

# € TRAINING

Process Equipment and Piping Systems





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## Introduction:

This training program offers comprehensive instruction covering the application, design, operation, failure prevention, and repair of process equipment and piping systems. By the end of the program, attendees will be equipped with the knowledge and skills necessary to effectively manage process equipment and piping systems throughout their operational lifespan.

## Program Objectives:

At the end of this program, participants will be able to:

- Apply principles of process equipment and piping system design in industrial settings.
- Implement effective operation and maintenance strategies to prevent failures.
- Identify potential failure modes and develop strategies for failure prevention.
- Perform diagnostic assessments to detect early signs of equipment and piping failures.
- Execute appropriate repair and remediation techniques to address identified failures.
- Develop comprehensive maintenance plans to ensure long-term reliability and performance.

## Targeted Audience:

- Process, Mechanical and Chemical Engineers.
- Operation and Maintenance Engineers.
- Project Engineers.
- Supervisors and Managers.
- Technical Personnel involved in the inspection.

## Program Outlines:

### Unit 1:

#### Failure Mechanics:

- Wear & Failure Mechanisms, Imperfections and Defects.

- Corrosion Mechanisms, Failure Modes, Fatigue, Fretting.
- Creep & Thermal fatigue, Stress Corrosion Cracking, Other modes.
- Carbon & Alloy steels, Nickel, Titanium, and Specialty alloys.
- Aluminum, aluminum alloys, Copper, copper alloys, Plastic piping.
- Alternative options-linings, cladding, Limitations and safeguards.
- Material selection - economics-life cycle costing, Material properties, and selection.

## Unit 2:

### Failure Prevention By Design:

- Failure Causes - Design, Operation; Maintenance, Other Causes.
- Material properties, and selection.
- Physical properties and limitations of components.
- Physical properties of steel and alloy piping and tubing.
- Physical properties of fittings, Basic Design, Pressure Vessels.
- Piping Systems, Liquid Storage Tanks.
- Operation and Maintenance of Process Equipment.
- Damage Mechanisms Affecting Process Equipment.

## Unit 3:

### Process Equipment Failures:

- Failures in Pressure Vessels, Piping, and Boilers.
- Strength reduction through material loss.
- Case histories, Piping System Vibration.
- Mechanical & Flow-Induced Resonance.
- Transient Hydraulic pulsation.
- Pipe supports and restraints, Wind Loading.
- Industry Practices for Failure Prevention.

## Unit 4:

### Inspection, Assessment, and Maintenance:

- Inspection Strategies Plans and Procedures - Risk-Based Inspection API 580.
- Developing an RBI Plan.
- Fitness-For-Service Assessment API 579.
- NDT Methods and Techniques.
- Probability of Detection, Damage Characterization.
- Selecting the correct techniques, Smart pigging, Cleaning.
- Operational procedures, Pigging of Pipelines.

## Unit 5:

### Operation and Maintenance:

- Maintenance Programs.
- Repair and Alteration of Pressure Equipment and Piping.
- Rating Piping and Pressure Vessels.
- Estimation of the Consequences of Pressure Vessels and Piping Failures.
- Failure Analysis Techniques.