



COURSE OVERVIEW TE0297 **Water Quality Modelling**

Course Title

Water Quality Modelling

Course Date/Venue

November 08-12, 2026/TBA Meeting Room,
Centro Corniche Al Khobar by Rotana,
Al Khobar, KSA

Course Reference

TE0297

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 Water Quality Modelling. It covers the purpose and applications of water quality models, types of water systems and modeling domains; the key water quality parameters, water quality standards and regulatory frameworks; the fundamentals of hydraulic behavior including mass transport and water quality process; the water quality data collection and management and development of a water distributions network model and hydraulic model; and the water quality modeling software, water age modeling and source tracing and mixing analysis.



During this interactive course, participants will learn the chlorine residual modelling, reaction kinetics and model parameters and disinfections by-product considerations; the contaminant transport modelling and storage tank and reservoir water quality; the principles of model calibration and hydraulic calibration, water quality model calibration and sensitivity and uncertainty analysis; the scenario and operational analysis, water quality optimization in distribution systems and chlorine booster modelling; the flushing and water quality improvement strategies, water quality incident and emergency modelling; and the model-based water quality management.





Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge of water quality modelling
- Discuss the purpose and applications of water quality models, types of water systems and modeling domains
- Recognize key water quality parameters, water quality standards and regulatory frameworks
- Explain the fundamentals of hydraulic behavior including mass transport and water quality process
- Illustrate water quality data collection and management and development of a water distributions network model and hydraulic model
- Interpret water quality modeling software, water age modeling and source tracing and mixing analysis
- Illustrate chlorine residual modelling, reaction kinetics and model parameters and disinfections by-product considerations
- Describe contaminant transport modelling and apply storage tank and reservoir water quality
- Discuss the principles of model calibration and carryout hydraulic calibration, water quality model calibration and sensitivity and uncertainty analysis
- Apply scenario and operational analysis, water quality optimization in distribution systems and chlorine booster modelling
- Employ flushing and water quality improvement strategies, water quality incident and emergency modelling and model-based water quality management

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 water quality modelling for environmental engineers and scientists, water resource managers and planners, government agencies and regulators, consulting firms, utility & wastewater treatment operators and other technical staff.

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

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. Henry Beer is a **Senior Water Engineer** with **30 years** of in-depth industrial experience within the **Petrochemical, Oil & Gas** and **Refinery** industries. His wide expertise covers in the areas of **Water Hydraulic Modelling, Water Distribution System, Water Analysis & Quality Control, Water Sampling, Water Resources Hydraulic, Water Hydraulic Operation & Troubleshooting, Crude Oil & Water Testing, Crude Oil Testing, Crude Stabilization Operations, Crude Oil Storage Handling, Crude Oil & Water Sampling Procedures, Equipment Handling Procedures, Crude Oil Testing Procedures, Water Analysis, Process Systems Foundations, Gas Processing Plant Operations & Control, Gas Processing Monitoring & Troubleshooting, Chemical Engineering, Process Equipment Design & Troubleshooting, Polymers & Polymerization, Applied Process Engineering, Process Plant Optimization, Process Plant Troubleshooting & Engineering Problem Solving, Process Plant Performance & Efficiency, Flare Blowdown & Pressure Relief Systems, Polypropylene Manufacturing, Polyethylene & Process Troubleshooting, Process Operation Troubleshooting, Fluidized Bed Reactor, Oil Movement & Storage, Power Plant Chemistry, Catalyst Manufacturing Techniques, Fuel Systems Management, Process Design & Optimization, Aviation Fuel, Diesel Engine, Jet Fuel, Petrol, IP Octane, Cetane Control, Pipeline Distribution, Boiler Fundamental Preparation, Flocculation Sedimentation, Hotline Water Softening Processes, Desalination Processes, Reverse Osmosis, Molecular Sieves, Loop Water Management System, Sludge Removal, Cooling Water System, Tank Farms and Hydrocarbons.** Currently, he is the **Director and Senior Technical Consultant** wherein he is deeply involved in developing new industrial process and designing new process plants and equipment.

During his career life, Mr. Beer has gained his practical and field experience through his various significant positions and dedications as the **Global Commissioning Manager, Senior Business Analyst, Water Engineer, Process Engineer, Chemical Engineer, Technical Sales Engineer, Senior Technician, Entrepreneur, Financial Consultant, Business Analyst, Business Financial Planner, Independent Financial Planner, Investment Independent Financial Advisor, Financial Broker, Trainer/Instructor and Technical Consultant** for various international companies such as the Sasol, TAG Solvents, Virgin Solvent Products, RFS Financial Services (Pty) Ltd, FNB and GHC Trading.



Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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: Sunday, 08th of November 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Introduction to Water Quality Modelling <i>Purpose and Applications of Water Quality Models • Types of Water Systems and Modelling Domains • Physical, Chemical, and Biological Processes Affecting Water Quality • Role of Modelling in Water-Resource and Utility Management</i>
0930 – 0945	Break
0945 – 1030	Key Water Quality Parameters <i>Physical Parameters: Temperature, Turbidity, Colour, and Solids • Chemical Parameters: pH, Alkalinity, Hardness, and Dissolved Oxygen • Nutrients, Organic Matter, and Chemical Contaminants • Microbiological Indicators and Pathogen Considerations</i>
1030 – 1130	Water Quality Standards & Regulatory Frameworks <i>Drinking-Water Quality Requirements and Guideline Values • WHO Drinking-Water Quality Guidelines • National and Utility-Specific Water Quality Requirements • Translating Regulatory Requirements into Modelling Objectives</i>
1130 – 1230	Fundamentals of Hydraulic Behaviour <i>Flow, Pressure, Velocity, and Head-Loss Relationships • Continuity and Energy Equations • Pipes, Pumps, Valves, Tanks, and Reservoirs • Influence of Hydraulic Conditions on Water Quality</i>



1230 – 1245	Break
1245 – 1330	Mass Transport & Water Quality Processes Advection and Transport of Dissolved Constituents • Mixing, Dispersion, and Diffusion • Reaction Kinetics and Decay Processes • Mass-Balance Principles for Water Quality Modelling
1330 – 1420	Water Quality Data Collection & Management Identifying Modelling Data Requirements • Sampling Locations, Frequencies, and Methodologies • Laboratory and Online Water-Quality Monitoring Data • Data Validation, Screening, and Preparation for Modelling
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 November 2026

0730 – 0830	Development of a Water Distribution Network Model Network Layout and Model Schematization • Representation of Pipes, Nodes, Pumps, Valves, and Storage • Elevation, Demand, and Operational Data Requirements • Model Simplification and Level-of-Detail Considerations
0830 – 0930	Hydraulic Model Development Demand Allocation and Demand Patterns • Pump Curves and Operating Controls • Valve Settings and Pressure Management • Hydraulic Simulation Under Varying Operating Conditions
0930 – 0945	Break
0945 – 1100	Basics of Water Quality Modelling Software Overview of EPANET and Comparable Modelling Platforms • Model Interface, Input Data, and Simulation Settings • Creating and Importing Network Models • Reviewing Hydraulic and Water-Quality Simulation Outputs
1100 – 1230	Water Age Modelling Concept and Significance of Water Age • Factors Contributing to Excessive Residence Time • Identification of Low-Turnover and Stagnation Areas • Operational Measures for Reducing Water Age
1230 – 1245	Break
1230 – 1330	Source Tracing & Mixing Analysis Tracking Water from Different Supply Sources • Source Contribution and Percentage Analysis • Mixing Within Tanks, Reservoirs, and Network Junctions • Application to Multiple-Source Distribution Systems
1330 – 1420	Practical Exercise – Building a Distribution Model Creating a Representative Network Model • Entering Network and Demand Data • Running Hydraulic and Water-Age Simulations • Interpreting Results and Identifying Problem Areas
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 November 2026

0730 – 0830	Chlorine Residual Modelling Chlorine Behaviour Within Distribution Networks • Bulk-Water Chlorine Decay • Pipe-Wall Chlorine Reactions • Factors Affecting Residual Chlorine Concentration
0830 – 0930	Reaction Kinetics & Model Parameters Zero-Order and First-Order Reactions • Bulk and Wall Reaction Coefficients • Temperature and Water-Quality Effects • Selection and Estimation of Reaction Parameters
0930 – 0945	Break
0945 – 1100	Disinfection By-Product Considerations Fundamentals of Disinfection By-Product Formation • Relationship Between Chlorine, Organic Matter, and Residence Time • Identification of High-Risk Network Locations • Using Model Results to Support DBP Management
1100 – 1230	Contaminant Transport Modelling Introduction of Contaminants into a Network Model • Transport and Propagation Through Distribution Systems • Concentration-Versus-Time Analysis • Identification of Potentially Affected Areas
1230 – 1245	Break
1230 – 1330	Storage Tank & Reservoir Water Quality Complete-Mix and Compartment Mixing Assumptions • Fill-and-Draw Operating Cycles • Stratification and Turnover Considerations • Effects of Storage Operation on Chlorine and Water Age
1330 – 1420	Practical Exercise – Chlorine Decay Simulation Setting Initial Chlorine Concentrations • Applying Bulk and Wall Reaction Coefficients • Simulating Residual Chlorine Throughout the Network • Evaluating Low-Residual Locations and Corrective Actions
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 November 2026

0730 – 0830	Principles of Model Calibration Purpose and Importance of Calibration • Hydraulic Versus Water-Quality Calibration • Selection of Monitoring and Calibration Locations • Establishing Model Acceptance Criteria
0830 – 0930	Hydraulic Calibration Calibration of Flow and Pressure • Verification of Demand Assumptions • Adjustment of Pipe Roughness and Operational Parameters • Comparison of Observed and Simulated Results
0930 – 0945	Break
0945 – 1100	Water Quality Model Calibration Calibration Using Chlorine Residual Measurements • Estimation of Decay Coefficients • Calibration Using Water-Age and Tracer Information • Evaluating Goodness of Fit and Model Uncertainty
1100 – 1230	Sensitivity & Uncertainty Analysis Identification of Influential Model Parameters • Sensitivity of Water-Quality Predictions • Sources of Modelling Uncertainty • Developing Realistic Modelling Scenarios and Ranges

1230 – 1245	Break
1230 – 1330	Scenario & Operational Analysis Normal and Peak-Demand Conditions • Pump and Valve Operational Changes • Storage-Level and Turnover Scenarios • Emergency and Abnormal Operating Conditions
1330 – 1420	Practical Exercise – Model Calibration & Scenario Testing Comparing Field Measurements with Simulation Results • Adjusting Selected Model Parameters • Running Alternative Operational Scenarios • Selecting Improvements Based on Model Outputs
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

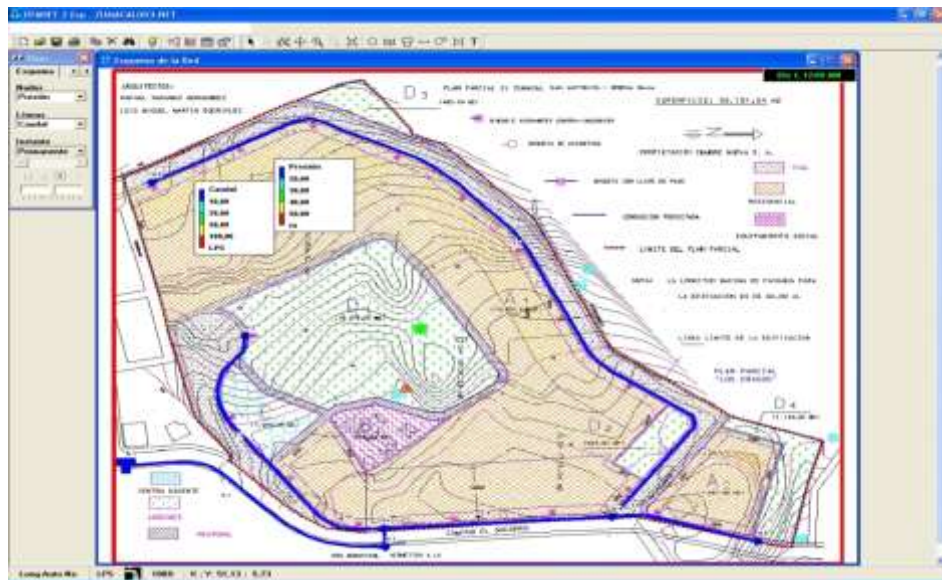
Day 5: Thursday, 12th of November 2026

0730 – 0830	Water Quality Optimization in Distribution Systems Optimizing Network Operation for Water Quality • Balancing Pressure, Energy, and Water-Quality Objectives • Reducing Excessive Water Age • Improving Circulation and Turnover
0830 – 0930	Chlorine Booster Station Modelling Identifying Locations Requiring Booster Chlorination • Booster Station Modelling Approaches • Determining Dosing Requirements • Evaluating Residual Chlorine Throughout the System
0930 – 0945	Break
0945 – 1100	Flushing & Water Quality Improvement Strategies Identification of Areas Requiring Flushing • Conventional Versus Unidirectional Flushing Concepts • Modelling Flushing Impacts • Optimizing Flushing Frequency and Locations
1100 – 1230	Water Quality Incident & Emergency Modelling Contamination Event Scenarios • Backflow and Accidental Contamination Considerations • Isolation and Response Strategy Evaluation • Using Modelling to Support Emergency Decision-Making
1230 – 1245	Break
1245 – 1300	Model-Based Water Quality Management Integration of Modelling and Monitoring Information • Using SCADA and Online Water-Quality Data • Model Updating and Periodic Validation • Developing Operational Dashboards and Performance Indicators
1300 – 1345	Final Integrated Case Study & Workshop Development of a Complete Water-Quality Modelling Scenario • Hydraulic, Water-Age, and Chlorine Residual Assessment • Identification of Water-Quality Risks and Critical Locations • Development and Presentation of Recommended Improvement Measures
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

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org