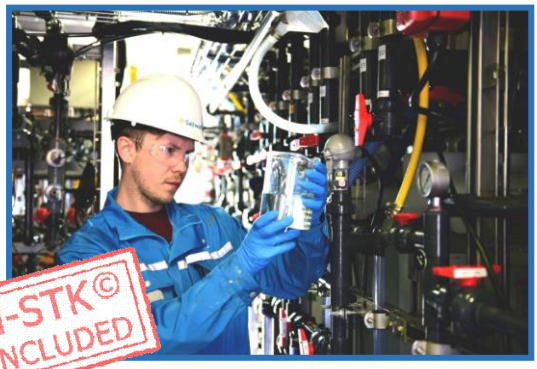
COURSE OVERVIEW TE0305
RO and Desalination Technologies

Course Title
RO and Desalination Technologies

Course Date/Venue
Session 1: August 11-15, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 15-19, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE



Course Reference
TE0305

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.

This course is designed to provide participants with a detailed and up-to-date overview of RO and Desalination Technologies. It covers the importance and application of desalination, types of desalination technologies, global desalination capacity and demand and economic considerations in desalination; the principles of reverse osmosis (RO), desalination process flow, types of desalination technologies and challenges in desalination; the factors influencing plant design, RO plant capacity considerations, layout and components of RO plants; and the integration with existing water infrastructure.

Further, the course will also discuss the types of membranes, membrane structure and function; the selection criteria for RO membranes as well as membrane cleaning and maintenance; the RO feed water quality covering water quality parameters, pre-treatment requirements for feed water and monitoring feed water quality for system optimization; the energy consumption in RO systems, types of energy recovery devices, efficiency of energy recovery systems and cost implications of energy recovery in desalination; the function of pumps in RO systems and selection of pumps for high-pressure applications; and the pressure vessels design, material considerations and maintenance and operational issues.

During this interactive course, participants will learn the post-treatment and distribution, operational monitoring and control and pre-treatment techniques in desalination; the types of fouling an RO membrane, fouling mitigation, membrane cleaning and monitoring fouling and scaling; the effect of fouling on RO performance, energy efficiency in desalination, zero liquid discharge (ZLD) systems and hybrid desalination systems; the methods for brine disposal, brine concentration and crystallization and sustainable brine management technologies; the environmental impact assessment of desalination plants and regulatory frameworks for environmental protection; the desalination research future trends, desalination project management and desalination in arid regions; and the operational optimization of RO plants, scaling up desalination plants and cost and financial considerations

Course Objectives

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

- Apply and gain an in-depth knowledge on RO and desalination technologies
- Discuss the importance and application of desalination, types of desalination technologies, global desalination capacity and demand and economic considerations in desalination
- Employ the principles of reverse osmosis (RO), desalination process flow, types of desalination technologies and challenges in desalination
- Identify the factors influencing plant design, RO plant capacity considerations, layout and components of RO plants and integration with existing water infrastructure
- Recognize the types of membranes, membrane structure and function and selection criteria for RO membranes as well as apply membrane cleaning and maintenance
- Carryout RO feed water quality covering water quality parameters for RO systems, pre-treatment requirements for feed water and monitoring feed water quality for system optimization
- Recognize energy consumption in RO systems, types of energy recovery devices, efficiency of energy recovery systems and cost implications of energy recovery in desalination
- Identify the function of pumps in RO systems, selection of pumps for high-pressure applications, pressure vessels design and material considerations and maintenance and operational issues
- Apply post-treatment and distribution, operational monitoring and control and pre-treatment techniques in desalination
- Recognize the types of fouling an RO membrane and apply fouling mitigation, membrane cleaning and monitoring fouling and scaling
- Identify the effect of fouling on RO performance, energy efficiency in desalination, zero liquid discharge (ZLD) systems and hybrid desalination systems
- Apply methods for brine disposal, brine concentration and crystallization and sustainable brine management technologies
- Carryout environmental impact assessment of desalination plants and regulatory frameworks for environmental protection
- Discuss desalination research future trends, desalination project management and desalination in arid regions
- Apply operational optimization of RO plants, scaling up desalination plants and cost and financial considerations

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 provides an overview of all significant aspects and considerations of RO and desalination technologies for utility and facility managers, project managers, water treatment plant operators, engineers and technicians, environmental professionals, government and regulatory officials, consultants and system designers, industrial water users and technical staff.

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 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: -

- 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.

- 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. Karl Thanasis, PEng, MSc, MBA, BSc, is a **Senior Water Engineer** with over **45 years** of practical experience within the **Oil**, **Gas**, **Refinery**, **Petrochemical**, **Utilities** and related industries. His expertise widely includes in the areas of **Water Distribution** System, **Water Reservoir**, **Water Tanks**, **Water Pumping Station**, **Water Network** System, **Water Pipes & Fittings**, **Water Hydraulic** Modelling, **Water Network Hydraulic** Simulation Modelling, **Water Balance** Modelling, **Water Distribution Network**, **Water Network** System Design, **Water Network System** Analysis, **Water Forecasts** Demand, **Water Network** System Extension, **Water Network** System Replacement & Upgrade, **Water Networks** Optimization, **Water Distribution Systems & Pumping Stations**, **Reservoirs & Pumping Stations** Design & Operation, **Water Reservoirs & Pumping Stations**, **Water Storage Reservoir**, **Pumping** Systems, Interconnecting Pipelines, **Pump** Houses & Booster Pumping Stations, **Water Pipelines** Materials & Fittings, **Waste Water Effluent Treating** Facilities, **Sewage & Industrial Waste Water** Treatment & Environmental Protection Best Practices, **Oily Water Treatment Technology**, **Water Equipment** Selection & Inspection, **Effluent Treatment & Slurry Handling**, **Water Testing & Commissioning** Techniques, **Wastewater** Treatment, **Water Supply** Design, **Potable Water** Transmission, Districts Meters Areas (**DMA**s), **Water Supply & Desalination** Plants Rehabilitation, **Water Supply & Distribution Systems** Efficiency & Effectiveness, **Water Treatment** Technology, **Reverse Osmosis**, **MSF Plants**, **Industrial Water Treatment** in Refineries & Petrochemical Plants, **Piping System**, **Water Movement**, **Water Filtering**, **Mud Pumping**, **Sludge Treatment** and **Drying**, **Aerobic Process** of **Water Treatment** that includes **Aeration**, **Sedimentation** and **Chlorination Tanks**. His strong background also includes **Design** and **Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps**, **Filters**, **Metering Pumps**, **Aerators** and **Sludge Decanters**.

Mr. Thanasis has acquired his thorough and practical experience as the **Water Engineer**, **Project Manager**, **Plant Manager**, **Area Manager - Equipment Construction**, **Construction Superintendent**, **Project Engineer**, **Design Engineer**, **Mechanical Engineer**, **Maintenance Engineer** and **Senior Instructor/Lecturer**. His duties covered **Plant Preliminary Design**, **Plant Operation**, **Write-up** of **Capital Proposal**, **Investment Approval**, **Bid Evaluation**, **Technical Contract Write-up**, **Construction** and **Sub-contractor Follow up**, **Lab Analysis**, **Sludge Drying** and **Management** of **Sludge Odor** and **Removal**. He has worked in various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has a **Master's** and **Bachelor's** degree in **Mechanical Engineering** with **Honours** from the **Purdue University** and **SIU** in **USA** respectively as well as an **MBA** from the **University of Phoenix** in **USA**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) and delivered numerous courses, trainings, conferences, seminars and workshops internationally.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop 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	***Overview of Desalination*** *Importance and Applications of Desalination • Types of Desalination Technologies • Global Desalination Capacity and Demand • Economic Considerations in Desalination*
0930 – 0945	*Break*
0945 – 1030	***Principles of Reverse Osmosis (RO)*** *Basic Working Principle of RO • Membrane Filtration Concept • Osmotic Pressure and its Relevance in RO • Types of RO Membranes used in Desalination*
1030 – 1130	***Desalination Process Flow*** *Pretreatment Process Before Desalination • Membrane Desalination Stages • Post-Treatment of Desalinated Water • Energy Consumption in Desalination Plants*
1130 – 1230	***Types of Desalination Technologies*** *Multi-Stage Flash Distillation (MSF) • Multi-Effect Distillation (MED) • Reverse Osmosis (RO) • Electrodialysis (ED)*
1230 – 1245	*Break*
1245 – 1330	***Challenges in Desalination*** *High Energy Consumption • Environmental Impact (Brine Disposal) • Membrane Fouling and Scaling • Regulatory and Operational Challenges*
1330 – 1420	***Desalination Plant Design Basics*** *Factors Influencing Plant Design • RO Plant Capacity Considerations • Layout and Components of RO Plants • Integration with Existing Water Infrastructure*
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	***RO Membranes*** *Types of Membranes: Thin-Film Composite, Cellulose Acetate • Membrane Structure and Function • Selection Criteria for RO Membranes • Membrane Cleaning and Maintenance*
0830 – 0930	***RO Feed Water Quality*** *Water Quality Parameters for RO Systems • TDS (Total Dissolved Solids) and its Effect on RO Performance • Pre-Treatment Requirements for Feed Water • Monitoring Feed Water Quality for System Optimization*
0930 – 0945	*Break*
0945 – 1100	***Energy Recovery Systems in RO*** *Energy Consumption in RO Systems • Types of Energy Recovery Devices: Pressure Exchangers, Turbines • Efficiency of Energy Recovery Systems • Cost Implications of Energy Recovery in Desalination*

1100 – 1230	***Pumps & Pressure Vessels*** *Function of Pumps in RO Systems • Selection of Pumps for High-Pressure Applications • Pressure Vessels Design and Material Considerations • Maintenance and Operational Issues*
1230 – 1245	*Break*
1230 – 1330	***Post-Treatment & Distribution*** *Post-Treatment Steps after RO Desalination • Stabilization of Desalinated Water • Chlorination and Remineralization • Distribution System Integration*
1330 – 1420	***Operational Monitoring & Control*** *Key Parameters for RO System Performance Monitoring • SCADA Systems for RO Plants • Automation and Control Strategies • Real-Time Monitoring and Data Analysis*
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	***Pre-Treatment Techniques in Desalination*** *Coagulation, Flocculation, and Filtration • Softening and Dichlorination • Microfiltration and Ultrafiltration • Activated Carbon and Chemical Dosing*
0830 – 0930	***Types of Fouling in RO Membranes*** *Biological Fouling • Organic Fouling • Inorganic Fouling and Scaling • Particulate Fouling*
0930 – 0945	*Break*
0945 – 1100	***Fouling Mitigation & Membrane Cleaning*** *Methods of Fouling Prevention • Chemical Cleaning Procedures • CIP (Clean-In-Place) Systems for RO • Membrane Replacement and Lifecycle Management*
1100 – 1230	***Monitoring Fouling & Scaling*** *Indicators of Fouling in RO Systems • Use of Monitoring Devices (e.g., Flux, Pressure) • Scaling Prediction Models • Preventive Measures for Scaling*
1230 – 1245	*Break*
1230 – 1330	***Effect of Fouling on RO Performance*** *Impact on Water Recovery Rate • Reduction in Permeate Quality • Energy Efficiency Degradation • Economic Consequences of Fouling*
1330 – 1420	***Case Studies of RO Fouling*** *Real-World Examples of Fouling in Desalination Plants • Techniques Used to Overcome Fouling • Lessons Learned from Major Desalination Projects • Best Practices in Fouling Management*
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	***Energy Efficiency in Desalination*** *Low-Energy Desalination Technologies • Comparative Analysis of Energy Use in MSF, MED, and RO • Integration with Renewable Energy Sources • Energy-Efficient Desalination Design*
0830 – 0930	***Zero Liquid Discharge (ZLD) Systems*** *Overview of ZLD Technology • ZLD Applications in Desalination • Process Flow of ZLD Systems • Environmental Impact of ZLD*

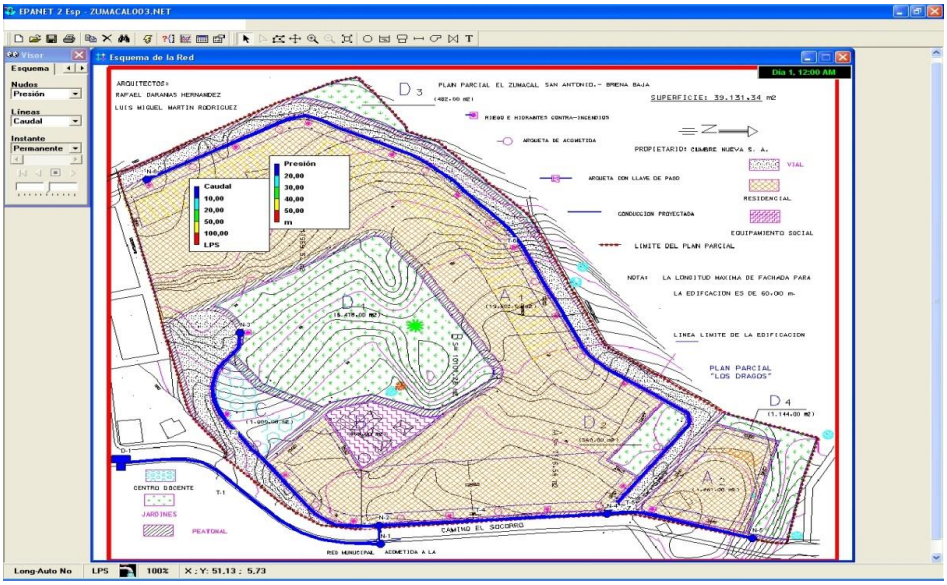
0930 – 0945	*Break*
0945 – 1100	***Hybrid Desalination Systems*** *Combining RO with Thermal Processes • Benefits of Hybrid Systems • Design Considerations for Hybrid Desalination • Case Studies of Hybrid Desalination Plants*
1100 – 1230	***Brine Management & Disposal*** *Environmental Concerns with Brine Discharge • Methods for Brine Disposal: Deep Well Injection, Evaporation Ponds • Brine Concentration and Crystallization • Sustainable Brine Management Technologies*
1230 – 1245	*Break*
1230 – 1330	***Desalination & Environmental Sustainability*** *Environmental Impact Assessment of Desalination Plants • Ecological Effects on Marine Life from Brine Discharge • Regulatory Frameworks for Environmental Protection • Sustainability Certifications and Best Practices*
1330 – 1420	***Desalination Research & Future Trends*** *Ongoing Research in Desalination Technologies • New Membrane Materials and Technologies • Innovations in Energy Recovery and Efficiency • Future Prospects of Desalination in Water-Scarce Regions*
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	***Desalination Project Management*** *Planning and Designing a Desalination Plant • Project Timelines and Budgeting • Stakeholder Management and Regulatory Considerations • Risk Assessment and Mitigation*
0830 – 0930	***Desalination in Arid Regions*** *Role of Desalination in Providing Fresh Water • Water Scarcity Issues in Desert Regions • Case Study: Middle East Desalination Projects • Socio-Economic Impact of Desalination in Arid Zones*
0930 – 0945	*Break*
0945 – 1100	***Operational Optimization of RO Plants*** *Strategies for Improving RO Plant Efficiency • Automation and Smart Monitoring in RO Systems • Periodic Maintenance and Lifecycle Management • Operational Performance Benchmarking*
1100 – 1230	***Scaling Up Desalination Plants*** *Challenges in Scaling up Desalination Capacity • Technological Advances in Large-Scale Desalination • Case Study: Scaling Desalination in Urban Areas • Planning for Future Water Demand and Growth*
1230 – 1245	*Break*
1245 – 1345	***Cost & Financial Considerations*** *Capital Expenditure versus Operational Expenditure • Cost Breakdown of Desalination Plants • Financial Models for Desalination Projects • Impact of Energy Costs on Desalination Pricing*
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.



EPANET Simulator

Course Coordinator

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