

# Inspection, Evaluation and Repair of Process Plant Equipment and Connected Piping

UK Traininig

# PARTNER



# Inspection, Evaluation and Repair of Process Plant Equipment and Connected Piping

## Introduction:

Refineries, petrochemical plants, and processing facilities operate with numerous pieces of equipment and thousands of meters of piping that handle hazardous and corrosive fluids, operating across a wide range of temperatures and pressures. Achieving plant safety and reliability is only possible if this equipment and its associated piping are properly designed and remain serviceable between scheduled shutdowns.

Process equipment and piping systems are designed and manufactured according to industry codes and standards. Manufacturing and welding processes are subject to specific inspections to ensure that any deficiencies are addressed to meet the acceptance criteria of the relevant codes.

Regular and reliable inspection processes are integral to any effective industrial maintenance program. The success of such a program heavily relies on the non-destructive testing NDT techniques employed. NDT techniques detect defects that could lead to potential future failures, providing information about the pipeline's safety as well as its current safety margin. Therefore, understanding the scope and limitations of commonly and advanced NDT tools is crucial to enhancing the effectiveness of scheduled inspection activities. Moreover, in today's competitive environment, plant operators need to reduce maintenance costs by minimizing downtime, and effective inspection significantly contributes to this goal.

## Course Objectives

- Understand the damage and degradation mechanisms that affect process equipment and piping and progressively adversely affect their condition and fitness for continued service.
- Understand that effective inspection is the backbone of plant integrity and that it has a significant impact on EHS and the financial performance of the company
- Increase the awareness of industry codes and best practices related to inspection, repair, and alteration of process equipment and piping including ASME BPVC and various API codes, standards, and recommended practices.
- Provide a sound and concise coverage of fitness-for-service assessment methodologies and API/ASME FFS standards to enable making run/repair/replace decisions about the damaged equipment/piping
- Cover the main industry codes and practices for repairs and alterations to achieve business focused repairs and lower maintenance costs
- Provide methodologies for performing fitness-for-service assessments of damaged equipment/piping to make run/repair/replace decisions

## Course Outlines

### Day 1: Inspection Fundamentals for Plant Safety

- Importance of inspection throughout the lifecycle.
- Basics of inspection: reasons, locations, methods, and timing.
- The true role of inspection and quality requirements.
- Regulatory requirements and their impact on plant safety.
- Manufacturing and repair deficiencies.
- Quality assurance and quality control requirements in manufacturing and welding.



- ASME BPVC and ultrasonic testing vs. radiography.
- Mechanisms of degradation and their impact on pressure equipment and pipelines.
- Overview of API 571 and vulnerabilities in refineries.
- Corrosion under insulation and structural integrity.
- In-service inspection and non-destructive testing NDT methods.
- Inspector qualifications and certification.

## Day 2: Inspection Strategies and Techniques

- Inspection strategies and systems.
- External and internal inspections: constraints, costs, and benefits.
- Inspection plans and procedures, and legal requirements.
- Risk-Based Inspection RBI: basics and overview of API RP 580 and API RP 581.
- Non-destructive testing NDT methods: highlights and applications.
- Advanced inspection techniques and best practices.
- Long-range ultrasonic testing LRUT and advanced phased array for weld inspection.
- Online monitoring: common sensors and their uses.

## Day 3: Inspection Codes and Best Practices

- Pressure vessel inspection: API 572 and API 510.
- Fired boilers and heaters: API 573 and ABSA AB 507.
- Furnace tube inspection and storage tank inspection.
- ANSI/API RP 575 and STI SP001 for storage tanks.
- Pipeline and component inspection: API 574 and API 570.
- Pressure relief devices: API RP 576.
- Pressure testing: code requirements and best practices.

## Day 4: Data Evaluation and Analysis

- Verification and assessment of inspection data.
- Data completeness and quality.
- Data management and risk assessment: Inspection Data Management Systems IDMS.
- Reliable damage assessment and corrosion rate calculations.
- Remaining life calculations and fitness-for-service FFS assessments.
- Overview of API Std 579-1 / ASME FFS-1.
- Inspection, maintenance, and repair IMR planning and mitigation activities.

## Day 5: Repair and Modification of Equipment

- Repair codes and standards: API 510, 570, 653.
- Positive Material Identification PMI and temporary vs. permanent repairs.
- Welding repairs and mechanical repairs: ASME BPVC IX.
- Specialized repair methods: hot tapping and line stopping.
- API 2201 for safe hot tapping practices.
- Re-evaluation of repair needs.
- Minimum thickness determination and maximum allowable working pressure MAWP.
- Authorization and documentation.





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