CONCEPT

Pipeline Leak Detection Systems: Computational Monitoring, Fibre Sensing and Risk Mitigation

13 – 17 December 2026
Riyadh - KAFD district five-star



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Introduction:

Pipeline leak detection often fails quietly: a small release sits below the instrument uncertainty of the line balance, a controller reads a genuine alarm as a meter fault, or a fibre-optic channel is installed but never tuned. Product loss, ground contamination and fire risk grow with every minute of delay. This Core Concept course builds the practical skills to select, specify, tune and test leak detection systems for liquid and gas pipelines, from computational pipeline monitoring to distributed fibre sensing. Participants produce a Leak Detection System Selection and Specification Report for a case pipeline.

Course Objectives:

- Classify leak causes, release scenarios and consequences for a pipeline segment and set leak detection performance targets for it
- Compare internal computational methods and external sensing methods against sensitivity, reliability, accuracy and robustness criteria
- Specify the SCADA data, meter, pressure and temperature instrumentation a computational leak detection method needs to reach its target
- Tune detection thresholds and run fluid withdrawal and simulated leak tests that prove system performance
- Define controller alarm response, shutdown authority and leak risk mitigation actions linked to the emergency response plan
- Produce a Leak Detection System Selection and Specification Report for a case pipeline

Target Audience:

- Pipeline operations engineers responsible for day-to-day running of liquid and gas transmission lines
- Control room and SCADA engineers responsible for leak alarm handling and data quality from field instruments
- Integrity engineers responsible for leak threat assessment and the performance of leak detection systems
- HSE engineers responsible for release consequence analysis and pipeline emergency preparedness
- Instrumentation and telemetry engineers responsible for flow meters, pressure transmitters and communication links along the line
- Project engineers responsible for specifying leak detection on new or upgraded pipelines

Course Outline:

Day 1: Leak Causes, Consequences and Detection Strategy

- Leak Cause Taxonomy: Corrosion, Third-Party Damage, Material Defects and Operational Upsets
- Rupture, Leak and Pinhole Release Scenarios and Their Detection Windows
- Release Consequence Review: Product Loss, Ground Contamination, Fire and Public Exposure
- Leak Detection Performance Metrics: Sensitivity, Reliability, Accuracy and Robustness
- Current-State Leak Detection Capability Checklist for an Operating Pipeline

Day 2: Computational Pipeline Monitoring Methods and Program Frameworks

- API RP 1130 Computational Pipeline Monitoring Concepts at Overview
- Line Balance and Volume Balance Methods With Line Pack Correction
- Rate of Pressure Change and Pressure Point Analysis in Steady-State Flow
- Real-Time Transient Model Principles: Mass, Momentum and Energy Conservation
- API RP 1175 Leak Detection Program Management Elements at Overview

Day 3: External Sensing, Surveys and SCADA Data Requirements

- Negative Pressure Wave Detection and Leak Location by Wave Arrival Time
- Fibre-Optic Distributed Acoustic Sensing and Distributed Temperature Sensing Layouts
- Acoustic Sensors, Vapour-Sensing Tubes and Hydrocarbon Sensing Cables Compared
- Aerial, Drone and Satellite Leak Surveys at Overview
- SCADA Polling Rate, Meter Uncertainty and Instrument Placement Worksheet

Day 4: Alarm Response, Testing, Tuning and Leak Risk Mitigation

- Leak Alarm Triage Procedure and Controller Shutdown Authority
- False Alarm Root Causes: Transients, Slack Line, Meter Drift and Communication Loss
- Threshold Tuning and Fluid Withdrawal Test Planning for Detection Validation
- Leak Risk Mitigation Matrix: Isolation Valve Timing, Pressure Reduction and Patrol Frequency
- Leak Response Interface With the Pipeline Emergency Response Plan

Day 5: Case Work: Leak Detection System Selection and Specification

- Case Pipeline Data Pack: Profile, Product, Flow Regime and Consequence Zones
- Leak Detection Method Scoring Matrix for the Case Pipeline
- Performance Target and Test Acceptance Criteria Drafting
- Instrumentation, Fibre Route and SCADA Integration Specification
- Leak Detection System Selection and Specification Report Presentation and Peer Review

Skills You Will Gain:

- Leak Scenario Analysis
- Leak Detection Method Selection
- Line Balance Uncertainty Analysis
- Fibre-Optic Sensing Layout
- Leak Alarm Triage
- Leak Detection Threshold Tuning
- Leak Test Planning
- Leak Risk Mitigation Planning

Why Attend This Course:

- Leave with a Leak Detection System Selection and Specification Report for a case pipeline, ready to adapt to your own line
- Understand why a computational method misses small leaks on your line and which instrument or tuning change closes the gap
- Cut nuisance leak alarms without losing detection of real releases, so controllers trust the system and act on it
- Compare fibre-optic, acoustic, vapour-sensing and survey options with engineers from crude, products, gas and water pipelines

Conclusion:

A leak detection system protects a pipeline only when its method suits the line, its instruments supply trustworthy data, its thresholds are tuned and tested, and controllers know exactly what to do when it alarms. The course moves from leak causes and performance metrics, through computational and external sensing methods and SCADA data requirements, to alarm response, testing, tuning and leak risk mitigation. The final day applies this to a case pipeline, producing a Leak Detection System Selection and Specification Report ready for technical review.