COURSE OVERVIEW FE0011-4D
Metallurgy, Corrosion, Damage Mechanisms, Failure Investigation & Remaining Life Assessment

Course Title
Metallurgy, Corrosion, Damage Mechanisms, Failure Investigation & Remaining Life Assessment

Course Reference
FE0011-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	May 06-09, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	November 04-07, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

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 Metallurgy, Corrosion, Damage Mechanisms, Failure Investigations and Remaining Life Assessment. It covers the basic metallurgy and heat treatment; the composition and properties of ferrous and non-ferrous metals; the alloying elements and phase diagrams, heat treatment processes and hardening mechanisms; the heat treatment furnaces and equipment, heat treatment standards and quality control; and the surface treatment techniques and application of metallurgy and heat treatment.

During this interactive course, participants will learn the high-temperature corrosion mechanisms that include oxidation, carburization, nitridation, sulfidation corrosion and chloridation corrosion; the high-temperature hydrogen attack (HTHA), corrosion-resistant alloys and high-temperature coatings; inspecting and maintaining high-temperature corrosion; the damage mechanisms, failure investigation techniques, inspection techniques and remaining life assessment for reformer tubes and boiler tubes; the materials and coatings, design considerations, manufacturing and fabrication; and the maintenance strategies and safety considerations for reformer tubes and boiler tubes.

Course Objectives

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

- Apply and gain an in-depth knowledge on metallurgy, corrosion, damage mechanisms, failure investigation and remaining life assessment
- Discuss the basic metallurgy and heat treatment and identify the composition and properties of ferrous and non-ferrous metals
- Illustrate alloying elements and phase diagrams, heat treatment processes and hardening mechanisms
- Recognize heat treatment furnaces and equipment, heat treatment standards and quality control
- Apply surface treatment techniques and metallurgy and heat treatment
- Identify high-temperature corrosion mechanisms that include oxidation, carburization, nitridation, sulfidation and chloridation
- Recognize high-temperature hydrogen attack (HTHA), corrosion-resistant alloys and high-temperature coatings as well as inspect and maintain high-temperature corrosion
- Apply damage mechanisms, failure investigation techniques, inspection techniques and remaining life assessment of reformer tubes and boiler tubes
- Identify materials and coatings, design considerations and manufacturing and fabrication
- Employ maintenance strategies and safety considerations for reformer tubes and boiler tubes

Who Should Attend

This course provides an overview of all significant aspects and considerations of metallurgy, corrosion, damage mechanisms, failure investigation and remaining life assessment for 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.

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**.*

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

Certificates are accredited by the following international accreditation organizations: -

- 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 **2.4 CEUs** (Continuing Education Units) or **24 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.

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. Geoff Kaschula is a **Senior Inspection Engineer** with over **45 years** of extensive experience within the **Oil & Gas**, **Petrochemical**, **Process** and **Power Industries**. His fields of specialization widely cover in the areas of **Design**, **Fabrication**, **Construction**, **Installation**, **Commissioning**, **Inspection** & **Maintenance** of **Process Equipment** such as **Boilers**, **Life Assessment of Boiler Tubes**, **Reformer Tube**, **Pressure Vessels**, **Piping Systems**, **Structures** & **Storage Tanks**; **Condition Assessment** of Rotating & Auxiliary Equipment like **Compressors**, **Steam Turbines**, **Pumps**, **Heat Exchangers** & **Valves**; Risk Based Inspection (**RBI**), Fitness-For-Service (**FFS**), **In-Service Inspection & Condition** Assessment, **Steam Drums & Pressure Vessels**, **Tanks**, **Piping** Inspection, **Welding & Fabrication** Engineering, **Welding** Technology, Fabrication, **Welding** Inspection, **High Temperature Corrosion**, Advanced Integrity Management for **Corrosion** & Inspection, **Corrosion and Metallurgy**, **Basic Metallurgy**, **Heat Treatment**, **Failure Analysis**, Flaw Evaluation, Remnant Life Determination, Capacity Reviews for Process and Power Equipment, Asset Management and Project Management. He has also worked extensively with international industry standards such as ASME VIII div 1 & 2, TEMA, BS/EN 13445, BS/EN 12952, API 650, API 653, ANSI B31.1, ANSI B31.3, PD5500, AWS D1.1, SANS 10162, just to name a few. Mr. Kaschula is currently the **Director** of **RBI-Asset Management** wherein he provides technical support and consultancy services in the field of physical infrastructure asset management.

During his career life, Mr. Kaschula has gained his practical and field experience through his various significant positions and dedication as the **Director/Owner**, **Project Manager**, **QE Division Manager**, **Resident Inspection Engineer**, **Refurbishment Inspection Engineer**, **Inspection Engineer**, **Welding Engineer**, **QA/QC Engineer**, **Appointed Statutory Management Representative**, **Technical Assessor** and **Senior Instructor/Trainer** for numerous international companies like the Parsons Brinckerhoff Africa, Weltech CC., Projects Expedited (Pty) Ltd., Airtec Davidson (Pty) Ltd. and Hubert Davies,
Arnot & Hendrina Power Station, Projects Expedited, Airtech Davidson & the Department of Transport.

Mr. Kaschula has a **National Diploma** (**Welding Engineer**) and a **Registered Professional Technologist** and **International Welding Technologist**. Further, he is a **Certified Instructor/Trainer**, a **Certified API 510 Pressure Vessel Inspector**, a **Certified API 570 Piping Inspector**, a **Certified API 580 Risk Based Inspector**, a **Registered Inspector** & **Competent Person** for Boilers, Pressure Vessels & Pressure Equipment, an ISO 9001 Lead Auditor and a member of South African Institute of Welding. He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

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

Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	US$ **4,500** per Delegate **+ VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course 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 – 0900	***Basic Metallurgy & Heat Treatment*** *Introduction to Metallurgy • Composition & Properties of Ferrous Metals*
0900 - 0930	***Basic Metallurgy & Heat Treatment (cont'd)*** *Composition & Properties of Non-Ferrous Metals • Alloying Elements & Phase Diagrams*
0930 – 0945	*Break*
0945 – 1030	***Basic Metallurgy & Heat Treatment (cont'd)*** *Heat Treatment Processes • Hardening Mechanisms*
1030 – 1230	***Basic Metallurgy & Heat Treatment (cont'd)*** *Heat Treatment Furnaces & Equipment • Heat Treatment Standards & Quality Control*
1230 – 1245	*Break*

1245 – 1420	***Basic Metallurgy & Heat Treatment (cont'd)*** *Surface Treatment Techniques • Applications of Metallurgy & Heat Treatment*
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 Corrosion Mechanisms such as Oxidation, Carburization, Nitridation, HTHA, etc.*** *High-Temperature Corrosion • Oxidation Corrosion*
0830 - 0930	***High-Temperature Corrosion Mechanisms such as Oxidation, Carburization, Nitridation, HTHA, etc. (cont'd)*** *Carburization Corrosion • Nitridation Corrosion*
0930 – 0945	*Break*
0945 – 1100	***High-Temperature Corrosion Mechanisms such as Oxidation, Carburization, Nitridation, HTHA, etc. (cont'd)*** *Sulfidation Corrosion • Chloridation Corrosion*
1100 – 1230	***High-Temperature Corrosion Mechanisms such as Oxidation, Carburization, Nitridation, HTHA, etc. (cont'd)*** *HTHA (High-Temperature Hydrogen Attack) • Corrosion-Resistant Alloys*
1230 – 1245	*Break*
1245 – 1420	***High-Temperature Corrosion Mechanisms such as Oxidation, Carburization, Nitridation, HTHA, etc. (cont'd)*** *High-Temperature Coatings • Inspection & Maintenance of High-Temperature Corrosion*
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	***Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection & Remaining Life Assessment*** *Reformer Tubes • Reformer Tube Damage Mechanisms*
0830 - 0930	***Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection & Remaining Life Assessment (cont'd)*** *Failure Investigation Techniques • Inspection Techniques for Reformer Tubes*
0930 – 0945	*Break*

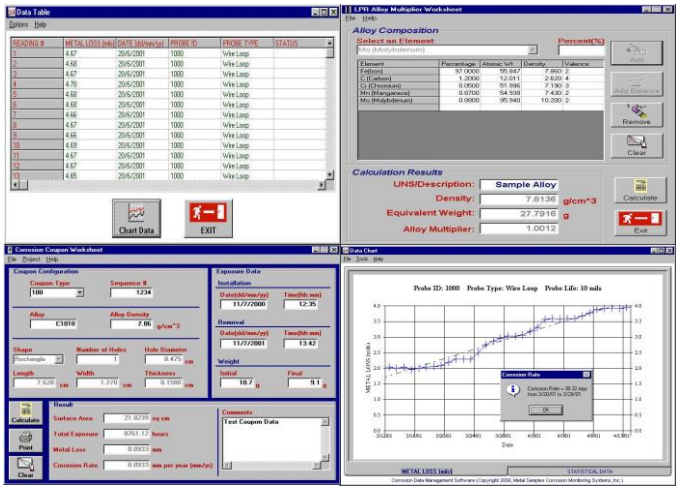
0945 – 1100	***Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection & Remaining Life Assessment (cont'd)*** *Remaining Life Assessment for Reformer Tubes • Reformer Tube Materials & Coatings*
1100 – 1230	***Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection & Remaining Life Assessment (cont'd)*** *Design Considerations for Reformer Tubes • Manufacturing & Fabrication of Reformer Tubes*
1230 – 1245	*Break*
1245 – 1420	***Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection & Remaining Life Assessment (cont'd)*** *Maintenance Strategies for Reformer Tubes • Safety Considerations for Reformer Tubes*
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

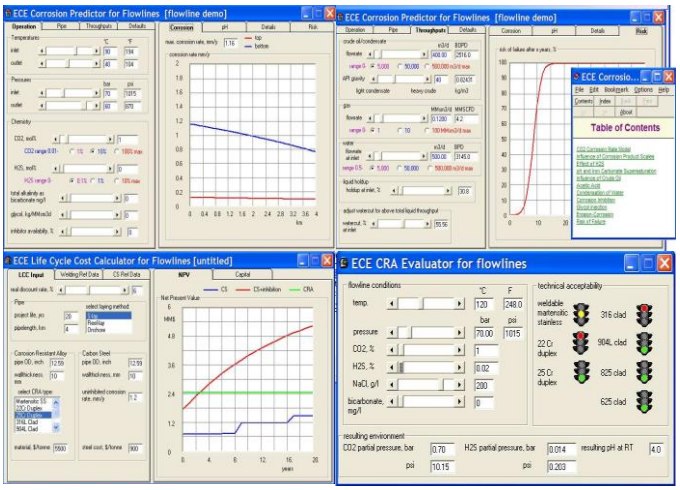
0730 – 0830	***Remaining Life Assessment of Boiler Tubes*** *Boiler Tubes • Boiler Tube Damage Mechanisms*
0830 - 0930	***Remaining Life Assessment of Boiler Tubes (cont'd)*** *Failure Investigation Techniques • Inspection Techniques for Boiler Tubes*
0930 – 0945	*Break*
0945 – 1100	***Remaining Life Assessment of Boiler Tubes (cont'd)*** *Materials & Coatings for Boiler Tubes*
1100 – 1230	***Remaining Life Assessment of Boiler Tubes (cont'd)*** *Design Considerations for Boiler Tubes • Manufacturing & Fabrication of Boiler Tubes*
1230 – 1245	*Break*
1245 – 1345	***Remaining Life Assessment of Boiler Tubes (cont'd)*** *Maintenance Strategies for Boiler Tubes • Safety Considerations for Boiler Tubes*
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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