



COURSE OVERVIEW TE0085

Reverse Osmosis

Course Title

Reverse Osmosis

Course Date/Venue

February 08-12, 2026/Crowne Meeting Room,
Crowne Plaza Al Khobar, an IHG Hotel, Al
Khobar, KSA

Course Reference

TE0085

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.

Reverse osmosis is rapidly growing as a water treatment technology used for many applications, such as boiler feed water and recovering wastewater for reuse. This “green” technology is becoming more and more widely used in many settings, especially in industry. Even as the technology becomes more widespread, the understanding of the technology is lagging behind.



The course is designed to provide delegates with a detailed and up-to-date overview of RO water desalination. The course will cover reverse osmosis; the different RO and NF membrane processes which include membrane module configurations, RO pressure tube construction, typical RO membrane pressure vessel, etc.; the different RO water chemistry which includes alkalinity, bicarbonate, color, conductivity, nitrate, pH, SDI (Silt Density Index), temperature, etc.; the hyperfiltration of RO and NF membranes processes, applications of membrane processes and the mode of operation of NF and RO; and the design of reverse osmosis by taking note of performance parameters in RO and design parameters affecting performance.





The course will further discuss the hydraulics design limits of RO plants and become familiar with the terms and equations used in reverse osmosis; the corrective measures and fouling control for fouling of MF and UF systems and illustrate the proper cleaning of these MF and UF systems; the system components, concentrate recirculation, concentrate staging and flow distribution of the flow configuration of RO water desalination; the need for membrane performance normalization, RO cleaning in place (CIP) system, NF/RO processes, pre-treatment and electro dialysis reversal; and the proper troubleshooting of RO plants, list ways to avoid trouble, identify problems and come up with an RO troubleshooting matrix

Course Objectives

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

- Apply and gain an in-depth knowledge on RO water desalination
- Define reverse osmosis and illustrate the different RO and NF membrane processes which include membrane module configurations, RO pressure tube construction, typical RO membrane pressure vessel, etc.
- Enumerate the different RO water chemistry which includes alkalinity, bicarbonate, color, conductivity, nitrate, pH, SDI (Silt Density Index), temperature, etc.
- Discuss hyperfiltration of RO & NF membranes processes, applications of membrane processes and the mode of operation of NF & RO
- Acquire knowledge on the design of reverse osmosis by taking note of performance parameters in RO and design parameters affecting performance
- Explain the hydraulics design limits of RO plants and become familiar with the terms and equations used in Reverse Osmosis
- Apply corrective measures and fouling control for fouling of MF and UF systems and illustrate the proper cleaning of these MF and UF systems
- Discuss the system components, concentrate recirculation, concentrate staging and flow distribution of the flow configuration of RO water desalination
- Recognize the need for membrane performance normalization, RO cleaning in place (CIP) system, NF/RO processes, pre-treatment and electro dialysis reversal
- Illustrate the proper troubleshooting of RO plants, list ways to avoid trouble, identify problems and come up with an RO troubleshooting matrix

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 covers systematic techniques and methodologies on RO water desalination for engineers, scientists and technologists involved in the planning, management and operation of water treatment plants.

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:



Mr. Emam Bakr, BSc, NEBOSH-PSM, is a NEBOSH Approved Instructor and a Senior Corrosion Engineer with over 25 years of industrial experience within the Petroleum, Oil & Gas industries. His wide expertise widely covers in the areas of Pipes & Pipeline Control, Troubleshooting & Repair, Pipeline Integrity, Pipeline Operation & Maintenance, Water Distribution Techniques, Water Pipe Networks, Oily Water Treatment Technology, Water Desalination, Waste Water Treatment Operation & Process, Oil Refinery & Petrochemical Industry Wastewater Treatment, Boiler Feed Water

Treatment, Corrosion Management & Monitoring and Water Injection Treatment, Oil & Water, Corrosion & Corrosion Protection, NEBOSH Certificate in Process Safety Management, Advanced Internal Corrosion in Pipelines, Basic of Corrosion, CIP level 1 & 2, API 570 Piping Inspection, API 510 Pressure Vessel Inspection, API 653 Storage Tank Inspection, API Lead Auditor, API 580 Risk Base Inspection, Startup & Commissioning, Corrosion Control by Cathodic Protection, Corrosion Control & Corrosion Monitoring, Metallurgy & Metallurgical Processes, Material Selection, Corrosion Monitoring Prevention & Control, Corrosion Prevention & Control, Corrosion Management in Production/Processing Operations, Corrosion Prevention in Oil and Gas Industry, Corrosion Inhibitor, Corrosion Technology & Inspection, Corrosion Control in Gas, Oil & Water, Corrosion & Corrosion Protection, Corrosion Prevention, Corrosion Assessment, Condition Monitoring & Assessment, Pipeline Corrosion Inspection, Pipeline Design & Construction, Pipeline Engineering, Pipeline Integrity, Pipeline Operations & Maintenance. His wide range of industrial experience also covers Cathodic Protection, Offshore Structure & Facilities, Onshore Facilities & Storage Tanks, Corrosion Management & Monitoring and Water Injection Treatment. Further, he is also well-versed in, HAZOP and HAZID, HAZMAT, Hazard & Risk Assessment, Emergency Response Procedures Behavioural Based Safety (BBS), Confined Space Entry, Fall Protection, Emergency Response, H₂S, Advanced Process Safety Management, Liquefaction of Natural Gases (LONG), Water Desalination, Boiler Feed Water Treatment, Absorption & Stripping, Acid Gas Removal, Gas Conditioning & Processes, Steam Boiler and Hazardous Waste Management.

During his career life, Mr. Emam has gained his practical and field experience through his various significant positions and dedication as the **General Manager Assistant, Corrosion & Material Team Leader, Pipeline Engineer, Integrity Engineer, Chemical Engineer and Senior Instructor/Consultant** from various international companies such as Gulf of Suez Petroleum Company, Gupco Ras Shukeir Oil Fields and Kafer Eldour Spinning Company.

Mr. Emam has a **Bachelor's** degrees in **Chemical Engineering**. He is a **Senior Internal Corrosion Technologist** of the **National Association of Corrosion Engineers (NACE-USA)**, a **Certified CSWIP Plant Inspector Level 1 through (TWI)**, **Certified API 570 Piping Inspector, Certified API 510 Pressure vessels inspection, Certified API 580 Risk Base Inspection, Certified API 653 Above Ground Storage Tank Inspection, a Certified NEBOSH Process Safety Management** and has further delivered numerous courses, trainings, seminars and conferences 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

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.

Accommodation

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

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, 08th of February 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	What is Reverse Osmosis? Historical Background • What is Semi-Permeable? • What is Osmosis? • Reverse Osmosis • Principles of Natural Osmoses • Principles of Reverse Osmosis
0930 – 0945	Break
0945 – 1130	RO & NF Membranes Processes Cellulose Acetate (CA) Membrane • Composite Aromatic Polyamide (CAP) Membrane • Membrane Module Configurations • Hollow Fiber RO Membrane
1130 - 1230	RO & NF Membranes Processes (cont'd) Spiral Wound RO Membrane • Spiral Wound Membrane Element • Cut-Out View of Spiral Wound Membrane Element • RO Pressure Tube Construction
1230 – 1245	Break
1245 – 1420	RO & NF Membranes Processes (cont'd) RO Flow Path • RO Pressure Vessel with a Flow Path Identified • Typical RO Membrane Pressure Vessel • Typical RO system and Components
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, 09th of February 2026

0730 – 0930	RO Water Chemistry Alkalinity • Minerals • Bicarbonate • BOD (Biological Oxygen Demand) • Brackish Water • Carbon Dioxide • COD (Chemical Oxygen Demand) • Color • Conductivity
0930 – 0945	Break
0945 – 1130	RO Water Chemistry (cont'd) Grains (Per Gallon) • Ionic Strength • LSI (Langlier Saturation Index) • Milli-Equivalent • Milligram per liter • Nitrate • Osmotic Pressure • pH • ppb (parts per billion)
1130 - 1230	RO Water Chemistry (cont'd) ppm (parts per million) • ppm as CaCO ₃ • SDI (Silt Density Index) • SDSI (Stiff Davis Saturation Index) • TDS (Total Dissolved Solids) • Temperature • TOC (Total Organic Carbon) • Turbidity
1230 – 1245	Break
1245 – 1420	Overview of RO & NF Membranes Hyperfiltration (RO & NF) Processes • Synthetic membrane Filtration Reminder • Applications of Membrane Processes • Mode of Operation NF & RO • NF/RO Processes
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, 10th of February 2026

0730 – 0930	Design of Reverse Osmoses RO Design Steps • RO Design Using Software • Performance Parameters in RO • Design Parameters Effecting Performance
0930 – 0945	Break
0945 – 1130	Hydranautics Design Limits Average Flux Rates & Expected % Decrease in Flux Per Year • Expected % Salt Passage Increase Per Year • Maximum Feed Flow and Minimum Concentrate Flow Rates Per Vessel
1130 - 1230	Hydranautics Design Limits (cont'd) Saturation Limits for Sparingly Soluble Salts in the Concentrate • Limits of Saturation Indices
1230 – 1245	Break
1245 – 1420	Terms and Equations of Reverse Osmosis Osmotic Pressure • Water Transport • Salt Transport • Salt Passage • Salt Rejection • Permeate Recovery Rate (Conversion) • Concentration Polarization
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, 11th of February 2026

0730 – 0930	Fouling of MF & UF Systems Fouling of Membranes Systems • Common Foulants & Scalants in Feed Water • Membrane Fouling Types
0930 – 0945	Break
0945 – 1130	Fouling of MF & UF Systems (cont'd) Membrane Fouling & Scaling Effects • Fouling Control
1130 - 1230	Flow Configuration System Components • Concentrate Staging and Pyramid Design • Concentrate Recirculation
1230 – 1245	Break
1245 – 1420	Flow Configuration (cont'd) Concentrate Staging • Flow Distribution • Permeate Staging
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

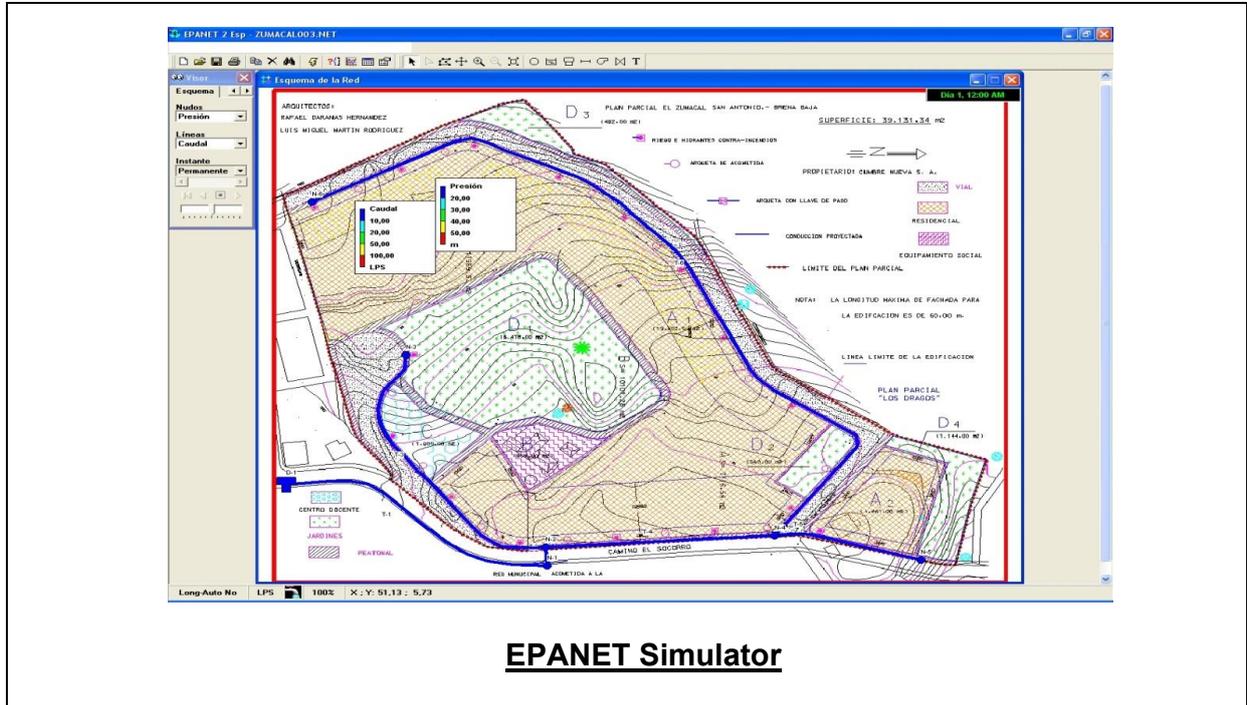
Day 5: Thursday, 12th of February 2026

0730 – 0930	Membrane Performance Normalization What is Membrane Performance Normalization? • Membrane Fouling & Scaling Effects • Fouling Control • RO Cleaning in Place (CIP) System
0930 – 0945	Break
0945- 1130	Membrane Performance Normalization (cont'd) NF/RO Processes, Pre-Treatment • RO Processes • Electrodialysis • Electrodialysis Reversal
1130 – 1230	Cleaning of MF & UF Systems Data Monitoring • Cleaning System Specifications • Cleaning Procedures • List of TSB's • Storage TSB's
1230 – 1315	Break
1315 – 1345	Troubleshooting RO Plant How to Avoid Trouble • Identifying a Problem • Questions to Ask • RO Troubleshooting Matrix
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 latest revision of “EPANET” simulators.



Course Coordinator

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