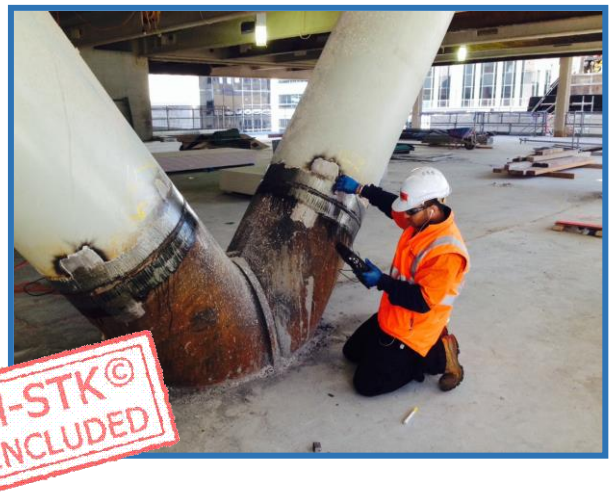
COURSE OVERVIEW FE0320-3D

Metallurgy, Corrosion and Prevention of Failures

Material Selection and Properties

Course Title

Metallurgy, Corrosion and Prevention of Failures: *Material Selection and Properties*



Course Date/Venue

September 13-15, 2020/Boardroom 3, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference

FE0320-3D

Course Duration/Credits

Three days/1.8 CEUs/18 PDHs

Course Description

This hands-on, highly-interactive course includes various practical sessions and. Theory learned will be applied using our state-of-the-art simulators.

Metallurgy: this section of the course discusses metals and the metallurgical characteristics of various metals. It provides an explanation of physical characteristics of metals, including the reason metals behave differently than non-metals. This section of the course also explains how and why different metals are selected for specific environmental purposes, including resistance to wear, corrosion, heat, cold, repeated stress, and impact. This is a lecture and problem-solving section that also deals with the metallurgical aspects of welding. Emphasis will be placed on mechanical metallurgy, materials selection, and the fundamentals of welding technology, welding metallurgy, inspection and quality of welds.

Corrosion: this section of the course focuses on the fundamentals of corrosion as well as the potential problems caused by corrosion. It provides a review of the causes of corrosion and the methods for identification, monitoring and control. An understanding of corrosion and its control is vital for any company hoping to avoid the high costs that can be directly or indirectly attributed to corrosion. This section of the course also presents fundamental principles of corrosion and assists participants in recognizing corrosion problems, determining their causes, and understanding and selecting control methods. Emphasis is on the practical applications of corrosion technology to solve industrial corrosion problems.

Prevention of failures: this section of the course is concerned with the prevention of failures, the assessment of the state of damage in plant and equipment, and the use of failure analyses, inspection data, and operating history in predicting safe operating life or determining necessary remedial measures. Maintenance requirements, risk-based inspection (RBI) procedures, and the fitness-for-service (FFS) approach will be discussed along with the various mechanisms leading to damage and potential failure, mechanisms of accumulation, and predictive methods.

Course Objectives

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

- Apply systematic techniques in metallurgy, corrosion and prevention of failure for plant, equipment and pipelines including material selection and properties
- Reduce corrosion and prevent failure of plant and equipment at the design stage or during the operation of the facility
- Assess the state of damage in plant, equipment and pipelines and implement the relevant repair technique
- Acquire a good background knowledge on the metallurgy of ferrous metals, nonferrous alloys and stainless steels as well as recognize the classification and heat treatment of steels and explain passivity and passive films on stainless steels
- Develop a good understanding on physical and mechanical metallurgy including crystal structure, phase diagrams, diffusion, phase transformations, T-T-T diagrams and C-C-T diagrams
- Discuss the materials, metallurgy and the general characteristics and mechanical properties of metals and alloys and describe welding metallurgy, non-destructive examinations and electrochemical principles
- Discuss the fundamentals of corrosion and identify its different forms in varying circumstances including atmospheric corrosion and corrosion by water and steam
- Describe cathodic protection, protective coatings and inhibitors as well as discuss the various aspects of high temperature corrosion, the prediction and control thereof
- Identify the different damage and failure mechanisms and the methods of failure prevention & inspection as well as carryout preventative and predictive maintenance
- Recognize the OSHA requirements for mechanical integrity as well as the API and ASME codes and standards related to the in-service, construction and repair

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides a wide understanding and deeper appreciation of material selection and properties for those who are responsible for metallurgy, corrosion and prevention of failures in plant and equipment. Facility integrity engineers, inspection engineers, metallurgy and corrosion engineers, materials engineers, design engineers, mechanical engineers, chemical engineers, corrosion field personnel, supervisors and other technical staff will find the course very attractive. Senior engineers and managers will be able to develop their interpretive skills in data analysis. Furthermore, the course is ideal for all engineers and technical staff whose responsibilities include the reduction of corrosion and the prevention of failure either at the design stage or during operation of the facility.

Course Fee

US$ 3,750 per Delegate + **5% 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

This interactive training course includes the following training methodologies as a percentage of the total tuition hours: -

30% Lectures
20% Workshops & Work Presentations
20% Case Studies & Practical Exercises
30% Videos, Software & Simulators

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

Course Certificate(s)
Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations
Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association 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 1-2013 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 1-2013 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 Association 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 **1.8 CEUs** (Continuing Education Units) or **18 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.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. 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.

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 Welding Engineer** with over **30 years** of industrial experience. His expertise includes **Welding Technology**, **Welding Machine Safety**, **Welding Machine Calibrations**, **Welding Machine Inspection & Maintenance**, **Welding Machine Operational Tests**, **Inspection Maintenance**, **Diesel Engine**, **Control Diagrams**, **Electrical Wiring Diagrams**, **GFCI Testing & Resetting Procedures**, **Battery Maintenance**, **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**, **Piping & Pipeline Systems**, **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. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **University of Manchester** (**UK**) and the **Universiy of Newcastle** (**UK**) respectively. Further, he is a **Certified Instructor/Trainer** and an active member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**).

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: ***Sunday, 13th of September 2020***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Metallurgy*** *Review of Ferrous Metals • Glossary*

0900- 0930	***Introduction to Steel*** *Classification of Steels • Heat Treatment of Steels*
0930 - 0945	***Physical & Mechanical Metallurgy*** *Haward Video VWE 7 Introduction to Phase Diagrams • Crystal Structure • Phase Diagrams • Diffusion • Phase Transformations • T-T-T Diagrams • C-C-T Diagrams • Practical Session • Isothermal, TTT & CCT Diagrams*
0945 – 1000	*Break*
1000– 1045	***Review of Nonferrous Alloys & Stainless Steels*** *Aluminium • Copper • Nickel-Based • Stainless Steel • Heat Treatment of Nonferrous & Stainless Steels • Practical Session • 'Turbine of the Times'*
1045 – 1130	***Materials & Metallurgy*** *Mechanical Properties • Metals & Alloys • General Characteristics of Metals • Alloying*
1130 – 1230	***Welding Metallurgy*** *Haward Video VWE 8 Welding Inspection & Quality Control • Glossary • Fundamentals • Characteristics of Weld Solidification • Weld Microstructure • Temperature Changes in Welding • Residual Stresses • Welding Processes • Heat Input • Shrinkage & Distortion in Weldments • Weld Defects • Practical Session • Liberty' Ships, Welding & Metallurgy*
1230 – 1245	*Break*
1245 – 1330	***Non-Destructive Examination*** *Haward Video VWE 11 Non Destructive Testing • Glossary • Quality Control • Standards for NDT • Welding • Inspection Techniques*
1330 - 1420	***Electrochemical Principles*** *Glossary • Overview • Anodes & Cathodes • Electron Flow • Electrolytes*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: ***Monday, 14th of September 2020***

0730 – 0900	***Forms of Corrosion*** *Haward Video VWE 13 Forms of Corrosion Parts 1 & 2 • General Corrosion • Localized Corrosion • Galvanic Corrosion • Dealloying • Intergranular Corrosion Cracking • Stress Corrosion Cracking • Velocity Effects • High Temperature Corrosion • Practical Session • Principles & Forms of Corrosion*
0900 – 0915	*Break*
0915 – 0945	***Passivity & Passive Films on Stainless Steels*** *Review of Fundamentals • Passive Film*
0945 - 1030	***Corrosion by Water & Steam*** *Role of Contaminants • Types of Water • Corrosion Materials • Cooling Systems • Water Treatment • Practical Session • Stress Corrosion Cracking*
1030 – 1230	***Atmospheric Corrosion*** *Types of Corrosion • Change of Environment • Design Considerations*
1230 – 1245	*Break*

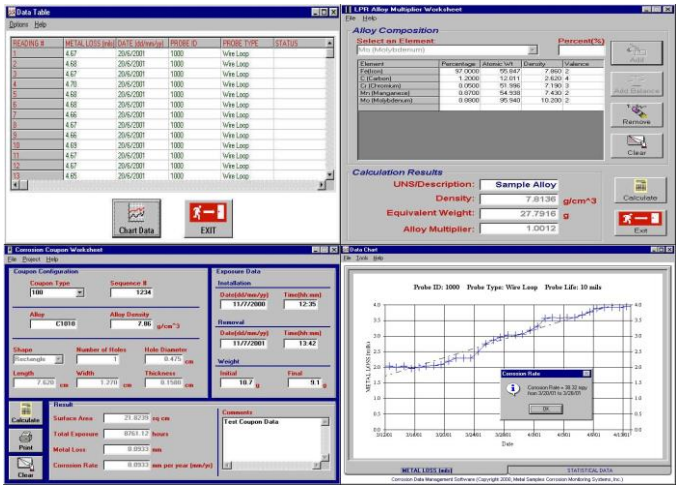
245 – 1420	***Cathodic Protection*** *Haward Video VWE 19 Corrosion & Corrosion Prevention • How Cathodic Protection Works • Galvanic Anodes • Impressed Current Systems • Design of Galvanic System • Theory • Sacrificial Anod System • Compound Current System*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3: ***Tuesday, 15th of September 2020***

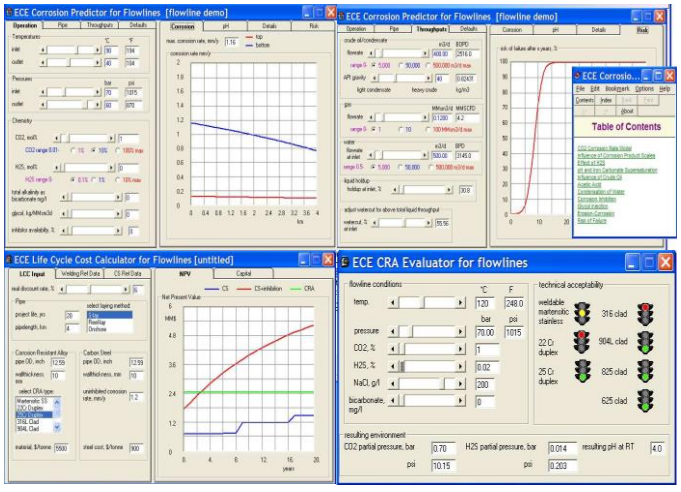
0730 – 0900	***Introduction to Protective Coatings*** *Coating Fundamentals • Types of Coatings • Surface Preparation • Cathodic Protection • Application & Cure • Specification*
0900 – 0915	*Break*
0915 – 0945	***Inhibitors*** *Types of Inhibitors • Aqueous Systems • Other Considerations • Practical Session • Corrosion Fatigue • Protection*
0945 - 1000	***Damage & Failure Mechanisms*** *Ductile & Brittle Fracture • Failure Mechanisms • How Components Fail*
1000– 1045	***Failure Prevention*** *Introduction • Failures • Inspection*
1045 - 1130	***Preventative & Predictive Maintenance*** *Haward Video VRE 3 Preventative & Predictive Maintenance • Process Safety Management • Occupational Health & Safety • Practical Session OSHA 29CFR1910.119(j)*
1130 -1215	***Mechanical Integrity - What OSHA Expects*** *Haward Video VWE 6 Principles of Failure Analysis • Risk Based Inspection • Failure Analysis • Summary • References • Practical Session • Risk Based Inspection – Case Study & Worked Example*
1215 – 1230	*Break*
1230 - 1345	***Codes & Standards*** *International Standards • Industry Standards • Management Models • American Standards • API 579-1/ASME FFS-1*
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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