COURSE OVERVIEW FE1019
Designing for Corrosion Control in Refinery

Course Title
Designing for Corrosion Control in Refinery

Course Date/Venue
Please refer to page 5

Course Reference
FE1019

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

Course Description

This hands-on, highly-interactive course includes various practical sessions and exercises. Theory learnt in the class 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 Designing for Corrosion Control in Refinery. It covers the corrosion in refinery operations, corrosion mechanisms in refinery environments and refinery process conditions affecting corrosion; the materials of construction for corrosion resistance, codes, standards and guidelines; the high-temperature sulfidation, fuel ash and oil ash corrosion; the oxidation and carburization, creep and metal dusting; the hydrogen attack and embrittlement, protective coatings and surface treatments; and the wet H_2S and sour water corrosion.

Further, the course will also discuss the CO_2 corrosion (sweet corrosion); the under-deposit corrosion and microbiologically influenced corrosion (MIC), chloride stress corrosion cracking (CSCC) and erosion–corrosion; the cathodic protection in refineries, corrosion allowance in design thickness, minimizing stagnant zones and dead legs; the flow regime control to reduce erosion and avoiding dissimilar metal contacts; the piping system design for corrosion control, pressure vessels and heat exchanger design; and the material selection and life-cycle costing.

During this interactive course, participants will learn the coatings, linings and claddings in design; the design for inspection and maintenance; the corrosion monitoring techniques, inspection and NDT for corrosion detection; the risk-based inspection (RBI) for corrosion management and failure analysis; the root cause investigation, integration design, operations and maintenance, chemical treatment programs and continuous improvement cycle; and the training and competency requirements.

Course Objectives

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

- Apply and gain in depth knowledge on designing for corrosion control in refinery
- Discuss corrosion in refinery operations, corrosion mechanisms in refinery environments and refinery process conditions affecting corrosion
- Identify materials of construction for corrosion resistance, codes, standards and guidelines and high-temperature sulfidation
- Recognize fuel ash and oil ash corrosion, oxidation and carburization, creep and metal dusting as well as hydrogen attack and embrittlement
- Carryout protective coatings and surface treatments and discuss wet H_2S and sour water corrosion, CO_2 corrosion (sweet corrosion) and under-deposit corrosion and microbiologically influenced corrosion (MIC)
- Describe chloride stress corrosion cracking (CSCC), erosion–corrosion and cathodic protection in refineries
- Apply corrosion allowance in design thickness, minimize stagnant zones and dead legs, flow regime control to reduce erosion and avoiding dissimilar metal contacts
- Illustrate piping system design for corrosion control, pressure vessels and heat exchanger design and material selection and life-cycle costing
- Carryout coatings, linings and claddings in design, design for inspection and maintenance and corrosion monitoring techniques
- Employ inspection and NDT for corrosion detection, risk-based inspection (RBI) for corrosion management and failure analysis and root cause investigation
- Integrate design, operations and maintenance and develop chemical treatment programs, continuous improvement cycle and training and competency requirements

Who Should Attend

This course provides an overview of all significant aspects and considerations of designing for corrosion control in refinery for corrosion engineers, technical managers, technical supervisors, mechanical engineer, process engineers, materials engineer, metallurgical engineers piping engineer asset integrity engineer, reliability engineers, inspection engineer, maintenance engineers design engineer, project engineers and other technical staff.

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**.*

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.

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:

Dr. Tony Dimitry, PhD, MSc, BSc, is a **Senior Pipeline & Piping Engineer** with over **30 years** of industrial experience. His expertise includes **Metallurgy Identification & Inspection**, **Corrosion and Metallurgy**, **Metallurgical Failure Analysis & Prevention**, **ASME B31 Piping & Pipeline**, **Piping**, **Pipelines & Fabrication**, **Piping & Flanges**, **Pressure Vessels**, **Pipeline & Compression**, Oil & Gas **Pipeline Infrastructure**, **Pipeline** Inspection, **Testing & Integrity** Assessment, **Pipeline** Defect Assessment, **Pipeline** Integrity Management, **Pipeline Pigging**-Technical & Operational Aspects, **Pigging** Operations, **Pigging** Technology, **Pipeline & Piping** Design, **Welding Technology**, **Welding Machine Safety**, **Welding Machine Calibrations**, **Welding Machine Inspection & Maintenance**, **Welding Machine Operational Tests**, **Welding Technology** & Qualifications, **Welding & Fabrication**, **Welding** Processes, **Welding** Inspection, **Welding** Procedure Specification, **Welding** Quality & Control, **Welding** Engineering, **Welding & Machining**, **Welding** Safety, **Welding** Defects Analysis, **Metallurgical & Materials Engineering**, **Piping & Pipeline Systems**, **Inspection Maintenance**, **Diesel Engine**, **Control Diagrams**, **Electrical Wiring Diagrams**, **GFCI Testing & Resetting Procedures**, **Battery Maintenance**, **Mechanical Pipe Fittings**, **Flange Joint Assembly**, Adhesive Bond Lamination, **Butt Jointing**, **Joint & Spool Production**, **Isometric Drawings**, **Flange Assembly** Method, **Fabrication & Jointing**, Jointing & Spool Fabrication, **Pipe Cuttings**, **Flange Bolt Tightening** Sequence, **Hydro Testing**, **Failure Analysis Methodologies**, Machinery Root Cause Failure Analysis (**RCFA**), **Preventive Maintenance** & **Condition Monitoring**, Reliability Centred Maintenance (**RCM**), Risk Based Inspection (**RBI**), Root Cause Analysis (**RCA**), **Planning & Managing Plant Turnaround**, **Scheduling Maintenance**, **Data Archive Maintenance**, **Master Milestone Schedule** (**MMS**), Piping & Mechanical **Vibration Analysis**, Preventive & Predictive Maintenance (**PPM**) **Maintenance**, Condition Based Monitoring (**CBM**), Risk Based Assessment (**RBA**), Planning & Preventive Maintenance, **Maintenance** Management (**Preventive**, **Predictive**, **Breakdown**), **Reliability** Management, Rotating Equipment, **Air Compressors Operation**, **Air Compressors Maintenance**, **Air Compressors Operational Tests**, **Air Compressors Inspection Lists**, **Generator Testing**, **Maintenance & Troubleshooting**, **Generator Operational Tests**, **Voltage Regulator**, **Generator Inspection Lists**, **Non Destructive Test**, **Metallurgical Failure Analysis & Prevention**, **ASME B31.8**, **Gas Transportation Piping Code**, **Mechanical Integrity**, **Fittings**, **Pressure Vessels**, **Dry Gas Seal**, **Process Equipment**, **Diesel Engine & Crane Maintenance**, **Reliability** Management, **Electric Arc Furnace** (**EAF**), **Vibration Analysis**, Heat Exchanger, Boiler, **Gas Turbine**, Siemens Steam Turbine Maintenance, Failure Analysis, FMEA, **Corrosion**, **Metallurgy**, Preventive and Predictive Maintenance. Currently, he is in charge of the **metallurgical failure analysis** and the usage of fracture mechanics for determining crack propagation in impellers of turbines.

During his career life, Dr. Dimitry was a **Senior Engineer** in **Chloride Silent** (**UK**) wherein he was responsible for the mechanical, thermal and electrical modelling of battery problems for electric vehicles and satellites as well as an **Operations Engineer** of the **National Nuclear Corporation** (**UK**) wherein he was responsible for the optimization of the plant. Prior to this, he was a **Professor** at the **Technical University of Crete** and an Assistant **Professor** of the **University of Manchester** (**UK**). Dr. Dmitry also held significant positions such as the **Operations Engineers**, **Technical Trainer**, **HSE Contracts Engineer**, **Boilers Section Engineer**, **Piping Engineer**, **Trainee Mechanical Engineer**, **Welding Engineer**, **Turbines Section Head** and **Lecturer/Instructor** and from various multinational companies like **National Nuclear Corporation**, **UMIST Aliveri Power Station** and **HFO Fired Power Station**.

Dr. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **Victory University of Manchester** and the **University of Newcastle**, **UK** respectively. Further, he is a **Certified Instructor/Trainer,** a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an associate member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**). He has further delivered various trainings, seminars, courses, workshops and conferences internationally.

Course Date/Venue

Session(s)	Date	Venue
1	September 07-11, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
2	October 13-17, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
3	November 09-13, 2025	Crowne Meeting Room, Crowne Plaza Al Khobar, an IHG Hotel, Al Khobar, KSA
4	December 14-18, 2025	Safir Meeting Room, Divan Istanbul, Taksim, Turkey

Course Fee

Al Khobar/ Abu Dhabi/Dubai	**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.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

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

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 Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course 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 in Refinery Operations*** *Overview of Corrosion Problems in Refining Industry • Impact on Safety, Reliability and Economics • Common Corrosion-Related Failures • Regulatory and Industry Standards*

0930 – 0945	*Break*
0945 – 1030	***Corrosion Mechanisms in Refinery Environments*** *General (Uniform) Corrosion • Localized Corrosion: Pitting & Crevice • Galvanic Corrosion • Flow-Accelerated Corrosion (FAC)*
1030 – 1130	***Refinery Process Conditions Affecting Corrosion*** *Temperature and Pressure Effects • Fluid Composition and Impurities • Acidic and Alkaline Process Streams • Erosion–Corrosion in High-Velocity Zones*
1130 – 1215	***Materials of Construction for Corrosion Resistance*** *Carbon Steel Limitations • Stainless Steels and Alloys • Non-Metallic and Composite Materials • Criteria for Material Selection*
1215 – 1230	*Break*
1230 – 1330	***Codes, Standards & Guidelines*** *API 571: Damage Mechanisms Affecting Fixed Equipment • NACE MR0175/ISO 15156 Requirements • ASME Boiler & Pressure Vessel Code Relevance • Company-Specific Corrosion Control Specifications*
1330 – 1420	***Case Studies of Corrosion Failures in Refineries*** *High-Temperature Sulfidation Case • Chloride Stress Corrosion Cracking Incident • Sour Service Hydrogen Embrittlement Case • Lessons Learned and Best Practices*
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	***High-Temperature Sulfidation*** *Mechanism and Temperature Range • Influence of Alloying Elements • Critical Sulfur Content in Hydrocarbons • Control Strategies in Design*
0830 – 0930	***Fuel Ash & Oil Ash Corrosion*** *Alkali Sulfate and Vanadium Pentoxide Attack • Role of Fuel Impurities • Temperature Effects on Ash Melting Points • Mitigation Through Material Upgrades*
0930 – 0945	*Break*
0945 – 1100	***Oxidation & Carburization*** *High-Temperature Oxidation Mechanisms • Carburization in Hydrogen-Rich Environments • Alloy Selection and Heat Treatment Effects • Protective Oxide Layer Formation*
1100 – 1230	***Creep & Metal Dusting*** *Creep Damage Mechanisms • Metal Dusting in Syngas and CO-Rich Streams • Operating Envelope Considerations • Design Margins for High-Temperature Service*
1230 – 1245	*Break*
1245 – 1330	***Hydrogen Attack & Embrittlement*** *High-Temperature Hydrogen Attack (HTHA) • Hydrogen Blistering and Embrittlement • Inspection Techniques for Hydrogen Damage • API 941 – Nelson Curves*

1330 – 1345	***Protective Coatings & Surface Treatments*** *Metallic Coatings: Aluminizing, Chromizing • Ceramic and Refractory Coatings • Thermal Spray Techniques • Life Expectancy and Inspection Intervals*
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	***Wet H_2S & Sour Water Corrosion*** *Mechanisms in Amine Units and Sour Water Strippers • Effect of pH and Temperature • Material Selection for Sour Service • NACE MR0175 Compliance*
0830 – 0930	***CO_2 Corrosion (Sweet Corrosion)*** *Carbonic Acid Formation and pH Impact • Flow Velocity and Turbulence Effects • Material Compatibility in CO_2 Service • Corrosion Inhibitors in CO_2 Environments*
0930 – 0945	*Break*
0945 – 1100	***Under-Deposit Corrosion & MIC*** *Role of Deposits in Localized Attack • Microbiologically Influenced Corrosion (MIC) Types • Biofilm Formation in Cooling and Firewater Systems • Monitoring and Cleaning Strategies*
1100 – 1230	***Chloride Stress Corrosion Cracking (CSCC)*** *Chloride Sources in Refineries • Susceptible Materials (Austenitic Stainless Steels) • Temperature and Tensile Stress Effects • Mitigation via Alloy Upgrade and Stress Relief*
1230 – 1245	*Break*
1245 – 1330	***Erosion–Corrosion*** *Synergy Between Mechanical Wear & Chemical Attack • High-Velocity Fluid Design Considerations • Protective Lining and Wear-Resistant Alloys • Monitoring and Replacement Planning*
1330 – 1345	***Cathodic Protection in Refineries*** *Principles of Cathodic Protection (CP) • Impressed Current versus Sacrificial Anode Systems • Application in Tanks and Buried Piping • CP Monitoring and Maintenance*
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	***Process Design Considerations*** *Corrosion Allowance in Design Thickness • Minimize Stagnant Zones and Dead Legs • Flow Regime Control to Reduce Erosion • Avoiding Dissimilar Metal Contacts*
0830 – 0930	***Piping System Design for Corrosion Control*** *Pipe Routing for Drainage and Venting • Sloping and Self-Draining Design • Avoiding Crevice-Prone Joints • Use of Internal Coatings and Linings*

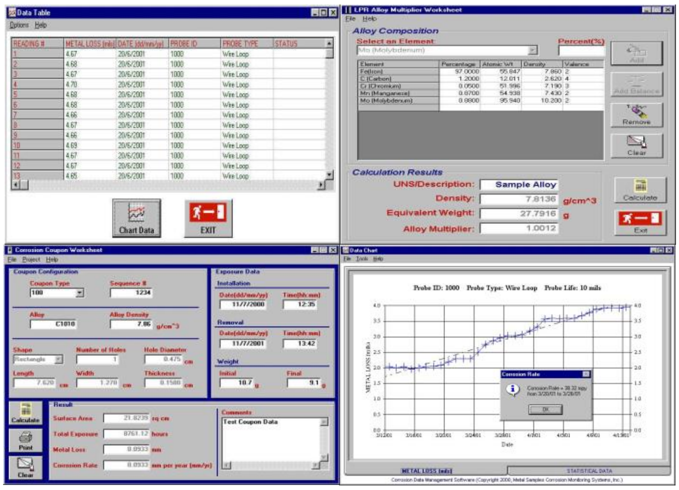
0930 – 0945	*Break*
0945 – 1100	***Pressure Vessels & Heat Exchanger Design*** *Tube Material and Geometry Selection • Baffle and Flow Path Optimization • Tube-to-Tubesheet Joint Design • API 660 & API 661 Material Recommendations*
1100 – 1230	***Material Selection & Life-Cycle Costing*** *Balancing Capital Cost and Corrosion Resistance • Life-Cycle Cost Analysis Approach • Alloy Upgrade Justifications • Vendor and Supplier Specifications*
1230 – 1245	*Break*
1245 – 1330	***Coatings, Linings & Claddings in Design*** *Epoxy, Phenolic, and Vinyl Ester Linings • Thermoplastic and Rubber Linings • Weld Overlay Cladding • Inspection of Lined and Clad Surfaces*
1330 – 1345	***Design for Inspection & Maintenance*** *Access for NDT Methods • Corrosion Monitoring Locations • Removable Components for Inspection • Design to Facilitate Quick Replacement*
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

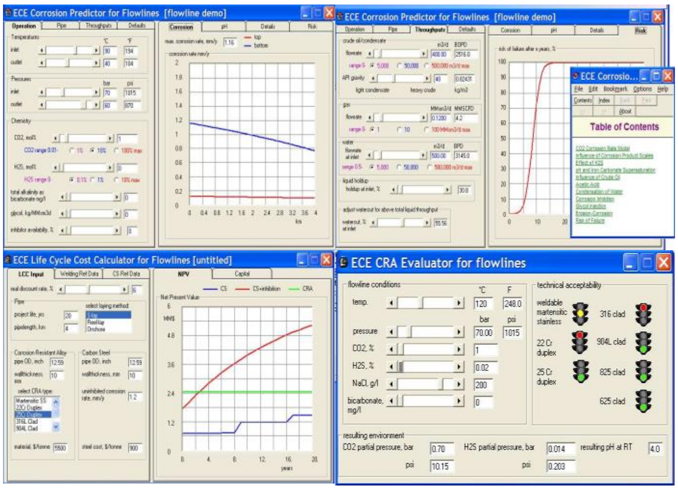
0730 – 0830	***Corrosion Monitoring Techniques*** *Weight Loss Coupons • Electrical Resistance Probes • Linear Polarization Resistance (LPR) • Online Corrosion Monitoring Systems*
0830 – 0930	***Inspection & NDT for Corrosion Detection*** *Ultrasonic Thickness Measurement (UTM) • Radiographic Testing (RT) for Wall Loss • Eddy Current for Exchanger Tubes • Magnetic Flux Leakage (MFL) for Tank Floors*
0930 – 0945	*Break*
0945 - 1100	***Risk-Based Inspection (RBI) for Corrosion Management*** *API 580 & API 581 Methodology • Damage Mechanism Review • Probability of Failure Assessment • Inspection Interval Optimization*
1100 – 1230	***Failure Analysis & Root Cause Investigation*** *Data Collection and Metallurgical Analysis • Identifying Primary versus Secondary Damage • Laboratory Testing for Corrosion Type • Corrective and Preventive Actions*
1230 – 1245	*Break*
1245 – 1315	***Refinery Corrosion Control Programs*** *Integration of Design, Operations & Maintenance • Chemical Treatment Programs • Continuous Improvement Cycle • Training & Competency Requirements*
1315 - 1345	***Case Studies*** *Review of Real-World Refinery Corrosion Failures • Analysis of Design Flaws and Prevention Measures • Group Design Challenge for Corrosion Control*
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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