



*Conference:  
Piping Systems & Process Equipment*

*20 April - 1 May 2025  
Cairo (Egypt)  
Holiday Inn & Suites Cairo Maadi, an IHG Hotel*

## Conference: Piping Systems & Process Equipment

Conference code: CO8207 From: 20 April - 1 May 2025 Venue: Cairo (Egypt) - Holiday Inn & Suites Cairo Maadi, an IHG Hotel Conference Fees: 6000 € Euro

### Introduction

This course is designed to improve the mechanical integrity and reliability of process equipment and piping systems, essential for plant safety, availability, and profitability. It covers fundamentals, methodologies, and best practices for design, operation, and maintenance within the integrity operating window IOW. Participants will gain practical tools to enhance technical competencies, ensuring improved performance and value for their organizations

### Structure

Module 1 - Process Equipment & Piping Systems: Application, Design & Operation

Module 2 - Process Equipment & Piping Systems: Failures, Failure Prevention and Repairs

### Objectives

- To increase the participant's awareness and understanding that the 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.
- Provide participants with practical and sound methods and tools to enable them to carry out basic design calculations for pressure equipment by applicable industrial codes, standards, and best practices.
- To provide the participants with a clear understanding of 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.
- To provide the participants with the knowledge and failure analysis skills they need to conduct damage and failure analysis to prevent similar failures from happening.
- To enhance the knowledge and skills of the participants in hazard identification and analysis, and in risk assessment and management.

### Process

The course combines structured and focused presentations and discussions of topics covered with actual relevant worked examples to enforce the learnings. It combines sound engineering principles, methods, applicable industry codes & standards, and best industry practices with workshops that cover case studies of major failures and their root causes with particular emphasis on the learnings from these incidents to prevent similar failures.

To maximize learning, optional Question & Answer sessions are available at the end of each day to avail participants the opportunity to ask the instructor one-on-one questions relating to the topics discussed as well as to

other work-related problems they may experience.

All delegates will receive a detailed set of course presentations and lecture notes which will provide an invaluable reference document.

## Benefits

- Delegates will enhance their knowledge and expertise in pressure equipment and piping system design and will be equipped with structured procedures and effective guidelines to perform design calculations.
- Participants will gain a sound working knowledge of the interdependence of design, operation, and maintenance on integrity, reliability, and cost-effectiveness of piping systems.
- Participants will extend their knowledge of the requirements and application of relevant sections of the ASME Boiler and Pressure Vessel Code and B31 Piping Codes, as well as relevant API Codes, standards, and Recommended Practices such as API 510 and 570 in pressure equipment and piping system design, operation, inspection repairs, and alterations.
- The delegates will gain a sound and practical understanding of the major degradation mechanisms that affect process equipment and piping systems, how to predict them, how to assess their impact on process equipment over their operating life, and how to prevent and control these degradation and damage mechanisms using best industry practices including API 571 and API 580.
- Participants will add to their ability and skills in process equipment and piping failure detection and analysis, estimating failure consequences, and conducting level 1 fitness-for-service assessments by API/ASME 579.

## Results

- This course will help the company achieve measurable improvement in mechanical integrity, as demonstrated by a reduction in failure incidents, through improved competency in design as well as through effective interaction and collaboration between the engineering, operation, and maintenance functions. As a result, the company will be able to enhance its loss prevention and safety performance.
- The company will be able to enhance its ability to use risk-based inspection & maintenance, fitness-for-service assessments, and risk assessment methodologies to quantify and prioritize risks, and to allocate resources for optimum benefit. This will result in lower life cycle costs while complying with codes, standards, and other regulatory requirements.

## Core Competencies

- Working knowledge in mechanical design of pressure equipment and piping systems in compliance with applicable codes, standards, and regulations - ASME B&PVC Section VIII, B31.3
- The inter-dependence of design, operation, and maintenance for achieving mechanical integrity of pressure equipment and piping systems
- Understanding, prediction and Identification and assessment of active degradation mechanisms and the failures they may cause

- Failure investigation techniques and root cause analysis
- Application of risk-based methodologies in inspection and maintenance - API 580
- NDT methods and their effective application - ASMEB&PVC Section V
- Performing Level 1 fitness-for-service assessments - API 579
- Engineering materials properties and selection criteria for specific applications
- Hazard identification and risk analysis and management

## Outlines

### Module 1:

#### Process Equipment and Piping Systems: Application, Design & Operation

##### Day 1: Key Design Considerations, Guidelines, and Practices

- Process Equipment - An Overview
- Plant Integrity and Reliability
  - The interdependence of engineering, operation, and maintenance
  - Management of change
- Fitness for Purpose
- Service conditions, equipment sizing, and functional performance
- Business-Focused-Facilities - Appropriate quality at the lowest life cycle cost
- Worst foreseeable credible scenarios, safeguarding, best industry practices
- Codes, Standards, and Industry Practices
- Safety by Design
- Compliance with Regulations and Acts - HS&E requirements and considerations

##### Day 2: Design and Operation of Thermal Equipment

- Process Heaters
  - Types and configuration; box type, vertical cylindrical type
  - Thermal and mechanical design

- API 560, API 530
- Boilers
- Types and configuration; water tube, firetube, and waste heat recovery boilers
- Fundamentals of design and operation
- Operating efficiency and testing
- ASME B&PVC Section 1 and Section 4, ASME PTC-4
- Types and applications; Shell & Tube Heat Exchangers, Plate Heat Exchangers, Air Cooled Heat Exchangers
- Thermal and mechanical design
- Overview of TEMA standards, API 660, API 661
- The operation, fouling, and effectiveness
- Heat Exchangers

### Day 3: Design and Operation of Pressure Equipment

- Pressure Vessels and Reactors
  - Materials of construction and standards
  - Basic Design Methodology
  - ASME Boiler and Pressure Vessel Code Sections 2, 5, 8 and 9
  - Worked examples
- Storage Tanks
- Types and applications; cone roof tanks, floating roof tanks
- Basic design methodology
- Overview of API 650
- Materials of construction and standards
- Basic Design Methodology - hydraulic design, pressure integrity, mechanical integrity
- ASME B31.1 and B31.3
- Piping flexibility and support

- Piping system components - valves and fittings; classes, ratings
- Worked Examples
- Types and applications of pressure-relieving devices
- Code requirements
- Sizing methodology: API 520 and 521
- Specific operation and maintenance requirements: API 576
- Piping Systems
- Overpressure Protection

#### Day 4: Design and Operation of Fluid Handling Equipment

- Pumps
  - Types and application; Centrifugal, Positive Displacement
  - Performance characteristics
  - Selection and design considerations and standards; ANSI, API 610
  - Worked examples
- Compressors
- Types and applications; Centrifugal, Screw, Reciprocating
- Design considerations and standards
- Operation and troubleshooting
- Types and application
- Operation and troubleshooting
- Vibration monitoring
- Lubricating oil analysis
- Methodology and guidelines
- Reliability improvement
- Electric motors
- Condition Monitoring



- Troubleshooting

#### Day 5: Degradation and Condition Assessment of Process Equipment

- Degradation processes
  - Corrosion, erosion, fatigue, hydrogen attack
  - Overview of API 571
- Industrial Failures and Failure Prevention
- Inspection and Testing
- Inspection strategies, plans, and coverage - A real function of inspection
- Nondestructive Testing NDT methods and their characteristics and applicability
- Risk-Based Inspection RBI
- Overview of API 580 and API 581
- Overview of API 579
- Worked examples
- Optimum mix of reactive, preventive, and predictive methods
- Reliability Centered Maintenance RCM
- Fitness-For-Service Assessment
- Maintenance Strategies and Best Practices

#### Module 2:

#### Process Equipment & Piping Systems: Failures, Failure Prevention & Repairs

#### Day 6: 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

#### Day 7: 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



#### Day 8: 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

#### Day 9: 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

#### Day 10: Operation and Maintenance

- Maintenance Programs
- Repair and Alteration of Pressure Equipment and Piping

- Rerating Piping and Pressure Vessels
- Estimation of the Consequences of Pressure Vessels and Piping Failures
- Failure Analysis Techniques

## Registration form on the Conference: Piping Systems & Process Equipment

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Complete & Mail or fax to Global Horizon Training Center (GHTC) at the address given below

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