



## COURSE OVERVIEW TE0010-3D Boiler Water Treatment Technology

### Course Title

Boiler Water Treatment Technology

### Course Date/Venue

August 04-06, 2020/Boardroom 3, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

### Course Reference

TE0010-3D

### Course Duration/Credits

Three days/1.8 CEUs/18 PDHs



### Course Description



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



This course will provide a comprehensive review of the principles of boiler water conditioning. The ASME and EPRI Boiler Chemistry Guidelines will be covered. Oxygen control by means of deaeration and chemical treatment will be reviewed. Boiler design principles will be developed, including heat transfer, circulation effects, and high-pressure requirements. The special requirements of HRSGs will be reviewed in depth.



The chemistry and control of phosphates, chelant, and sludge conditions will be reviewed in depth. Problems and solutions associated with steam purity and condensate corrosion will be covered in detail with several practical examples. Guidelines for chemical cleaning will be developed.

The discussion of the metallurgical analysis of failed boiler tubes includes a workshop. The course concludes with destructive and non-destructive options for boiler tube inspection.



Ion exchange is a critical unit process in purifying water for steam generation, semiconductor manufacture, and pharmaceutical applications. The course reviews resin structure, function, and the gamut of water purification applications from softening to the preparation of ultra-quality water. The course has been modified to focus on monitoring performance and reacting to system upsets (troubleshooting).

Upon completion of this course, participants will have an understanding of the chemistry of boiler water treatment for scale, corrosion, and carryover control, treatment options for the gamut of industrial boiler system pressures, the options and precautions associated with boiler chemical cleaning, and metallurgical analysis of failed boiler specimens. Further, participants will have a strong understanding of the chemistry of ion exchange resins and the operation of systems using ion exchange resins for water purification, including system and vessel design parameters. The course also provides practical options to use when troubleshooting resin-based systems.

### **Course Objectives**

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

- Apply and gain an in-depth knowledge on boiler water treatment technology
- Discuss the properties, resources, chemistry of water and the elements of contaminated water
- Explain the three phases of water treatment and the pretreatment for control of scale
- Discuss the pretreatment requirements for ion exchange as well as synthesis, types, water hydration and commercial equivalents of ion exchange resins
- Describe the equipment, service and regeneration reactions and troubleshooting of ion exchange softening
- Explain the purpose of ion exchange dealkalizers, decarbonators and degassifiers
- Explain the process of two bed demineralization and mix beds as well as troubleshooting methods
- Carry out resin testing, pre-treatment for corrosion control, oxygen control and deaeration
- Perform corrosion control, deposition control and boiler system testing
- Discuss chemical cleaning of boilers, condensate corrosion, heat recovery system generators, failure analysis and boiler tube testing

### 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 an overview of all significant aspects and considerations of boiler water treatment technology for utility superintendents, power house supervisors and plant engineers. Further, foremen/women and shift supervisors will also gain job enrichment by understanding the importance of water treatment equipment, early detection of problems and operator training techniques. Those in a design capacity at architect-engineering firms will find merit in the review of the technology. At the corporate level, this course provides a comprehensive update for company water consultants or engineering review committee members. The course is especially valuable for engineers working on plant expansions, since technology trends are reviewed. Special emphasis has been added on cogeneration and combined cycle systems. Further, R&D, laboratory and corrosion professionals will highly benefit from this course.

### 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 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.

### 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: -

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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.

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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. Yousef Al-Mashni, PhD, MSc, BSc, is an International Expert in Analytical Laboratory & Waste Water Treatment with over 35 years of extensive experience. He is an authority in Water and Waste Water Treatment, Water Quality Management, Hydraulic Network System, Water Pipeline System, Water Distribution System, Industrial Water Management, Industrial Water Management, Water Analysis & Reporting, Water Sampling & Testing, Water Analyzer, Helmith Ova & Salmonella in Waste Water, Sludge, Microbiological**

**Aspects & Analysis of Wastewater, Laboratory Equipment, Laboratory Quality Management Systems (ISO 17025 and ISO 15189), Lab Safety & Health, Good Laboratory Practice (GLP) and Safety Procedure in Laboratories. His wide expertise also covers, Medical Laboratory Auditing, ISO 15489, Infection Control, Internal Quality Control for Microbiologists, Analytical Techniques, Biochemical, Hematological, Parasitological, Biochemical, Microbiological & Serological Analysis of Clinical Specimens, Microbiology of Wetlands, Microbiological Indoor Air Quality, Entrococcus, Pseudomonas & Aeromonas, Sulfate Reducing Bacteria, Fluorescence Microscopy, Planktology of Ambient Environment, Oral, Medical & Diagnostic Microbiology and Oral & Dental Hygiene. He is currently the Deputy Principal & Chief Technical Instructor of UNRWA wherein he is responsible in developing and managing operations at the college/centre including building workshops and laboratories capacity, curriculum development and introducing new courses.**

During his long career life, Dr. Yousef worked for many international companies handling key positions such as ICDL Centre **Manager, Deputy Principal, Chief Technical Instructor, Acting Principal, Laboratory Supervisor, Technical Instructor, Technical & Vocational Instructor, Senior Medical Laboratory Technician and Medical Laboratory Technician.**

Dr. Yousef has a **PhD degree in Natural Health Sciences from the University of Florida (USA), Master degree in Clinical Microbiology and Bachelor degree with Honours in Microbiology. Further, he has Diploma in Vocational Education (UNRWA & UNESCO) and received several certifications like ICDL and Training of Trainers (TOT) in Cambridge University (England). He is an active member of Jordan Medical Laboratories Society, Technical Accreditation Committee of Medical Laboratories (Jordan Institution & Metrology) and the Technical Accreditation Committee for Granting ISO 15189 Certificate. Furthermore, he has also published numerous technical papers and books including Medical & Diagnostic Microbiology, Practical Competencies in Medical Laboratory Technology, Safety in Medical Laboratory Science and Quality Control in Medical Laboratory Science just to name a few.**



**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: Tuesday, 04<sup>th</sup> of August 2020**

0730 - 0745	Registration & Coffee
0745 - 0800	Welcome & Introduction
0800 - 0815	<b>PRE-TEST</b>
0815 - 0845	<b>Water</b> Properties • Water Resources • Water Contamination • Water Chemistry • Solutions & Mixtures • Corrosive Properties of Water
0845 - 0915	<b>Scale Formation</b> Mechanisms & Chemistry • Boiler Water Quality Requirements
0915 - 0930	Break
0930 - 1000	<b>Three Phases of Water Treatment</b> Pre-treatment • Internal Treatment • Blowdown
1000 - 1030	<b>Pre-Treatment for Control of Scale</b> Distillation • Reverse Osmosis • Ion Exchange
1030 - 1100	<b>Distillation</b> Boiling Water for a Boiler
1100 - 1130	<b>Reverse Osmosis</b>
1130 - 1200	<b>Introduction to Ion Exchange</b> Water Chemistry Units • Pre-treatment Requirements of Ion Exchange
1200 - 1230	<b>Ion Exchange Resins</b> Synthesis • Types • Water of Hydration • Commercial Equivalents
1230 - 1245	Break
1245 - 1330	<b>Ion Exchange Softening</b> Equipment • Service & Regeneration Reactions • Troubleshooting
1330 - 1400	<b>Ion Exchange Dealkalizers</b> Purpose & Comparison
1300 - 1420	<b>Decarbonators &amp; Degassifiers</b> Purpose & Comparison
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2: Wednesday, 05<sup>th</sup> of August 2020**

0730 - 0800	<b>Condensate Polishing</b> Powdered Resin Units • Magnetic Filtration
0800 - 0830	<b>Two-Bed Demineralization</b> Equipment • Service and Regeneration Reactions • Performance Expectations • Exhaustion Profiles • Distributor Design • Regenerant Dilution Systems
0830 - 0900	<b>Mixed Beds</b> Makeup Mixed Beds • Condensate Mixed Beds • Performance Expectations • Regeneration Protocols • Three Component Systems • Uniform Particle Size Resins
0900 - 0930	<b>Troubleshooting Demineralizers</b> Short Run • Poor Water Quality • Resin Problems
0930 - 0945	Break





0945 – 1015	<b>Resin Testing</b> Vessel Inspection • Sample Procurement • Interpretation of Resin analysis • Decision to Clean or Replace
1015 – 1045	<b>Pre-Treatment for Corrosion Control</b> Requirements for Different Boilers
1045 – 1115	<b>Oxygen Control</b> Deaeration • Types of Deaerators
1115 – 1145	<b>Deaeration</b> Operating Sequences • Problems • Temperature Guidelines
1145 – 1230	<b>Individual Conferences</b> Water & Resin Analysis
1230 – 1245	Break
1245 – 1330	<b>Principles of Internal Treatment</b> Boiler Design & Heat Flux • Circulation
1330 – 1430	<b>Corrosion Control</b> Cast Iron Boilers • Oxygen Control • Chemical Scavenging • High Pressure - Coordinated Phosphate/pH • Congruent Control • Hydrazine
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Two

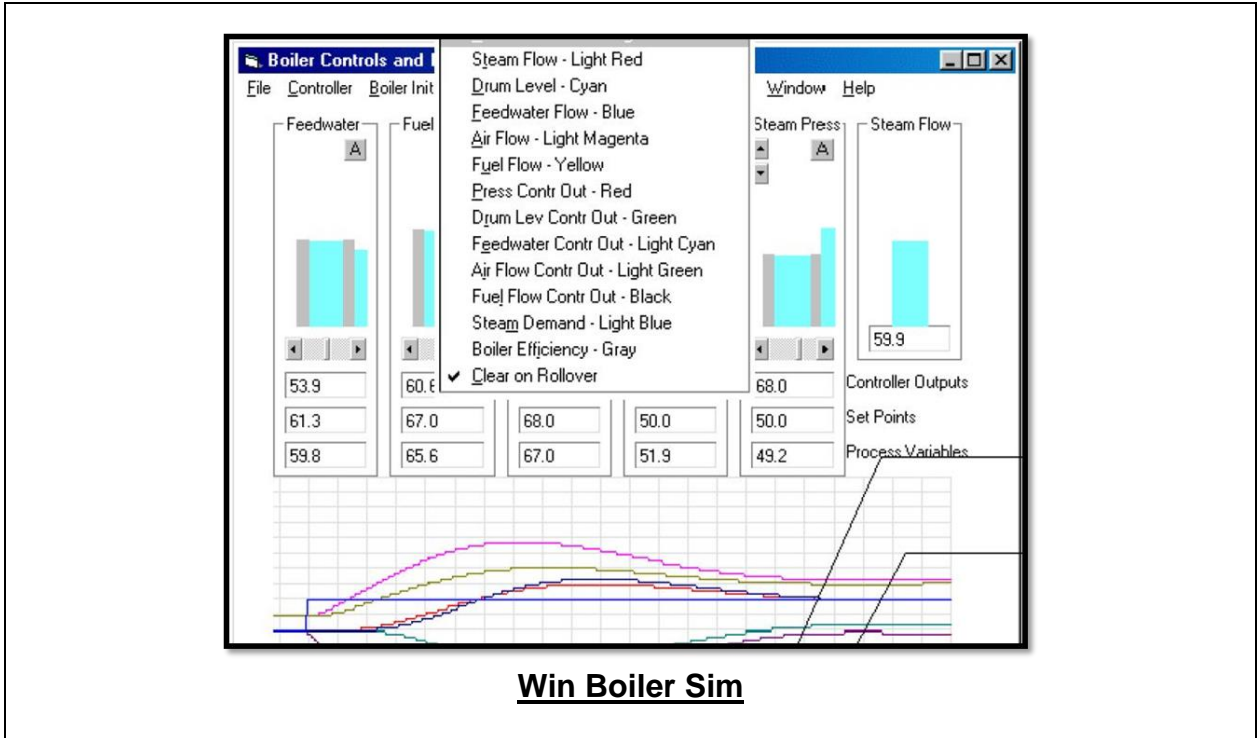
**Day 3: Thursday, 06<sup>th</sup> of August 2020**

0730 – 0800	<b>Deposition Control</b> Low pressure – Phosphates • Chelants • Dispersants • Iron Deposition • Dispersants
0800 – 0830	<b>Boiler Systems Testing</b> Sampling and Analysis
0830 – 0900	<b>Carry-Over Control</b> Carryover Mechanisms • Steam Purification • Monitoring Carryover • Clean Steam Systems
0900 – 0915	Break
0915 – 1015	<b>Boiler Calculations</b> Cycles of Operation • Blowdown Monitoring
1015 – 1100	<b>Chemical Cleaning of Boilers</b> Commissioning Cleaning • Deposit Monitoring • Deposit Removal
1100 – 1145	<b>Condensate Corrosion</b> Corrosion Mechanisms • Amine Treatment • Testing
1145 – 1215	<b>Heat Recovery Steam Generators</b> Flow and Load Considerations • Multiple Pressure System Chemistries
1215 – 1245	<b>Failure Analysis</b> Boiler Tube Failure Modes • Metallurgical Analysis • Metallurgical Workshop
1245 – 1300	Break
1300 – 1330	<b>Boiler Tube Testing</b> Destructive Sampling and Non-destructive Testing Methods • Visual Boiler Inspection
1330 – 1345	<b>Summary, Open Forum &amp; Closure</b>
1345 - 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course



**Simulator (Hands-on Practical Sessions)**

Practical session 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 simulator “Win Boiler Sim”.



**Course Coordinator**

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