CONCEPT

Pipeline Geohazard Assessment and Ground Movement Management: Strain-Based Monitoring and Mitigation

29 August – 2 September 2027
Dammam - Eastern Province five-star



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Introduction:

Pipeline geohazard assessment is often the weakest link in onshore integrity programmes: landslides, subsidence, fault offsets, liquefaction, river scour and migrating sand dunes load buried pipe slowly and unseen until a girth weld buckles or tears. This Core Concept course equips integrity, geotechnical and route engineers to locate ground movement hazards along a right-of-way, rank them by susceptibility and consequence, estimate pipe strain demand, choose monitoring and mitigation, and feed results into the integrity programme. Participants build a Geohazard Assessment and Monitoring Plan for a case pipeline route.

Course Objectives:

- Compile a geohazard register for a pipeline corridor from terrain, geological, hydrological and seismic desk study data and field reconnaissance
- Rank slope, subsidence, fault, liquefaction, scour and dune sites with a susceptibility and consequence matrix that sets response priority
- Estimate longitudinal and bending strain demand from ground displacement using soil spring models and compare it with girth weld strain capacity
- Specify a monitoring scheme combining satellite InSAR, inclinometers, piezometers, vibrating wire strain gauges and repeat ILI inertial mapping
- Select mitigation such as rerouting, stress relief excavation, slope drainage, deeper burial or trenchless crossings using strain and cost evidence
- Integrate geohazard findings, trigger levels and reassessment intervals into the pipeline integrity management programme

Target Audience:

- Integrity engineers responsible for threat assessment of onshore transmission and gathering pipelines
- Geotechnical and engineering geology specialists responsible for slope, settlement and seismic studies along corridors
- Route selection and pipeline design engineers responsible for alignment and crossing decisions
- Right-of-way and field surveillance engineers responsible for patrols, erosion control and site reconnaissance
- Monitoring and survey specialists responsible for instrumentation, satellite deformation data and ILI mapping interpretation

Course Outline:

Day 1: Geohazard Types and Pipeline Exposure

- Onshore Geohazard Taxonomy: Sudden Versus Gradual Ground Movement
- Landslide, Creep and Debris Flow Mechanisms Acting on Buried Pipe
- Subsidence, Sinkholes and Collapsible Soil Settlement Profiles
- Active Fault Crossings, Seismic Shaking, Liquefaction and Lateral Spreading
- Flood Scour, Bank Erosion, Wind Erosion and Mobile Sand Dune Migration

Day 2: Desk Study, Field Reconnaissance and the Geohazard Register

- Desk Study Inputs: Digital Terrain Models, Geological Maps and Aerial Imagery
- Hydrological Catchment and Watercourse Crossing Screening
- Field Reconnaissance Checklist: Tension Cracks, Seepage, Tilted Markers and Exposed Pipe
- Geohazard Register Structure: Site Identifier, Chainage, Mechanism and Evidence Log
- Susceptibility Scoring and Consequence Matrix for Site Prioritisation

Day 3: Pipe-Soil Interaction and Strain-Based Assessment

- Soil Spring Models: Axial, Lateral and Vertical Load-Displacement Curves
- Transverse and Longitudinal Ground Movement Loading Scenarios
- Strain Demand Estimation from Displacement Magnitude and Slide Width
- Tensile and Compressive Strain Capacity of Girth Welds and Local Buckling Limits
- Strain-Based Acceptance Decision Tree for Affected Pipe Sections

Day 4: Monitoring Technologies, Trigger Levels and Mitigation

- Satellite InSAR Deformation Mapping: Line-of-Sight Limits and Persistent Scatterers
- ILI Inertial Mapping Unit Surveys: Curvature, Bending Strain and Run Comparison
- Slope Instrumentation: Inclinometers, Piezometers and Vibrating Wire Strain Gauges
- Alert, Action and Alarm Trigger Levels With Response Procedures
- Mitigation Toolbox: Rerouting, Stress Relief Excavation, Drainage, Deeper Burial and Trenchless Crossings

Day 5: Case Study: Geohazard Assessment and Monitoring Plan

- Case Corridor Data Pack Review: Terrain, Geology, Seismicity and ILI Mapping Results
- Case Register Build and Susceptibility-Consequence Ranking of Hazard Sites
- Case Strain Screening and Mitigation Option Selection for Priority Sites
- Monitoring Schedule, Trigger Levels and Integrity Programme Interfaces for the Case Route
- Geohazard Assessment and Monitoring Plan Presentation and Peer Challenge

Skills You Will Gain:

- Geohazard Register Development
- Terrain and Slope Hazard Interpretation
- Pipe-Soil Interaction Modelling
- Bending Strain Evaluation
- InSAR Deformation Data Review
- Geotechnical Instrumentation Planning
- Ground Movement Mitigation Selection
- Trigger Level Setting

Why Attend This Course:

- Return with a Geohazard Assessment and Monitoring Plan for a case pipeline route that can be adapted to your own corridor
- Spot early signs of slope creep, settlement and scour on the right-of-way before pipe strain reaches weld limits
- Defend mitigation spending to asset owners with strain estimates and ranked hazard sites rather than general concern
- Compare ground movement cases from mountain, desert, river and seismic corridors with engineers from other operators

Conclusion:

Buried pipelines fail at geohazard sites when ground movement is noticed too late or judged without strain evidence. The week moves from hazard mechanisms and exposure, through desk study, field reconnaissance and the geohazard register, to pipe-soil interaction and strain-based assessment, then satellite InSAR, inertial mapping, slope instrumentation, trigger levels and mitigation choices. The final day applies every step to a case corridor, and each participant completes a Geohazard Assessment and Monitoring Plan linked to the integrity management programme.