COURSE OVERVIEW TE0306
Advanced Water Chemistry

Course Title
Advanced Water Chemistry

Course Date/Venues
Session 1: July 28-August 01, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: November 24-28, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
TE0306

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 Advanced Water Chemistry. It covers the key properties of water and the types of water contaminants and water composition and properties; the acid-base chemistry in water, chemical reactions in water treatment and water hardness and softening; the water quality parameters, coagulation and flocculation, disinfection chemistry, filtration and membrane technologies; the basic principles of ion exchange and applications in water softening; and the removal of specific ions and regeneration of ion exchange resins.

Further, the course will also discuss the principles of desalination technologies and chemical processes in reverse osmosis; the impact of desalination on water chemistry and brine disposal and environmental impact; the advanced chemical processes in water treatment, water quality analysis and spectroscopic techniques in water chemistry; the chromatographic techniques for water quality, electrochemical techniques and microbiological water testing; the water chemistry modeling and simulation; and the heavy metal contamination, nutrient pollution and eutrophication.

During this interactive course, participants will learn the emerging contaminants in water, microplastics in water, radionuclides and radioactive water contaminants; the water quality in industrial effluents, water reuse and recycling and sustainable water treatment practices; the relationship between water use and energy consumption and the energy recovery in water treatment processes; the desalination and strategies for reducing energy consumption in water treatment; the effects of climate change on water resources, alterations in water chemistry due to climate factors and adaptation strategies for water management; the water quality management plans and monitoring and reporting requirements; and the risk management in water quality control.

Course Objectives

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

- Apply and gain an advanced knowledge on water chemistry
- Discuss the key properties of water, types of water contaminants and water composition and properties
- Describe acid-base chemistry in water, chemical reactions in water treatment and water hardness and softening
- Explain water quality parameters, coagulation and flocculation, disinfection chemistry and filtration and membrane technologies
- Discuss the basic principles of ion exchange and its applications in water softening, removal of specific ions and regeneration of ion exchange resins
- Explain the principles of desalination technologies, chemical processes in reverse osmosis, impact of desalination on water chemistry and brine disposal and environmental impact
- Carryout advanced chemical processes in water treatment, water quality analysis and spectroscopic techniques in water chemistry
- Employ chromatographic techniques for water quality, electrochemical techniques and microbiological water testing
- Illustrate water chemistry modeling and discuss heavy metal contamination, nutrient pollution and eutrophication
- Recognize the emerging contaminants in water, microplastics in water, radionuclides and radioactive water contaminants
- Employ water quality in industrial effluents, water reuse and recycling and sustainable water treatment practices
- Discuss the relationship between water use and energy consumption, energy recovery in water treatment processes, desalination and its energy demands and strategies for reducing energy consumption in water treatment
- Identify the effects of climate change on water resources, alterations in water chemistry due to climate factors and adaptation strategies for water management
- Implement water quality management plans, monitor and report requirements and apply risk management in water quality control

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 advanced water chemistry for water treatment plant operators, power plant chemists and engineers, environmental engineers and technicians, laboratory analysts and chemists, process engineers, quality assurance/quality control (QA/QC) personnel, utility engineers, health, safety & environmental (HSE) officers, R&D and technical support staff, desalination plant engineers and other 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. Paul Patsi, MSc, BSc, is a **Senior Analytical Chemist** and an **International Expert** in **Water & Waste Water Treatment Technology** with over **25 years** of extensive experience in **Analytical Laboratory** and **Water & Wastewater Treatment Engineering**. His expertise covers **Laboratory Assessment**, **Microbiological Quality Assurance**, **Analytical Chemistry**, **Statistical Analysis**, **Laboratory Safety**, **Equipment & Infrastructure Management**, **Budgeting & Planning of Laboratory Consumables**, **Business Administration**, **Personnel Management**, **Laboratory Management**, **Chemical Analysis**, **Laboratory Auditing**, **Risk Assessment**, **Microbiological Analysis of Water & Waste Water**, **Waste Water Treatment Analysis**, **Water Chemistry**, **HACCP**, **ISO 22000**, **ISO 17025**, **ISO 9001**, Good Manufacturing Practice (**GMP**), Good Hygiene Practice (**GHP**) and Good Laboratory Practice (**GLP**). He is also an expert in microbiological indoor air quality, water biology, food sampling and calibration. He is currently the **Head of Industrial Analytical Laboratory** of PINDOS wherein he is in-charge of the budgeting, auditing, consumables, suppliers, personnel management, equipment and infrastructure management along with waste water treatment and water/environmental legislation.

During his career life, Mr. Paul has held key positions such as the **Head of Microbiology & Chemical Laboratory**, **Head of Quality Control**, **Technical Consultant**, **Research Projects Specialist**, **Scientific Consultant**, **Biologist-Scientific Expert** and **Biologist** for multi-billion companies like the **European Union**, **Help LTD**, **Lake Pamvotis Municipality Company**, **Hellenic Centre for Marine Research**, **Cargill** and **Nestle** just to name a few.

Mr. Paul has a **Master's** degree in **Food Science and Food Technology** from the **University of Ioannina** (**Greece**) and a **Bachelor's** degree in **Biology** from the **Aristotle University of Thessaloniki** (**Greece**). He is a **Certified Instructor/Trainer** and a **Member** of the **Society for Applied Microbiology**, **Society of Biological Scientist** and the **Global Coalition for Sustained Excellence in Food & Health Protection**.

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 – 0930	***Introduction to Water Chemistry*** *Definition of Water Chemistry • Key Properties of Water • Importance of Water Quality in Industry • Types of Water Contaminants*
0930 – 0945	*Break*
0945 – 1030	***Water Composition & Properties*** *Chemical Structure of Water • pH & its Importance in Water Chemistry • Dissolved Gases in Water • Solubility & Chemical Equilibrium in Water*
1030 – 1130	***Acid-Base Chemistry in Water*** *Concept of pH & pOH • Buffer Systems in Water • Acid-Base Reactions in Natural Waters • Methods for Measuring Ph & Alkalinity*
1130 - 1230	***Chemical Reactions in Water Treatment*** *Precipitation & Coagulation • Oxidation & Reduction Reactions • Complexation Reactions • Hydrolysis in Water Chemistry*
1230 – 1245	*Break*
1245 – 1335	***Water Hardness & Softening*** *Definition & Causes of Hardness • Types of Hardness (Temporary & Permanent) • Softening Methods (Lime-Soda, Ion Exchange) • Impact of Hard Water on Water Systems*
1335 - 1420	***Water Quality Parameters*** *Total Dissolved Solids (TDS) • Conductivity & its Relationship with Water Quality • Turbidity & its Measurement • Biological Oxygen Demand (BOD)*
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	***Coagulation & Flocculation*** *Coagulation Theory & Mechanism • Types of Coagulants & Flocculants • Factors Affecting Coagulation Efficiency • Monitoring & Optimizing Coagulation Processes*
0830 - 0930	***Disinfection Chemistry*** *Disinfection Mechanisms (Chlorination, Ozonation) • Chemical Disinfectants & Their Reactions • Disinfection Byproducts (DBPs) • Regulatory Standards for Disinfection*
0930 – 0945	*Break*
0945 – 1100	***Filtration & Membrane Technologies*** *Principles of Filtration in Water Treatment • Chemical Additives in Filtration • Reverse Osmosis & Nanofiltration • Membrane Fouling & Cleaning*

1100 – 1230	***Ion Exchange in Water Treatment*** *Basic Principles of Ion Exchange • Applications of Ion Exchange in Water Softening • Removal of Specific Ions (e.g., Nitrate, Fluoride) • Regeneration of Ion Exchange Resins*
1230 – 1245	*Break*
1245 – 1330	***Desalination & its Chemistry*** *Principles of Desalination Technologies • Chemical Processes in Reverse Osmosis • Impact of Desalination on Water Chemistry • Brine Disposal & Environmental Impact*
1330 - 1420	***Advanced Chemical Processes in Water Treatment*** *Ozonation & Advanced Oxidation Processes (AOP) • Chemical Treatment for Heavy Metals Removal • Chemical Precipitation for Phosphate Removal • Removal of Emerging Contaminants*
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	***Water Quality Analysis: Overview*** *Key Parameters to Monitor in Water Chemistry • Laboratory versus Field Testing • Importance of Accuracy & Precision in Water Testing • Water Sample Preservation & Handling*
0830 - 0930	***Spectroscopic Techniques in Water Chemistry*** *UV-Vis Spectroscopy for Water Analysis • Atomic Absorption Spectroscopy (AAS) • Inductively Coupled Plasma Mass Spectrometry (ICP-MS) • Application of Spectroscopy in Heavy Metal Detection*
0930 – 0945	*Break*
0945 – 1100	***Chromatographic Techniques for Water Quality*** *Gas Chromatography (GC) • High-Performance Liquid Chromatography (HPLC) • Application in Organic Pollutant Detection • Sample Preparation for Chromatographic Analysis*
1100 – 1230	***Electrochemical Techniques*** *pH & Conductivity Meters • Electrodes for Ion-Specific Analysis • Redox Potential & ORP Measurement • Use of Electrochemical Sensors in Water Quality Monitoring*
1230 – 1245	*Break*
1245 – 1330	***Microbiological Water Testing*** *Importance of Microbiological Testing in Water Quality • Detection of Pathogenic Microorganisms • Culture-Based & Molecular Methods • Coliform Testing & its Importance*
1330 - 1420	***Water Chemistry Modeling & Simulation*** *Modeling Chemical Reactions in Water Systems • Use of Computational Tools for Water Chemistry • Predictive Models for Water Treatment Optimization • Case Studies in Modeling of Water Treatment Plants*
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	***Heavy Metal Contamination*** *Sources of Heavy Metals in Water • Toxicity & Environmental Impact of Heavy Metals • Removal Methods (Precipitation, Adsorption) • Regulations & Standards for Heavy Metal Concentrations*
0830 - 0930	***Nutrient Pollution & Eutrophication*** *Impact of Nutrients on Water Quality • Phosphorus & Nitrogen Removal Techniques • Chemical Additives for Nutrient Control • Eutrophication & its Effect on Ecosystems*
0930 – 0945	*Break*
0945 – 1100	***Emerging Contaminants in Water*** *Pharmaceuticals, Personal Care Products (PPCPs) • Endocrine Disrupting Chemicals (EDCs) • Industrial Chemicals in Water Systems • Treatment Methods for Emerging Contaminants*
1100 – 1230	***Microplastics in Water*** *Sources & Impact of Microplastics • Detection & Quantification of Microplastics in Water • Removal & Filtration Techniques • Regulatory Framework for Microplastic Contamination*
1230 – 1245	*Break*
1245 – 1330	***Radionuclides & Radioactive Water Contaminants*** *Occurrence & Sources of Radionuclides in Water • Radiological Standards for Drinking Water • Treatment Methods for Radioactive Contaminants • Health Risks & Environmental Considerations*
1330 - 1420	***Water Quality in Industrial Effluents*** *Types of Industrial Contaminants • Chemical Treatment of Industrial Wastewater • Effluent Regulations & Compliance • Case Studies in Industrial Wastewater 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 Four*

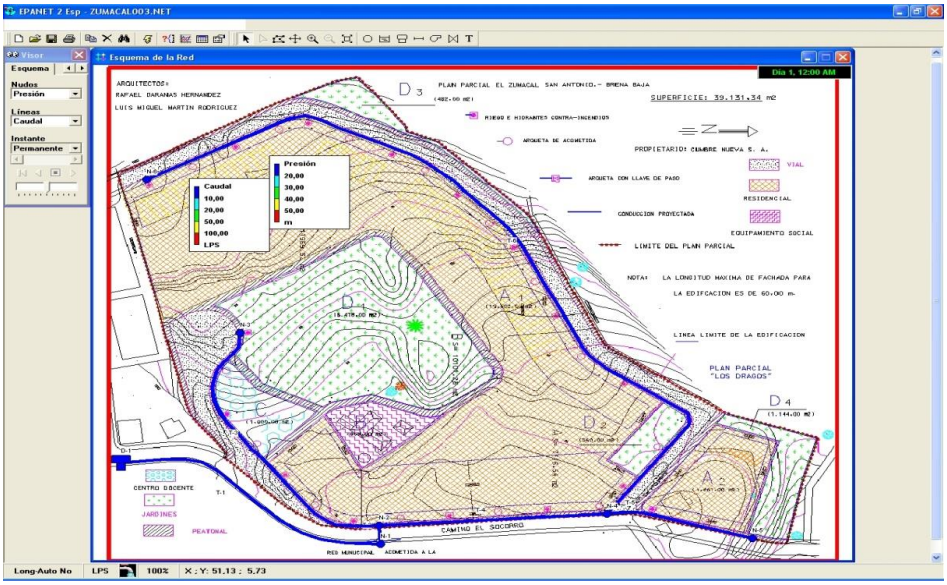
Day 5

0730 - 0830	***Water Reuse & Recycling*** *Concepts of Water Reuse & Recycling • Chemical Treatments for Recycled Water • Applications in Agriculture, Industry & Municipal Use • Regulatory & Environmental Considerations*
0830 - 0930	***Sustainable Water Treatment Practices*** *Green Chemistry in Water Treatment • Minimizing Chemical Usage in Water Treatment Plants • Sustainable Disinfection Methods • Case Studies in Sustainable Water Treatment*
0930 – 0945	*Break*
0945 – 1100	***Water-Energy Nexus*** *Relationship Between Water Use & Energy Consumption • Energy Recovery in Water Treatment Processes • Desalination & its Energy Demands • Strategies for Reducing Energy Consumption in Water Treatment*
1100 – 1230	***Climate Change & its Impact on Water Chemistry*** *Effects of Climate Change on Water Resources • Alterations in Water Chemistry Due to Climate Factors • Adaptation Strategies for Water Management • Case Studies on Water Chemistry in a Changing Climate*

1230 – 1245	*Break*
1245 – 1315	***Water Quality Management Systems*** *Implementation of Water Quality Management Plans • Monitoring & Reporting Requirements • Risk Management in Water Quality Control • Role of Technology in Water Quality Management*
1315 - 1345	***Future Trends in Water Chemistry*** *Innovations in Water Treatment Technologies • Advances in Chemical & Biological Water Quality Monitoring • Role of Artificial Intelligence in Water Chemistry • Emerging Regulations & Standards in Water Chemistry*
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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