COURSE OVERVIEW FE0266
Advanced Corrosion Technology
Corrosion Control, Corrosion Inhibitors and Corrosion Mitigation in Refinery Distillation, Recovery, Hydrotreating & Hydrocracking

Course Title
Advanced Corrosion Technology: *Corrosion Control, Corrosion Inhibitors and Corrosion Mitigation in Refinery Distillation, Recovery, Hydrotreating & Hydrocracking*

Course Date/Venue
April 26-30, 2026/TBA Meeting Room, Elite Byblos Hotel, Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
FE0266

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 Advanced Corrosion Technology. It covers the corrosion thermodynamics and kinetics, electrochemical fundamentals and polarization and corrosion control; the electrochemical perspective of corrosion inhibitors, refinery corrosion mechanisms and monitoring and measurement; the atmospheric and vacuum distillation units (CDU/VDU), key damage mechanisms and overhead system corrosion control; the desalter and crude pretreatment, recovery units, materials selection and inspection and risk-based inspection (RBI); and the hydrotreating reaction chemistry, hydrocracking severity, pressure regimes and hydrogen partial pressure effects.

During this interactive course, participants will learn the major damage mechanisms, reactor and high-pressure equipment and effluent and cold sections; the mitigation strategies, inspection and integrity management covering advanced NDT for HTHA, acoustic emission monitoring and risk-based inspection in hydroprocessing units; the CP fundamentals, CP criteria and standards and CP interference; the isolation techniques, AC mitigation and CP monitoring and troubleshooting; the coating fundamentals, surface preparation, coating systems for refinery and coatings and CP interaction; and the failure analysis of coatings and integrated corrosion management strategy.

Course Objectives

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

- Apply and gain an advanced knowledge on corrosion technology
- Discuss corrosion thermodynamics and kinetics, electrochemical fundamentals and polarization and corrosion control
- Explain electrochemical perspective of corrosion inhibitors including refinery corrosion mechanisms and monitoring and measurement
- Identify atmospheric and vacuum distillation units (CDU/VDU), key damage mechanisms and overhead system corrosion control
- Apply desalter and crude pretreatment, recovery units, materials selection and inspection and risk-based inspection (RBI)
- Explain hydrotreating reaction chemistry, hydrocracking severity, pressure regimes and hydrogen partial pressure effects
- Describe major damage mechanisms, reactor and high-pressure equipment and effluent and cold sections
- Apply mitigation strategies, inspection and integrity management covering advanced NDT for HTHA, acoustic emission monitoring and risk-based inspection in hydroprocessing units
- Discuss CP fundamentals, CP criteria and standards and CP interference
- Apply isolation techniques, AC mitigation and CP monitoring and troubleshooting
- Discuss coating fundamentals, surface preparation, coating systems for refinery and coatings and CP interaction
- Carryout failure analysis of coatings and apply integrated corrosion management strategy

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 advanced corrosion technology for corrosion and materials engineers, maintenance and inspection engineers, asset integrity and reliability engineers/specialists, project engineers and design engineers, operations and plant managers, corrosion technicians and technologists, quality, HSE and risk management professionals and pipeline, refinery and petrochemical professionals.

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 in 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.

Accommodation

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

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. Greg Combrink, MSc, BSc, is a **Senior Corrosion Engineer** with over **30 years** of industrial experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery**, **Utilities** and **Power** industries. His wide expertise widely covers in the areas of **Corrosion** Control & Monitoring, **Corrosion Inhibition**, **Inhibitor Effectiveness** Calculation, **Metallurgy**, **Corrosion Failure Investigation**, Environmental Testing for **Corrosivity Classification**, **Stress Corrosion Cracking** Investigations & Testing, **Corrosion** Testing & Evaluation, **Corrosion** Mitigation, **Corrosion & Cathodic** Protection Survey, **Corrosion & Material** Testing, **Corrosion Cracking** Investigations & Testing, **Corrosion** Prevention & Risk, **Cathodic Protection** Systems Design & Implementation, **Coating** Technology & Applications, **Coating** Inspection & Corrosion Mechanism, **Coating** Application & Quality Control, **Metal Casting** Technology, **Material Sustainability** Testing, **Material Selection** Testing, **Electrochemical & Exposure** Testing, Contamination Control of Lubricants/Fuels & Process Fluids, **Tribology & Lubrication**, Rust Removal, **NDT** Testing, Underground Minerals Corrosivity, Conventional & Air Spray Coating, Stainless Steel **Welded Tanks**, **Heat & Mass Transfer**, **Metal** Analysis and Friction Testing & Non-Skid Surfaces.

During his career life, Mr. Combrink has gained his practical and field experience through his various significant positions and dedication as the **CEO/Technical Director**, **Corrosion Engineering Director**, **Corrosion Engineer**, **Officer-in-Charge & General Manager**, **Technical Manager**, **Programme Manager**, **Corrosion Projects Manager**, **Corrosion Specialist**, **Metalworking Product Applications Engineer**, **Manager/Officer-In-Charge Materials Lab**, **Sub-Lieutenant**, **Senior Instructor/Trainer** and **Reactor Technician** for various companies such as the Corrosion Hub, Total Contamination Control SA (Pty) Ltd, Bora Corrosion Solutions, Solar Even Pty Ltd, University of Johannesburg, University of Witwatersrand, Castrol South Africa, Sa Navy, SA Police, Geyser Enode and Metal Casting Technology Station.

Mr. Combrink has a **Master's** degree in **Corrosion Science & Engineering** from the **University** of **Manchester Institute** of **Science** and **Technology** (**UMIST**), **UK** and a **Bachelor's** degree in **Chemical Engineering**. Further, he is an **Accredited Assessor & Moderator** from the South African Qualifications Authority (**SAQA**) and an **Accredited Assessor & Committee Member** (**Corrosion Protection**) from the South African Qualification & Certification Committee (**SAQCC**). He is also a **Fellow** from the Corrosion Institute Ghana (**CorrIGh**), an **Executive Committee Member/Former President** from the Corrosion Institute of Southern Africa (**CorrISA**) and a **Member** of the Southern African Institute of Tribology (**SAIT**) and has further delivered numerous trainings, courses, seminars, conferences and workshops 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.

Course Fee

US$ 6,750 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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: ***Sunday, 26th April 2026***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Corrosion Thermodynamics & Kinetics*** *Free Energy, ΔG and Spontaneity of Corrosion Reactions • Pourbaix (E–pH) Diagrams for Fe, Cr, Ni, H_2S, CO_2 Systems • Stability Domains in Refinery Environments • Effect of Temperature and Pressure on Corrosion Equilibria • Multiphase Systems (Oil/Water/Gas)*
0900 - 0930	***Electrochemical Fundamentals*** *Half-Cell Reactions and Mixed Potential Theory • Tafel Behavior and Polarization Curves • Activation, Concentration, and Resistance Polarization • Butler–Volmer Equation • Linear Polarization Resistance (LPR) Fundamentals*
0930 – 0945	*Break*
0945 – 1030	***Polarization & Corrosion Control*** *Anodic versus Cathodic Control • Passivation Mechanisms (Cr, Mo Alloys) • Cathodic Protection Principles • Anodic Protection Theory • Practical Interpretation of Polarization Curves*
1030 – 1130	***Corrosion Inhibitors – Electrochemical Perspective*** *Film-Forming Inhibitors • Anodic versus Cathodic Inhibitors • Adsorption Isotherms (Langmuir, Temkin) • Inhibitor Efficiency and Electrochemical Testing • High-Temperature Inhibitor Behavior*
1130 – 1215	***Refinery Corrosion Mechanisms Overview*** *CO_2 Corrosion • H_2S Corrosion • Sulfidation • Naphthenic Acid Corrosion (NAC) • Chloride Corrosion • Ammonium Bisulfide Corrosion • High-Temperature Hydrogen Attack (HTHA)*
1215 – 1230	*Break*

1230 – 1330	***Monitoring & Measurement*** *Corrosion Probes (LPR, ER) • Coupons and Weight Loss • Hydrogen Probes • Electrochemical Noise • Online Monitoring in Refinery Systems*
1330 – 1420	***Practical Session*** *Interpreting Real Refinery Polarization Curves • Case Study: Failure due to Poor Electrochemical Control*
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: ***Monday, 27th April 2026***

0730 – 0830	***Atmospheric & Vacuum Distillation Units (CDU/VDU) Corrosion Zones:*** *Overhead System Corrosion • Top Tower Condensation Corrosion • Desalter Corrosion • Vacuum Column Corrosion*
0830 - 0930	***Key Damage Mechanisms*** *HCl Corrosion • Ammonium Chloride Salt Deposition • Ammonium Bisulfide Corrosion • Wet H_2S Corrosion • Erosion-Corrosion in Transfer Lines • Under-Deposit Corrosion*
0930 – 0945	*Break*
0945 – 1030	***Overhead System Corrosion Control*** *Neutralizing Amine Programs • Filming Amine Inhibitors • Wash Water Design & Optimization • Salt Point Control • pH Control Strategies • Chloride Monitoring*
1030 – 1100	***Desalter & Crude Pretreatment*** *Emulsion Breaking • Chloride Removal • Desalter Water Quality Control • Interface Corrosion*
1100 – 1130	***Recovery Units*** *Sour Water Stripper Corrosion • Gas Recovery Systems • Amine Units Corrosion (DEA, MDEA Degradation) • CO_2 and H_2S Loading Effects*
1130 - 1215	***Materials Selection*** *5Cr, 9Cr Alloys • Stainless Steels (304, 316, Duplex) • Clad Materials • Corrosion Allowance Decisions*
1215 – 1230	*Break*
1230 – 1330	***Inspection & Risk-Based Inspection (RBI)*** *Thickness Monitoring Locations • CUI in Distillation Systems • Damage Mechanism Review (API 571 Alignment)*
1330 – 1420	***Case Studies*** *Overhead Condenser Failure • Vacuum Unit Sulfidation Incident*
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: Tuesday, 28th April 2026

0730 – 0830	***Process Overview*** *Hydrotreating Reaction Chemistry • Hydrocracking Severity and Pressure Regimes • Hydrogen Partial Pressure Effects*
0830 – 0930	***Major Damage Mechanisms*** *High-Temperature Hydrogen Attack (HTHA) • Hydrogen Blistering • Hydrogen-Induced Cracking (HIC) • Sulfidation Corrosion • Ammonium Bisulfide Corrosion • NH_4Cl Salt Corrosion • Polythionic Acid Stress Corrosion Cracking • Wet H_2S Cracking (SSC, SOHIC)*
0930 – 0945	*Break*
0945 – 1100	***Reactor & High-Pressure Equipment*** *Nelson Curves and Limitations • Cr-Mo Steels Performance • PWHT Requirements • Weld Degradation • Cladding Integrity*
1100 – 1130	***Effluent & Cold Sections*** *Salt Deposition Control • Water Injection Optimization • Velocity Control • Dead-Leg Corrosion*
1130 - 1215	***Mitigation Strategies*** *Process Control (Temperature, Velocity, Hydrogen Purity) • Inhibitor Injection Programs • Water Wash System Design • Materials Upgrade Decision Criteria*
1215 – 1230	*Break*
1230 – 1330	***Inspection & Integrity Management*** *Advanced NDT for HTHA • Acoustic Emission Monitoring • Risk-Based Inspection in Hydroprocessing Units*
1330 – 1420	***Workshop*** *Failure Analysis of Hydrotreater Effluent Line • Hydrogen Damage Assessment Exercise*
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: Wednesday, 29th April 2026

0730 – 0830	***CP Fundamentals (Advanced Review)*** *Galvanic versus Impressed Current Systems • CP Design Calculations • Current Requirement Estimation • Anode Selection (MMO, Graphite, Silicon Iron) • Transformer Rectifier Operation*
0830 – 0930	***CP Criteria & Standards*** *NACE SP0169 / ISO 15589 • -850 mV Criterion • Polarization Decay Testing • IR Drop Correction*
0930 – 0945	*Break*
0945 – 1100	***CP Interference*** *Stray Current Interference • Foreign Pipeline Interference • AC Interference from Power Lines • DC Transit Systems Effects • Detection Methods • Interference Testing Protocols*
1100 – 1130	***Isolation Techniques*** *Isolation Flanges & Kits • Dielectric Unions • Monolithic Joints • Isolation in Refinery Tank Farms • Bonding versus Isolation Philosophy*

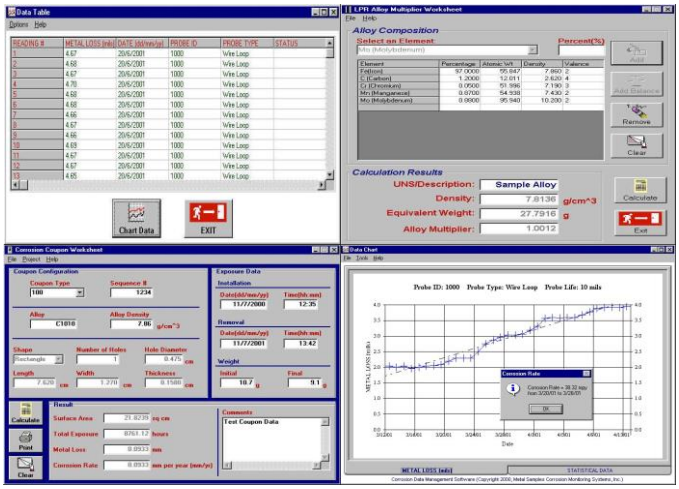
1130 - 1215	***AC Mitigation*** *Gradient Control Mats • Zinc Ribbon Systems • Decouplers*
1215 – 1230	*Break*
1230 – 1330	***CP Monitoring & Troubleshooting*** *Remote Monitoring • Instant-Off Surveys • Close Interval Surveys (CIS) • Current Attenuation Surveys*
1330 – 1420	***Practical Exercise*** *CP System Troubleshooting Scenario • Interference Case Evaluation*
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: ***Thursday, 30th April 2026***

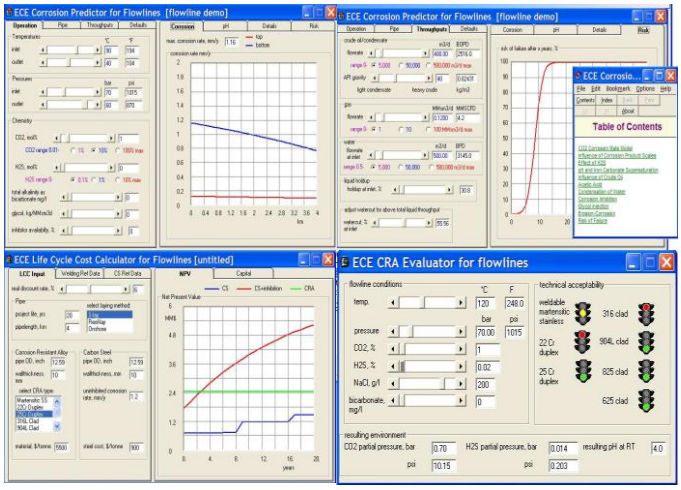
0730 – 0830	***Coating Fundamentals*** *Coating Chemistry (Epoxy, Polyurethane, FBE) • Barrier Protection Principles • Adhesion Mechanisms • Permeability & Diffusion • Cathodic Disbondment*
0830 – 0930	***Surface Preparation*** *SSPC/NACE Standards • Blast Profiles • Surface Contamination • Salt Testing*
0930 – 0945	*Break*
0945 – 1100	***Coating Systems for Refinery*** *Tank Internal Linings • High-Temperature Coatings • CUI-Resistant Coatings • Splash Zone Coatings*
1100 – 1130	***Coatings & CP Interaction*** *Shielding Effects • Disbondment • CP Compatibility*
1130 - 1215	***Failure Analysis of Coatings*** *Blistering • Delamination • Osmotic Effects • Underfilm Corrosion*
1215 – 1230	*Break*
1230 – 1300	***Integrated Corrosion Management Strategy*** *Corrosion Control Matrix • Process Control + Materials + Inhibitors + Coatings + CP • Risk-Based Corrosion Management • Corrosion KPIs*
1300 – 1345	***Emerging Technologies*** *Corrosion Prediction Software • Smart Corrosion Monitoring • Nanotechnology Coatings • Digital Twins for Corrosion Management*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course 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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