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5-day Interactive Training Course

API RP 571 & Advanced Damage Mechanisms and Material Investigation in the Refining Petrochemical & Petroleum Industries

Understand Materials and Processes in Oil & Gas

22 Jul - 26 Jul 2024	London - UK	$ 5,950
23 Sep - 27 Sep 2024	Dubai – UAE	$ 4,950
18 Nov - 22 Nov 2024	Barcelona - Spain	$ 5,950
21 Jul - 25 Jul 2025	London - UK	$ 5,950
22 Sep - 26 Sep 2025	Dubai – UAE	$ 4,950
17 Nov - 21 Nov 2025	Barcelona - Spain	$ 5,950

API RP 571 & Advanced Damage Mechanisms and Material Investigation in the Refining Petrochemical & Petroleum Industries

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About the Course

This comprehensive 5-day API RP 571 & Advanced Damage Mechanisms and Material Investigation in the Refining Petrochemical & Petroleum Industries training course provides an in-depth exploration of advanced damage mechanisms affecting fixed equipment within the refining, petrochemical, and petroleum industries. Following the principles of API RP 571, it aims to equip delegates with the knowledge and skills necessary to identify, analyse, and mitigate various forms of material degradation and mechanical damage.

The training program covers many topics, including corrosion mechanisms such as pitting, crevice corrosion, and microbiologically influenced corrosion (MIC). It also explores mechanical damage phenomena like fatigue, creep, and stress corrosion cracking (SCC) and environmental damage mechanisms, including high-temperature hydrogen attack (HTHA), sulfidation, and oxidation, among others.

Delegates will master state-of-the-art inspection and monitoring techniques, such as non-destructive testing (NDT) methods, which are crucial for early detection and prevention of equipment failure. Also, it emphasizes the importance of proper material selection, process control, and the application of protective coatings in mitigating damage mechanisms.

Through case studies and real-world applications, delegates will learn from failures and understand the real root causes of equipment degradation. Advanced material investigation techniques, including metallurgical analysis, chemical composition analysis, and mechanical testing, will be discussed to provide a holistic approach to failure analysis and prevention.

Core Objectives

The delegates will achieve the following objectives:

- Analyse various damage mechanisms affecting fixed equipment in the refining, petrochemical, and petroleum industries
- Evaluate the effectiveness of different non-destructive testing (NDT) methods and inspection techniques associated with the corresponding damage mechanism
- Identify the root causes of equipment failures through advanced material investigation techniques, including metallurgical analysis, chemical composition analysis, and mechanical testing
- Apply knowledge of corrosion mechanisms, mechanical damage, and environmental damage to develop strategies for mitigating and preventing equipment degradation
- Design effective maintenance and inspection plans that incorporate the latest advancements in monitoring technologies and predictive maintenance tools
- Implement material selection and process control strategies to enhance the durability and reliability of fixed equipment
- Synthesize information from various sources to create comprehensive reports and recommendations for improving equipment integrity and extending service life

Training Approach

This training course employs a blended methodological approach, combining both classroom and virtual training to maximise accessibility and engagement, including interactive lectures, real-life case studies, and hands-on exercises to reinforce theoretical concepts. Delegates will analyse past failures, conduct material investigations, and use advanced inspection techniques. Collaborative group discussions and problem-solving sessions will encourage knowledge sharing and practical application. Emphasis is placed on real-world examples and the latest research to ensure that delegates can relate course content to their everyday professional experiences, fostering a deeper understanding and retention of the material.

The Attendees

This training course is designed for professionals involved in designing, operating, and maintaining equipment in the refining, petrochemical, and petroleum industries. It is ideal for those seeking to enhance their understanding of advanced damage mechanisms and material investigation techniques. It is also beneficial for individuals responsible for ensuring equipment integrity and reliability.

This training course will be valuable to professionals, including (but not limited to) the following:

- Corrosion Engineers
- Maintenance Engineers
- Reliability Engineers
- Inspection Engineers
- Process Engineers
- Plant Managers
- Materials Scientists

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DAILY DISCUSSION

DAY ONE

INTRODUCTION TO MATERIALS AND CORROSION BASICS

- Overview of API RP 571, ASME PCC-3, API 580/581
- Applicability of Various Materials of Construction
- Overview of Carbon Steel, Cast Iron, C-Mo Steel, Cr-Mo Steels
- Characteristics of Stainless Steels and Duplex Steels
- Material Selection Process and Criteria
- Understanding Damage Mechanisms and Barriers
- Key Standards, References, Terms, Symbols, and Abbreviations
- Introduction to Refining Processes
- Types and Basic Mechanisms of Corrosion

DAY TWO

IN-DEPTH CORROSION MECHANISMS

- Galvanic and Concentration Cell Corrosion
- Erosion, Erosion-Corrosion, and Cavitation
- Atmospheric Corrosion and Corrosion Under Insulation (CUI)
- Corrosion in Cooling Water and Boiler Systems
- Non-boiler Oxygenated Water and Brine Corrosion
- Microbiologically Influenced Corrosion (MIC) and Soil Corrosion
- Dealloying, Graphitic, and CO2 Corrosion
- Caustic and HCl Corrosion
- Workshops: Corrosion Assessment for CO2 and HCl Corrosion

DAY THREE

REFINING CORROSION AND HIGH-TEMPERATURE DAMAGE

- Sour Water and Ammonium Bisulfide Corrosion
- Amine and Ammonium Chloride Corrosion
- Corrosion by Aqueous Organic Acid and Hydrofluoric Acid (HF)
- Sulfuric and Phenol (Carbolic) Acid Corrosion
- Phosphoric Acid Corrosion and Oxidation
- Sulfidation and High-temperature H2/H2S Corrosion
- Naphthenic Acid Corrosion, Carburization, and Metal Dusting
- Decarburization and Nitriding
- Flue-Gas Dew-Point and Fuel Ash Corrosion
- Workshop: Filtering Damage Mechanisms using ASME PCC-3

DAY FOUR

EMBRITTLEMENT AND HIGH-TEMPERATURE DAMAGE MECHANISMS

- Temper Embrittlement and 885°F (475°C) Embrittlement
- Sigma Phase and Hydrogen Embrittlement
- Liquid Metal Embrittlement and Titanium Hydriding
- Graphitization and Spheroidization (Softening)
- Strain Aging and Creep/Stress Rupture
- Short Term Overheating and Stress Rupture, including Steam Blanketing
- High-Temperature Hydrogen Attack and Dissimilar Metal Weld (DMW) Cracking
- Stress Relaxation Cracking (Reheat Cracking)
- Refractory Degradation and Gaseous Oxygen-Enhanced Ignition
- Thermal Fatigue, Thermal Shock, and Mechanical Fatigue including Vibration-Induced Fatigue
- Corrosion Fatigue

DAY FIVE

ENVIRONMENTAL-ASSISTED CRACKING AND PROCESS FUNDAMENTALS

- Chloride Stress Corrosion Cracking (Cl-SCC) and Polythionic Acid SCC
- Wet H2S Damage and Caustic SCC (Caustic Embrittlement)
- Amine and Carbonate SCC
- Ethanol and Ammonia SCC
- Hydrogen Stress Cracking - HF
- Hydrofluoric Acid SCC of Nickel Alloys
- Workshop: Assessing Susceptibility to Cl-SCC
- Overview of Refining Damage Mechanisms and API 581 Coverage
- Process Unit PFDs and Proposed IOWs Linked to Damage Mechanisms
- Workshop: API 571 Test Quiz

THE CERTIFICATE

XCalibre Training Centre Certificate of Completion will be provided to delegates who attended and completed the training course.

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