

€ TRAINING

Advanced Process Equipment and Piping
Systems





Advanced Process Equipment and Piping Systems

Introduction:

This training program provides the appropriate mix of fundamentals, methodologies, best industry practices, and practical tools to enhance the competencies and improve the performance of design, operation, and maintenance technical professionals individually and collectively to add value to the organization and improve the plant safety and reliability.

Program Objectives:

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

- Increase awareness and understanding that mechanical integrity of process equipment and piping systems depends jointly on the proper design, operation, condition assessment, and maintenance of the equipment, underscoring their vital individual and team roles in managing change.
- Explore practical and sound methods and tools to enable them to carry out basic design calculations for pressure equipment following applicable industrial codes, standards, and best practices.
- Understand the degradation mechanisms that process equipment could be subjected to over their operating life, how to identify them, predict and determine their impact, and what appropriate measures can be taken to prevent and control the resultant damage.
- Gain the knowledge and failure analysis skills they need to conduct damage and failure analysis to prevent similar failures from happening.
- Gain the knowledge and skills of hazard identification and analysis, and in risk assessment and management.

Targeted Audience:

- Engineers.
- Technical Professionals.
- Operations and Maintenance Personnel.
- Maintenance of Oil & Gas Plants.
- Oil Refineries & Petrochemical Plants, and Power Plants.

Program Outlines:

Unit 1:

Understanding Process Equipment Failures:

- Identification of common types of process equipment failures.
- Analysis of failure mechanisms and root causes.
- Examination of the consequences of equipment failures on production and safety.
- Understanding the importance of failure analysis for preventive measures.
- Case studies illustrating real-world examples of equipment failures.
- Introduction to failure investigation techniques.

Unit 2:

Failure Prevention Strategies:

- Implementation of preventive maintenance programs.
- Utilization of predictive maintenance techniques such as vibration analysis and thermal imaging.
- Development of equipment inspection schedules and protocols.
- Training on proper equipment operation and maintenance practices.
- Incorporation of design improvements for enhanced reliability.
- Integration of safety systems to mitigate the impact of failures.

Unit 3:

Materials Selection and Compatibility:

- Understanding the importance of materials selection in equipment design.
- Examination of material properties and their impact on equipment performance.
- Evaluation of material compatibility with process fluids and operating conditions.
- Identification of corrosion and erosion-resistant materials.
- Consideration of material degradation mechanisms and their prevention.
- Guidelines for selecting appropriate materials for different process applications.

Unit 4:

Corrosion and Erosion Management:

- Overview of corrosion and erosion mechanisms in process equipment.
- Assessment of corrosion and erosion risks in different operating environments.
- Implementation of corrosion monitoring and inspection programs.
- Introduction to corrosion-resistant coatings and linings.
- Application of erosion control measures such as flow optimization and material selection.
- Case studies on successful corrosion and erosion management strategies.

Unit 5:

Inspection and Testing Techniques:

- Introduction to non-destructive testing NDT methods for equipment inspection.
- Training on visual inspection procedures and techniques.
- Hands-on practice with ultrasonic testing UT and radiographic testing RT.
- Utilization of magnetic particle testing MPT and dye penetrant testing DPT.
- Interpretation of inspection results and identification of defects.
- Application of testing techniques for condition monitoring and quality assurance.

Unit 6:

Repair and Rehabilitation Methods:

- Overview of repair techniques for damaged process equipment and piping systems.
- Introduction to welding and fabrication methods for equipment repair.
- Application of hot tapping and line stopping techniques for in-service repairs.
- Utilization of composite repair systems for corroded or damaged components.
- Rehabilitation of corroded pipelines using lining and coating technologies.
- Case studies demonstrating successful equipment repair and rehabilitation projects.

Unit 7:

Emergency Response and Contingency Planning:

- Development of emergency response plans for equipment failures and leaks.
- Training on emergency shutdown procedures and evacuation protocols.
- Establishment of communication channels and emergency contacts.
- Coordination with emergency response teams and regulatory agencies.
- Conducting drills and simulations to test emergency preparedness.
- Review of lessons learned from past incidents and near-misses.

Unit 8:

Regulatory Compliance and Standards:

- Overview of regulatory requirements and industry standards for process equipment.
- Understanding of codes and regulations related to pressure vessels and piping systems.
- Compliance with environmental regulations and emissions standards.
- Incorporation of safety standards such as API, ASME, and OSHA guidelines.
- Maintenance of records and documentation for regulatory inspections.
- Collaboration with regulatory agencies for compliance audits and assessments.

Unit 9:

Reliability Engineering Principles:

- Introduction to reliability engineering concepts and methodologies.
- Utilization of reliability-centered maintenance RCM strategies for equipment reliability.
- Application of failure mode and effects analysis FMEA for risk assessment.
- Implementation of reliability modeling and prediction techniques.
- Integration of reliability engineering into equipment design and maintenance practices.
- Continuous improvement initiatives for enhancing equipment reliability and availability.

Unit 10:

Case Studies and Best Practices:

- Analysis of real-world case studies highlighting equipment failures and their consequences.



- Examination of best practices in failure prevention and equipment maintenance.
- Identification of lessons learned and key takeaways from successful projects.
- Discussion of industry trends and emerging technologies in equipment reliability.
- Peer-to-peer sharing of experiences and insights from practitioners.
- Development of action plans for implementing lessons learned in participants' organizations.