



The Essentials of Pipeline Integrity Management



TRAINING METHODOLOGY

This interactive training workshop includes the following training methodologies :

- ◆ Lectures
- ◆ Video
- ◆ Discussion of case histories and hands on calculations

While a generic approach will be followed specific reference to pertinent sections of AS2885 will be made throughout

TO REGISTER CALL NOW!

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WHO SHOULD ATTEND

The course is intended for engineers, maintenance technicians and inspectors responsible for the integrity, inspection, maintenance and repair of pipelines and piping systems. The fitness-for-service and integrity techniques are based on quantitative analysis, please bring a calculator.



The Essentials of Pipeline Integrity Management

Course Objectives

- Understand the need for, and essential elements of, an Integrity Management Plan and its place within an Overall Pipeline Management System
- Be able to relate the Integrity Management Program to the Maintenance Plan
- Identify relevant pipeline integrity threats to your Pipeline system
- Understand the importance of practical risk assessment including the concept of the safety Case
- Improve your knowledge of pipeline material properties, facets of mechanical design and fracture mechanics, as they combine to effect fitness for purpose (remaining life) assessments
- Benefit from learning through pipeline defect assessment worked examples
- Understand common types of defects leading to pipeline failure
- Assess failures due to corrosion, dents and gouges, welded joint defects
- Understand requirements for in line inspection tool selection and performance
- Appreciate the importance of defect detection and sizing
- Develop a consistent strategy for determining corrosion and fatigue crack growth rates
- Formulate an approach for Continuous improvement and record keeping



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DAY 1

Introduction

- Types and functions of Oil and Gas pipelines – Gathering and Transmission Systems
- The Importance of Protecting Your Pipeline Asset
- Pipeline Management Systems and the Integrity Management Plan
- Brief Overview of Codes and Standards Used In Developing Integrity Management Plans
- AS 2885.3 Sections 5,6 , 7 and 12
- AS 2885.3 The Safety Case
- ASME B31.8S "Managing System Integrity of Gas Pipelines"
- API standard 1160 "Managing System Integrity for Hazardous Liquid pipelines"
- DOT 49 CFR 195 and 192 (United States)
- Onshore Pipeline Regulations and CSA Z662 Annex N (Canada)
- NACE recommended Practice 102

Elements of an Integrity Management Plan (IMP)

- Threat Identification –the PRCI 22 Threat categories
- Baseline Assessment Plan
- Direct Assessment Plan
- Conducting an Assessment
- Collecting Reviewing and Integrating data
- Data base: types, GIS software compatibility and risk analysis
- Data integration: common systems of reference
- Cartographic information: Availability in Australia (IGM Image Geometry Model, satellite images)
- Record Keeping Provisions and Communication Plans
- Performance Plan and Key Performance Indicators
- Management of Change Process

DAY 1 continued

Approaches to Risk Assessment Analysis

- Objectives of Risk Assessment
- Understanding Pipeline Failure Causes - PRCI's
- 21 common causes
- High Consequence Areas
- Risk to the Environment
- Data Elements for a Prescriptive Integrity Management Plan
- Failure modes, frequency rates, fault trees and root cause analysis
- Use of historical data on incidents and spills
- Risk Based Inspection (RBI)
- Resource allocation
- Quantitative and qualitative methods of risk assessment
- Advantages / disadvantages and limitations of each approach
- Combined approaches based on the relative importance of different threats

Summary and Questions and Answers session



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DAY 2

Prevention and Mitigation Measures

- Community and Stakeholder awareness, Signage
- Pipeline patrols, surveillance
- Pipeline Puncture resistance
- External (multi party) damage
- Coating damage and repairs
- Cathodic Protection
- Close interval surveys

Background to Pipeline Failure

- Why Pipelines fail – a brief review of some notable failures and their causes
- The failure triangle: Stress, Material Properties, Defects.
- Basics of Pipeline Design, Materials, Fracture (Factors important for engineering critical assessment)
- Pipeline manufacture and Material Properties Strength, Ductility, Toughness and their Measurement
- Fracture and Arrest of Dynamic Cracks
- Fracture propagation and crack arrest
- Setting toughness requirements

Pipeline Structural Integrity

- Mechanical Design
- Pipeline Stresses
- Design factors
- Combined stresses
- Principal stresses
- Theories of Failure

Introduction to Fracture Mechanics

- Linear elastic, Plastic fracture mechanics
- Stress intensity factors
- Brittle and Ductile modes of failure
- Toughness dependence or plastic collapse

Qualitative (workmanship) and quantitative assessment processes (Engineering critical assessment)

- Fitness for purpose methods and their limitations
- Failure Assessment Diagrams

Summary and Questions and Answers session

DAY 3

Pigging Operations

- Overview of Pigging
- Types of Pigs – cleaning, batching etc
- Pig traps and Launchers
- Preparing for an In Line Inspection

Inspection Methods: Characteristics and Limitations

- API Standard 1163 In Line Inspection Systems
- Key terms and definitions
- Systems Qualification Process
- Preparing the Pipeline for ILI
- Planning and scheduling an In Line Inspection
- In Line Inspection System Selection
 - Types of tools and their mode of operation
- Deformation Caliper, Inertial
- Metal Loss: Magnetic Flux Leakage, Ultrasonic
- Crack Detection : Ultrasonic, Elastic Wave, Electro
- Magnetic Acoustic Technology(EMAT)
- When and where to use MFL, Ultrasonic In Line Inspection tools

Detection and sizing performance

- Tool accuracy and selection
- Probability of Detection
- Probability of Identification
- Qualification of Performance Specifications – Unity plots , Verification digs
- Probability of Exceedance
- Reporting requirements

In the Ditch Measurement

- Surface profiling methods
- Measurement of dents, surface cracks and metal loss
- Review of available assessment **methods for non piggable lines**
- Hydrostatic Pressure testing, establishing re test intervals
- Direct assessment
 - ECDA (External Corrosion Direct Assessment)
 - ICDA (Internal Corrosion Direct Assessment)
- Practical worked examples of Corrosion and crack growth rates
- **Determining Growth rates**
- Determination of Re - Inspection Intervals
- Use of tool data and operational history to predict corrosion and fatigue crack growth rates

Summary and Questions and Answers session



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DAY 4

Failure Modes

Flow Stress Dependent

- Corrosion
- Blunt-notch defects

Toughness Dependent

- Crack
- Preferential Corrosion
- Selective Seam Corrosion

Failure Assessment for Corrosion and Crack like Defects

- Rupture Pressure ratio /estimated repair factor (ERF)
- Development of B31G and RSTRENG
- Comparison between B31G and RSTRENG
- Interacting Defects and Interaction Rules
- Worked Examples of Corrosion Defects Application of Results
- NG18 equation and Log Secant method
- Limitations and Modifications of Log Secant approach

Failure Assessment for Welded Joints

- Defect Acceptance using fracture mechanics methods for surface breaking and embedded defects

Fracture and Arrest of Dynamic Cracks

- Fracture control plan
- Crack arresters, Sleeves, Use of composites

Failure Assessment for Dents and Gouges

- Assessing axial and circumferential gouges
- Smooth dents, spring back and re-rounding, dents with gouges, (fatigue strength assessment)
 - Fatigue life Assessment

Summary and Questions and Answers session

DAY 5

Pipeline Repairs

- AS2885.3 Section 9 Acceptable Methodologies
- Repair Strategies I
- Temporary Measures
- Review of Permanent repair methods (Grinding, direct deposition, sleeves, cut outs etc)
- *Emergency Response Planning, Incident Management and Investigation*

ERP and Incident Management

- Preparedness Effective policies
- Setting up of Incident and field Response command posts
- Incident ranking and proportionate response
- Procedures for meeting regulatory needs including Permitting Considerations
- Activation and Notification of Third parties /emergency first responders
- Site Safety
- Equipment deployment readiness
- Tools & equipment
- Legal and Procurement Support
- Table top and Full Scale Drills.
- Monitoring Clean up, waste disposal

Investigation

- Specifics of failure Investigation
- Securing the site / Preservation of evidence
- Collection of witness statements
- Field evidence gathering
- Custody transfer and Forensic examination
- Root cause analysis and reporting

Course Summary and Questions and Answers session