COURSE OVERVIEW FE0125
Corrosion Basics, Forms, Control & Mitigation Methods

Course Title
Corrosion Basics, Forms, Control & Mitigation Methods

Course Date/Venue
Session 1: June 22-26, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: July 27-31, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference
FE0125

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Corrosion Basics, Forms, Control & Mitigation Methods. It covers the corrosion and the economic impact of corrosion, electrochemical nature of corrosion and the factors affecting corrosion rates; the materials and their corrosion behavior, corrosion environments and the basic laboratory and field testing methods; the uniform or general corrosion as well as the galvanic corrosion, crevice corrosion, pitting corrosion, intergranular and sensitization corrosion and erosion-corrosion and flow-induced corrosion; and the stress corrosion cracking (SCC), hydrogen-induced corrosion (HIC) and embrittlement, microbiologically influenced corrosion (MIC) and high-temperature corrosion.

During this interactive course, participants will learn the inspection and monitoring techniques; the corrosion mapping and risk and assessment; the principles and design of cathodic protection (CP); the protective coatings and linings, corrosion inhibitors, material selection and design, environmental control and the maintenance and inspection programs; the corrosion in oil and gas industry, corrosion in water and wastewater systems; and the corrosion in power plants and boilers and corrosion standards and compliance.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on corrosion basics, forms, control and mitigation methods
- Discuss corrosion covering the economic impact of corrosion, electrochemical nature of corrosion and the factors affecting corrosion rates
- Identify the materials and their corrosion behavior, corrosion environments and the basic laboratory and field testing methods
- Explain the uniform or general corrosion as well as the galvanic corrosion, crevice corrosion, pitting corrosion, intergranular and sensitization corrosion and erosion-corrosion and flow-induced corrosion
- Recognize stress corrosion cracking (SCC), hydrogen-induced corrosion (HIC) and embrittlement, microbiologically influenced corrosion (MIC) and high-temperature corrosion
- Carryout inspection and monitoring techniques and the corrosion mapping and risk and assessment as well as discuss the principles and design of cathodic protection (CP)
- Discuss protective coatings and linings, corrosion inhibitors, material selection and design, environmental control and the maintenance and inspection programs
- Determine corrosion in oil and gas industry, corrosion in water n and wastewater systems, corrosion in power plants and boilers and corrosion standards and compliance

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of corrosion basics, forms, control, and mitigation methods for maintenance engineers and technicians, inspection and integrity engineers, process and mechanical engineers, materials and metallurgical engineers, project engineers/managers, pipeline, tank, and pressure vessel operators, utility, refinery, and power plant staff and those who involve the design, maintenance, inspection, or operation of systems susceptible to corrosion.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector inp the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. George Poulos, MBA, MSc, BSc, CEng, is a **Senior Corrosion & Metallurgical Engineer** with over **30 years** of extensive experience within the **Oil & Gas, Petrochemical, Refinery, Construction, Aircraft & Shipbuilding** Industry. His wide experiences cover in the areas of **Pressure Vessels**, **Piping Inspection**, **Risk-Based Inspection**, **Fitness-for-Service** (**FFS**), **Metallurgical** Failure, **Metallurgy & Metallurgical Processes, Metallurgical** Lab, Corrosion and **Metallurgy**, Analysis & Prevention, **Corrosion** Fabrication & Inspection, **Fabrication** & **Repair**, **Corrosion** Prevention, **Corrosion** Engineering, **Corrosion Control**, **Corrosion Inhibition**, **Corrosion** Management in Process Operations, **Corrosion** & Prevention of Failures, **Material** Selection, **Cathodic Protection** Systems, **Steel Metallurgy**, **Steel** Structure Welding, **Steelmaking** Slag, **Steel** Making Application, **Steel Making** Process, **Steel** Manufacturing, **Steel Forging**, **Steel** Manufacturing & Process Troubleshooting, **Hot Rolling** Process, **Hot Strip Mill**, **Mill** Operations, **Roll Mill**, **Electric Arc Furnace** (**EAF**), **Slit Rolling**, **Carbon Steel Pipe** Wall Thickness & Grade Selection, **Ferro-Alloys**, **Heat Treatment** & **Prevention Techniques** and **Post Weld Heat Treatment**. Further, he is also well-versed in **Welding** Inspection, **Welding** & **Machine** Techniques, **TIG** & **Arc Welding**, **Shielded Metal Arc Welding**, **Gas Tungsten** & **Gas Metal Arc Welding**, **Welding** Procedure Specifications & Qualifications, **Aluminium Welding**, **Hot Work-Safety**, **SMAW**, **GTAW**, **Welding** Techniques, **Pipeline Welding** Practices, **Welding** Engineering, **Welding** Fatigue & Fracture Mechanics, **Welding Inspection Technology**, **Welding Safety**, **Welding** Defects Analysis, **Welding Technology**, **Welding Problems**, **Welding & Non Destructive** Testing and **Metallurgy Techniques**.

During his career life, Mr. Poulos has gained his practical and field experience through his various significant positions and dedication as the **Chief Executive**, **Head of Technical Studies**, **Manager**, **Senior Consultant**, **Lead Welding Engineer**, **Senior Welding Engineer**, **Design Engineer**, **Sales Engineer**, **Author**, **Welding Instructor**, **Visiting Lecturer** and **Technical Proposal Research Evaluator** from various international companies such as Greek Welding Institute, Hellenic Quality Forum and International Construction Companies such as Shipbuilding, Aircraft Industry and Oil and Gas Industry.

Mr. Poulos is a **Registered Chartered Engineer** and has a **Master's** degree in **Naval Architecture**, a **Bachelor's** degree in **Welding Engineering** and a Master of Business Administration (**MBA**) from the **Sunderland University**, **Aston University** and **Open University**, **UK**, respectively. Further, he is a **Certified Trainer/Instructor**, an active Member of Chartered Quality Institute (**CQI**), The British Welding Institute (**TWI**), The Royal Institution of Naval Architects (**RINA**) and American Welding Society (**AWS**), a Registered **EWF/IW** (European Welding Federation-International Welding Institute W/E) and an **IRCA** Accredited External Quality Systems Auditor through BVQI. He is an **Author** of Technical Book dealing with Protection/Health/Safety in the Welding/Cutting domain and delivered various trainings, seminars, conferences, workshops and courses globally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Corrosion*** *Definition and Significance of Corrosion • Economic Impact of Corrosion • Direct and Indirect Consequences (Safety, Downtime) • Corrosion versus Erosion and Other Degradation Types*
0930 – 0945	*Break*
0945 – 1030	***Electrochemical Nature of Corrosion*** *Anodic and Cathodic Reactions • Galvanic Series and Potential Differences • Role of Electrolyte and Corrosion Cell Formation • Thermodynamics of Corrosion (ΔG, EMF)*
1030 – 1130	***Factors Affecting Corrosion Rates*** *Material Properties (Composition, Microstructure) • Environmental Factors (pH, Temperature, Humidity) • Electrochemical Factors (Potential, Conductivity) • Flow Dynamics and Aeration*
1130 – 1215	***Materials & Their Corrosion Behavior*** *Carbon Steels and Alloy Steels • Stainless Steels and Passivation Behavior • Non-Ferrous Metals (Al, Cu, Zn, Ni, Ti) • Selection Criteria for Corrosion Environments*
1215 – 1230	*Break*
1230 – 1330	***Corrosion Environments*** *Atmospheric Corrosion and Urban/Rural Effects • Immersed and Buried Conditions • High-Temperature Environments • Industrial and Marine Exposure*

1330 – 1420	***Basic Laboratory & Field Testing Methods*** *Visual Inspection and Simple Measurements • pH and Conductivity Testing • Weight Loss Method and Coupon Testing • Data Interpretation and Limitations*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Uniform or General Corrosion*** *Characteristics and Mechanisms • Examples in Piping and Tanks • Corrosion Rate Calculation • Prevention Methods*
0830 – 0930	***Galvanic Corrosion*** *Principle of Dissimilar Metal Contact • Galvanic Series in Seawater and Acid Media • Surface Area Effect and Distance • Material Selection and Insulation Techniques*
0930 – 0945	*Break*
0945 – 1100	***Crevice Corrosion*** *Common Crevice Geometries (Gaskets, Joints) • Oxygen Depletion and Chloride Accumulation • Susceptible Materials (Stainless Steels) • Design Modifications and Sealing Methods*
1100 – 1215	***Pitting Corrosion*** *Localized Attack and Initiation Sites • Role of Chlorides and Halides • Growth Mechanism and Propagation • Inspection, Detection, and Prevention*
1215 – 1230	*Break*
1230 – 1420	***Intergranular & Sensitization Corrosion*** *Grain Boundary Precipitation and Chromium Depletion • Sensitization in Austenitic Stainless Steels • Heat-Affected Zones in Welds • Heat Treatment and Alloy Stabilization*
1330 – 1420	***Erosion-Corrosion & Flow-Induced Corrosion*** *Synergy of Mechanical Wear and Corrosion • High-Velocity Effects and Turbulent Zones • Typical Materials Affected (Cu, Al, CS) • Flow Design and Protective Coatings*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Stress Corrosion Cracking (SCC)*** *Combined Effect of Tensile Stress and Corrosive Environment • Examples: Chloride SCC of Stainless Steels, Caustic Cracking • Threshold Stress and Crack Growth Rate • Prevention through Material Choice and Stress Relief*
0830 – 0930	***Hydrogen-Induced Corrosion (HIC) & Embrittlement*** *Hydrogen Diffusion and Accumulation • Effects on Steels and High-Strength Alloys • Decarburization and Blister Formation • Mitigation by Material Control and Coatings*
0930 – 0945	*Break*

0945 – 1100	***Microbiologically Influenced Corrosion (MIC)*** *Sulfate-Reducing Bacteria (SRB) and Acid-Producing Bacteria (APB) • Biofilm Formation and Localized Attack • Common Industries Affected (Oil & Gas, Water Treatment) • Detection, Sampling, and Biocide Treatment*
1100 – 1215	***High-Temperature Corrosion*** *Oxidation, Sulfidation, and Carburization • Role of Combustion Products and Thermal Gradients • Materials for High-Temperature Resistance • Protective Coatings and Cladding*
1215 – 1230	*Break*
1230 – 1330	***Inspection & Monitoring Techniques*** *Visual Inspection and Photographic Records • Ultrasonic Thickness Gauging (UTG) • Magnetic Flux Leakage (MFL), Radiography (RT) • Online Monitoring: ER Probes, LPR Sensors*
1330 – 1420	***Corrosion Mapping & Risk Assessment*** *Corrosion Loop Identification • Risk-Based Inspection (RBI) Principles • Criticality Ranking and Degradation Modes • Inspection Frequency and Data Management*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Cathodic Protection (CP) – Principles & Design*** *Galvanic versus Impressed Current Systems • Current Demand and Polarization Curves • Anode Types (Mg, Zn, Al, Ti, Mixed Metal Oxide) • Monitoring and Testing of CP Effectiveness*
0830 – 0930	***Protective Coatings and Linings*** *Organic, Metallic, and Ceramic Coatings • Surface Preparation and Application Techniques • Lining Systems (Rubber, Epoxy, Cementitious) • Inspection and Holiday Testing*
0930 – 0945	*Break*
0945 – 1100	***Corrosion Inhibitors*** *Classification: Anodic, Cathodic, Mixed • Applications in Pipelines, Cooling Systems, Boilers • Dosage Optimization and Injection Systems • Environmental and Safety Concerns*
1100 – 1215	***Material Selection & Design*** *Selecting Corrosion-Resistant Alloys • Designing to Avoid Crevices and Stagnation Zones • Weld Design and Heat Treatment Effects • Designing for Inspectability and Drainage*
1215 – 1230	*Break*
1230 – 1330	***Environmental Control*** *Dehumidification and Heating in Enclosed Systems • Oxygen Scavengers and pH Control • Chloride Removal and Contaminant Flushing • Environmental Modification as a Strategy*

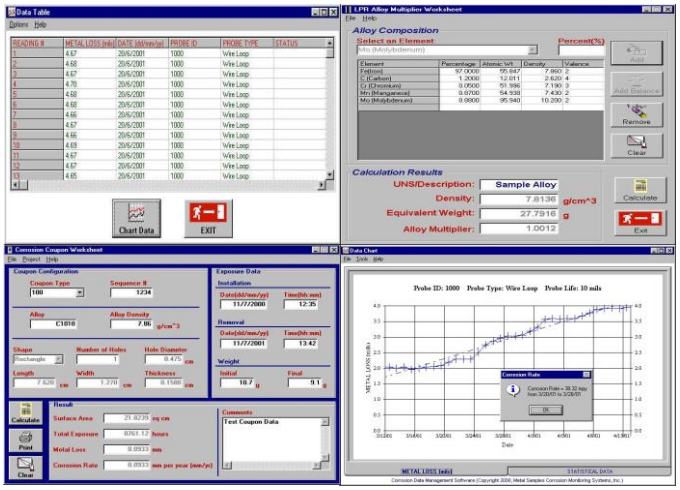
1330 – 1420	***Maintenance & Inspection Programs*** *Scheduled versus Condition-Based Maintenance • Inspection Intervals and Historical Analysis • Documentation and CMMS Integration • Asset Integrity and Lifecycle Extension*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

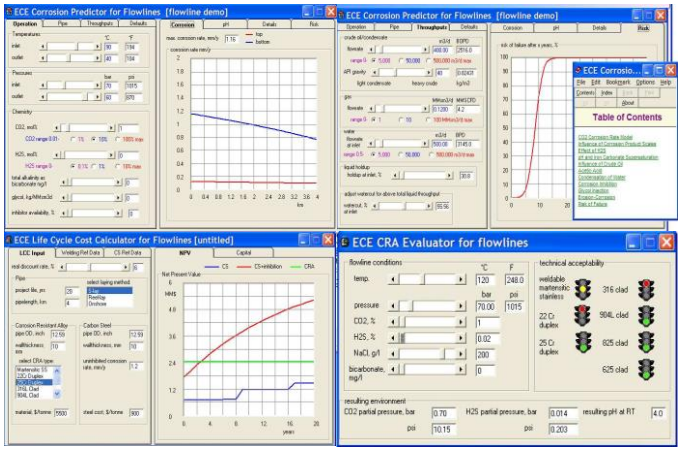
0730 – 0830	***Corrosion in Oil & Gas Industry*** *Internal Corrosion of Pipelines and Pressure Vessels • Sour Service and NACE MR0175 Compliance • Downhole Corrosion and Annular Fluid Impact • Best Practices for Offshore Platforms*
0830 – 0930	***Corrosion in Water &Wastewater Systems*** *Effects of Chlorination, Biofilm, and pH • Reinforced Concrete Degradation • Corrosion of Pumps, Valves, and Pipes • Mitigation via Coatings, CP, and Inhibitors*
0930 – 0945	*Break*
0945 – 1100	***Corrosion in Power Plants & Boilers*** *Water/Steam Cycle Corrosion • High-Temperature Oxidation in HRSG and Turbines • Condensate Return System Issues • Water Treatment Programs and Blowdown*
1100 – 1215	***Case Studies & Failure Analysis*** *Real-World Corrosion Failure Investigations • Root Cause Analysis and Corrective Actions • Lessons Learned and Avoidance Strategies • Workshop on Mock Failure Analysis Report*
1215 – 1230	*Break*
1230 – 1300	***Corrosion Standards & Compliance*** *NACE, ASTM, ISO, API Standards Overview • Key Documents: SP0169, SP0170, RP0502 • QA/QC in Corrosion Management • Regulatory Implications (EPA, OSHA, ADNOC)*
1300 - 1345	***Future Technologies & Innovations*** *Smart Coatings and Self-Healing Materials • AI and Machine Learning for Corrosion Prediction • Drones and Robotics in Inspection • Corrosion in Renewable Energy Systems (Solar, Wind, Hydrogen)*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “Corrosion Data Management Software (CDMS)” and “Electronic Corrosion Engineer (ECE®) 5”.



Corrosion Data Management Software (CDMS)



Electronic Corrosion Engineer (ECE®) 5

Course Coordinator

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