# ISO 19345-1:2019 (E)

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

# Contents

Foreword

Introduction

- 1 Scope
- 2 Normative references
- 3 Terms, definitions and abbreviated terms
  - 3.1 Terms and definitions
  - 3.2 Abbreviated terms

## 4 General

- 4.1 Key principles
- 4.2 Integrity management program
- 4.2.1 General
- 4.2.2 Introduction to integrity management program elements
- 4.3 Integrity management process elements
- 4.3.1 Data management
- 4.3.2 Risk assessment
- 4.3.3 Inspection and monitoring
- 4.3.4 Integrity assessment
- 4.3.5 Mitigation activity
- 4.3.6 Performance measurement and improvement
- 4.3.7 Emergency response plan
- 4.3.8 Failure management plan
- 4.3.9 Remaining life assessment
- 4.4 Management elements
- 4.4.1 Policy and commitment
- 4.4.2 Scope of integrity management program
- 4.4.3 Organization structure, roles and responsibilities
- 4.4.4 Records and documents management plan
- 4.4.5 Communication plan
- 4.4.6 Management of change plan
- 4.4.7 Management review and audit plan
- 4.4.8 Training and competency plan

## Integrity management for the pipeline lifecycle phases

5.1 General

5

- 5.1.1 Objectives
- 5.1.2 Principles
- 5.2 Key lifecycle integrity processes
- 5.3 Lifecycle phases for integrity management
- 5.3.1 General
- 5.3.2 Feasibility
- 5.3.2.1 Objectives
- 5.3.2.2 Principles
- 5.3.3 Design
- 5.3.3.1 Objectives
- 5.3.3.2 Principles
- 5.3.4 Procurement
- 5.3.4.1 Objectives

- 5.3.4.2 Principles
- 5.3.5 Fabrication
- 5.3.5.1 Objectives
- 5.3.5.2 Principles
- 5.3.6 Transportation and storage
- 5.3.6.1 Objectives 5.3.6.2 Principles
- 5.3.6.2 Principles 5.3.7 Integrity during cons
- 5.3.7Integrity during construction5.3.7.1Objectives
- 5.3.7.2 Principles
- 5.3.8 **Pre-commissioning and commissioning**
- 5.3.8.1 Objectives
- 5.3.8.2 Principles
- 5.3.9 Handover Preparation for operation
- 5.3.9.1 Objectives
- 5.3.9.2 Principles
- 5.3.10 Operation and maintenance
- 5.3.10.1 Objectives
- 5.3.10.2 Principles
- 5.3.11 Modifications during operation
- 5.3.11.1 Objectives
- 5.3.11.2 Principles
- 5.3.12 Abandonment
- 5.3.12.1 Objectives
- 5.3.12.2 Principles

#### 6 Risk assessment

- 6.1 Definition of objectives and requirements
- 6.1.1 General
- 6.1.2 Objective
- 6.1.3 Requirements
- 6.2 Team definition
- 6.3 Segmentation
- 6.4 Threat identification
- 6.5 Probability of failure assessment
- 6.6 Consequence of failure assessment
- 6.6.1 Consequence assessment
- 6.6.2 Critical consequence areas analysis
- 6.6.2.1 Critical consequence areas for liquid and gas pipelines
- 6.6.2.2 Definitions
- 6.6.2.2.1 Identified sites
- 6.6.2.2.2 Potential impact radius
- 6.6.2.2.3 Environmentally sensitive area
- 6.7 Risk determination
- 6.8 Reporting
- 6.9 Reassessment

### Inspection and monitoring

- 7.1 In-line inspection
- 7.1.1 General

7

- 7.1.2 Baseline inspection
- 7.1.3 Considerations for the use of ILI tools
- 7.1.3.1 Choice of ILI tools
- 7.1.3.2 Personnel
- 7.1.3.3 Pipeline preparation
- 7.1.3.4 ILI risk management
- 7.1.4 Acceptance of inspection data
- 7.1.5 Reporting requirements
- 7.1.5.1 General
- 7.1.5.2 Delivery requirements
- 7.1.5.2.1 Field report
- 7.1.5.2.2 Preliminary report
- 7.1.5.2.3 Final report
- 7.1.5.2.4 Supplement report for other type of anomalies

- 7.1.5.2.5 Software
- 7.1.6 Excavation verification
- 7.2 Aboveground inspection
- 7.3 Non-destructive testing (NDT)
- 7.4 River crossing inspections
- 7.4.1 Inspecting submerged river crossings
- 7.4.2 Inspecting structurally supported river crossings
- 7.5 Monitoring

#### 8 Integrity assessment

General

8.1

- 8.2 Fitness for purpose
- 8.2.1 Assessment data collection
- 8.2.2 Defect data statistics and causation analysis
- 8.2.3 Assessment method selection
- 8.2.4 Residual strength and remaining life assessment
- 8.2.4.1 General
- 8.2.4.2 Acceptance criteria
- 8.2.4.3 Acceptability criterion for corrosion
- 8.2.4.4 Acceptability criterion for manufacturing defects
- 8.2.4.5 Acceptability criterion for cracks
- 8.2.4.6 Acceptability criterion for dents
- 8.2.4.7 Acceptability criteria for weld defects
- 8.2.5 Reporting requirements
- 8.3 Pressure test
- 8.3.1 General
- 8.3.2 Preconditions for use of pressure testing on an in-service pipeline
- 8.3.3 Features to be considered for water pressure test
- 8.3.4 Pressure test risks
- 8.3.5 Management measures
- 8.3.6 Monitoring of pressure test procedures
- 8.3.7 Review of pressure test results
- 8.3.8 Pressure test report
- 8.4 Direct assessment
- 8.4.1 General
- 8.4.2 Direct assessment process
- 8.4.3 Direct assessment methods
- 8.4.4 Limitations of direct assessment
- 8.5 Other assessments

### Mitigation

9

- 9.1 General
- 9.2 Prevention of mechanical/third party damage
- 9.2.1 General
- 9.2.2 Physical measures during construction
- 9.2.3 Depth of cover
- 9.2.4 Pipe wall thickness
- 9.2.5 Concrete capping/barriers
- 9.2.6 Marker tape
- 9.2.7 Pipeline markers
- 9.2.8 Procedural measures during operation
- 9.2.9 Right-of-way maintenance
- 9.2.10 Public awareness
- 9.2.11 Pipeline surveillance
- 9.2.12 Communication between operator and with third parties
- 9.2.13 Locating and marking
- 9.2.14 Site communication and monitoring of excavation
- 9.3 Corrosion control systems
- 9.3.1 External corrosion
- 9.3.2 Internal corrosion and erosion
- 9.3.3 Stress corrosion cracking
- 9.4 Preventing or mitigating releases associated with weather and geophysical events
- 9.5 Management of unintended releases
- 9.6 MAOP reduction

- 9.7 Emergency response
- 9.8 Defect repair
- 9.8.1 General
- 9.8.2 Repair strategy
- 9.8.3 Repair method selection
- 9.8.4 Factors in repair planning and execution of repair activities
- 9.8.5 Considerations of in-service pipeline welding

#### 10 Performance measurement and improvement

- 10.1 General
- 10.2 Performance measurement
- 10.3 Management review
- 10.4 System audit

#### 11 Data management

- 11.1 Data acquisition
- 11.1.1 Data acquisition content
- 11.1.2 Data acquisition method
- 11.1.2.1 Centreline measurement
- 11.1.2.2 Data acquisition for pipeline facilities and landbase
- 11.1.3 Data alignment
- 11.2 Data transfer
- 11.3 Data integration
- 11.3.1 General
- 11.3.2 Data integration requirements
- 12 Pipeline integrity management within emergency response planning and failure management
  - 12.1 Emergency response planning
  - 12.1.1 General
  - 12.1.2 Emergency plan preparation
  - 12.1.3 Preparation for emergency data
  - 12.1.4 Emergency response
  - 12.1.5 Emergency response management system review
  - 12.2 Failure management
  - 12.2.1 General
  - 12.2.2 Failure analysis
  - 12.2.3 Incident investigation report
  - 12.2.4 Remedial and preventative measures
  - 12.2.5 Failure recovery prior to restart
  - 12.2.6 Trend analysis of pipeline incidents and causes
- 13 Pipeline remaining life assessment and abandonment processes
  - 13.1 General
  - 13.2 Pipeline remaining life assessment process
  - 13.2.1 General
  - 13.2.2 Data collection
  - 13.2.3 Pipeline segmentation
  - 13.2.4 Integrity assessment
  - 13.2.5 Physical life determination
  - 13.2.5.1 Key index method
  - 13.2.5.2 Factorization method (analogy method)
  - 13.2.6 Economic viability assessment
  - 13.2.6.1 Economic comparison
  - 13.2.6.2 Minimum annual average cost method
  - 13.2.6.3 Cost-benefit method
  - 13.2.7 Risk assessment
  - 13.2.8 Remaining life assessment
  - 13.3 Deactivation and abandonment process
  - 13.3.1 Guideline for the abandonment of a transportation pipeline
  - 13.3.2 Preparation before pipeline abandonment
  - 13.3.3 Pipeline cleaning
  - 13.3.4 Deactivation of piping
  - 13.3.5 Permanent disposal process of abandoned pipeline
  - 13.3.6 Records

- 13.4 Life extension and recycle of pipeline
- 13.4.1 Life extension
- 13.4.2 Recycling of a pipeline
- 13.4.2.1 Reactivation of pipeline
- 13.4.2.2 Recycle of abandoned pipelines
- 13.5 Uprating
- 13.5.1 General requirements
- 13.5.2 Limitation on increase in maximum allowable operating pressure
- 13.5.3 Uprating method
- 13.6 Reporting
- 14 Records and documents management
- 15 Communication
  - 15.1 General
  - 15.2 External communications
  - 15.3 Internal communications
- 16 Management of change
- 17 Training and skills
  - 17.1 General
  - 17.2 Levels of skill
- Annex A (informative) Example approach of semi-quantitative risk assessment
- Annex B (informative) Risk matrix
- Annex C (informative) Example of the threat identification in lifecycle phases
- Annex D (informative) Determining CCA-affected segments
- Annex E (informative) Establishing performance measures
  - E.1 Classification of performance measures
  - E.2 Performance measures by integrity assessment process steps
  - E.3 Inspection audit form
- Annex F (informative) Integrity data acquisition list
- Annex G (informative) Structure of pipeline data tables
- Annex H (informative) Statistics of pipeline failure information
- Annex I (informative) Outline requirements for pipeline integrity management training and skills
  - I.1 Training program
  - I.2 Training objectives
  - I.2.1 Training objectives of Level 1 skills
  - I.2.2 Training objectives of Level 2 skills
  - I.2.3 Training objective of Level 3 skills
  - I.3 Requirements for skills

Page count: 108