Response to action threshold exceedance	26
6.8.5 Response to safety threshold exceedance	27
6.9 Operation and maintenance	27
6.10 GHMP termination	28
7 Data acquisition and management systems	28
7.1 System composition	28
7.2 Data acquisition system	29

ISO/FDIS 10903:2025(en)

7.2.1	Overview	29
7.2.2	Manual data collection	29
7.2.3	Automated data collection	29
7.2.4	Automated data collection with telemetry	29
7.2.5	System requirements	30
7.3	Data processing and management system	30
7.3.1	Monitoring data management system	30
7.3.2	Integrated geohazard and monitoring data management system	30
7.3.3	Safety for data transmission	31
Annex A (informative) Monitoring methods and elements		33
Annex B (informative) Monitoring scheme design for three common geohazards		66
Bibliography		69

iTeh Standards (<https://standards.iteh.ai>) Document Preview

ISO/FDIS 10903

<https://standards.iteh.ai/catalog/standards/iso/c20b0d8b-de05-4ca6-9718-ca8b2d2108b3/iso-fdis-10903>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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.

ISO/FDIS 10903

<https://standards.iteh.ai/catalog/standards/iso/c20b0d8b-de05-4ca6-9718-ca8b2d2108b3/iso-fdis-10903>

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.

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

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.

ISO/FDIS 10903

<https://standards.iteh.ai/catalog/standards/iso/c20b0d8b-de05-4ca6-9718-ca8b2d2108b3/iso-fdis-10903>

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>