Maintenance Of Process Plant Equipment

Introduction:

Pressure vessels, heat exchangers, aboveground atmospheric storage tanks, and piping systems typically represent over half the capital investment in a process plant. These fixed equipments and piping systems are subject to a number of damage mechanisms throughout their service life that could result in serious or even catastrophic failures. Effective inspection strategies and programs are required to monitor the condition of these fixed equipment and piping systems, to assess their fitness for continued service, make repair/replace decisions, and develop appropriate cost-effective repair methods

This course is structured to provide the delegates with the appropriate mix of technical fundamentals and practical best practices to maximize their learning. The material presented demonstrates some concepts that are not always shown or described in textbooks. The course emphasis is on developing a practical understanding of the inspection and maintenance requirements for fixed equipment and piping systems in process plant applications. Sample problems and participant exercises are included throughout the course to illustrate the concepts discussed and provide the delegates with practice in applying them.

Who Should Attend?

Engineers, Supervisors, Plant Operators, Managers, and other technical personnel who are responsible for the inspection, fitness-for-service assessments and maintenance of pressure vessels, heat exchangers, aboveground atmospheric storage tanks, and piping systems

Course Objectives:

By the end of this course delegates will be able to:

- Apply the requirements of the relevant industry standards and practices to the inspection and maintenance of pressure vessels, heat exchangers, piping systems, and aboveground atmospheric storage tanks.
- Develop inspection and maintenance programs for process plant equipment and piping systems.
- Prepare appropriate details for repairs and alterations to process plant equipment and piping systems.

Course Outline:

Integrity and Reliability of Process Plant Equipment

- Mechanical integrity – Interdependence of design, operation and maintenance
- Regulations, codes, standards, and recommended practices
- Key aspects of process equipment design
- Deterioration Mechanisms – Overview of API RP 571
- Examples of industrial failures
- Inspection strategies
- Fitness-for-Service Assessments

Pressure Vessel Integrity Program

- Overall Risk Assessment
- Inspection Plan

Fitness-for-Service Assessments

- Overview of API RP 579 requirements
- Data Requirements
- Assessment Methods and Acceptance Criteria

Pressure Vessel Inspection

- Overview of API 510 Requirements
- Scope
- Definitions

Pressure Vessel Inspection Practices

- Causes of Vessel Deterioration
- Inspection Intervals
- Corrosion Rate Determination

Evaluating Corroded Pressure Vessels for Continued Operation

- Determining Minimum Actual Thickness
- Acceptability of Corroded Area

Brittle Fracture Assessment

- Fracture Toughness Determination
- Brittle Fracture Evaluation of Existing Equipment

Details for Welded Repairs and Alterations

- Classification of Repairs and Alterations
- Welding and Design Requirements
- Defect Repairs

Rerating Pressure Vessels

Changes to Original Design Conditions

Hydrostatic Test Requirements

Glossary

Heat Exchanger Maintenance

Evaluating the Suitability of Corroded Components

Typical Maintenance and Inspection Procedures

- Damage mechanisms
- Tubes vibration
- Locating leaks
- Leak repairs
- Re-tubing considerations
- Typical cleaning methods
- Tube inspection techniques

Rerating Exchangers

Piping Inspection and Evaluation

- API 570 Requirements
- Piping Inspection Planning and Data Analysis
- Inspection Techniques for Piping and Components
- Piping Retirement

Piping Materials and Modes of Failure

- Materials Considerations
- Corrosion Rate and Remaining Life Calculation
- Cracking Mechanisms in Piping
- Piping Deterioration

Piping System Repair, Alteration, Rerating, and Pressure Testing

- Valve Repair and Maintenance

- API 570 Piping Repair, Alterations, Rerating, and Testing Requirement
- Piping System Repair
- Piping System Alterations and Rerating
- Pressure Testing After Repairs or Alteration

Flange Joint Assembly and Bolt up Procedure

- Introduction
- Establish Flange Joint Categories
- Identify and List Flange Joints in Critical Services
- Determine Required Bolt Type and Material
- Select Bolt Tightening Method
- Develop Flange Joint Assembly and Bolt Up Procedures
- Procedure Qualification
- Crew Qualification
- Hot Bolting
- Additional Leakage Control Procedures

Guidelines for Hot Tapping (Pressure Tapping)

- Necessary Conditions for Performing a Hot Tap
- Hot Tap Design Considerations
- Selecting the Hot Tap Site
- Installation
- Inspection
- Pressure Tests before Cutting Pipe
- Hot Tap Operations
- Special Safety Considerations
- Hot Tap Machines

Appendices

- Design Procedure for Designing Welded Full Encirclement Repairs with End Plates

- Design Procedure for a Welded Full Encirclement Sleeve
- Design Procedure for a Fillet-Welded Lap Patch
- Design Procedure for Welded Partial Leak Containment Box

Glossary

Aboveground Storage Tank Maintenance

Introduction

- Scope of API 653
- Definitions
- Starting an API 653 Compliance Program

Tank Inspection

- Objectives
- Prioritization
- Inspection Frequencies
- Record Keeping
- Inspector Qualifications

Tank Component Evaluation

- Shell
- Bottom
- Roof
- Foundation
- Shell and Bottom Settlement

Tank Repair and Alteration

- General Considerations
- Material Considerations
- Removal, Repair, and Replacement of Shell Plate Material

- Repair, Addition, Replacement and Alteration of Shell Penetrations
- Repair of Tank Bottoms
- Tank Roof Repair

Dismantling and Reconstruction

- Dismantling Methods
- Reconstruction
- Dimensional Tolerances

Examination and Testing

- General
- Welding Inspection
- Hydrostatic Testing