COURSE OVERVIEW DE0815
Water Injection Technology: *Water Flooding A-Z*

Course Title
Water Injection Technology: *Water Flooding A-Z*



Course Date/Venue
Session 1: January 10-14, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar
Session 2: August 01-05, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
DE0815



Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes real-life case studies where participants will be engaged in a series of interactive small groups and class workshops.



The objective of oil producing companies is to maximize oil recovery from any given reservoir. To achieve the stated objective, the reservoir engineers do not rely only on primary (natural) energy, but also on artificial energy which gives rise to what we call secondary and tertiary methods of oil recovery.

Water flooding is one of the secondary methods of oil recovery. It involves injecting clean, non-corrosive water into the reservoir to displace the remaining oil. This course is primarily on the mechanics of oil recovery by water flooding.



The aim of this course is to provide the participants with a complete and up-to-date overview of the area of Water Flooding. Upon the successful completion of this course, the participant should have a solid grounding in the understanding of the purpose, operation and inspection of water injection systems for enhanced oil recovery. The course will illustrate potential problems and their resolution.

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 on power generation
- Explain steam power plants and steam turbines and auxiliaries
- Discuss gas turbines as well as current and future gas turbine technologies
- Distinguish the concepts of combined cycles and the turbine governing system
- Identify gas turbine instrumentation and control systems
- Discuss gas turbine emission guidelines and control methods including lubrication and fuel systems
- Review the economics of power generation, co-generation and combined-cycle plants
- Illustrate the applications of co-generation and combined-cycle plants
- Define transformers and explain interconnection with grid and transformer components
- Illustrate synchronous generators and generator operation
- Discuss generator components, generator excitation, AVR and PSS
- Employ generator operation, testing, inspection and maintenance

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 injection technology and water flooding for reservoir and production engineers, technical staff and geoscientists with interest in improved oil recovery by water flooding. Basic knowledge of reservoir engineering concepts is recommended. Further, the course is recommended for all engineers and technical staff (superintendents, supervisors & foremen) whose responsibilities include the safe and cost-effective operation of water injection systems. Management will also benefit by increasing their awareness of the cost-effective use of treatment chemicals and by developing their skills in analysis of water quality data. Furthermore, this course is suitable for corrosion personnel, W.I. personnel, lab personnel, chemists and chemical engineers.

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 Fee
US$ 8,500 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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. Konstantin Zorbalas, MSc, BSc, is a **Senior Petroleum Engineer & Well Completions Specialist** with **30 years** of **offshore** and **onshore** experience in the **Oil** & **Gas**, **Refinery** & **Petroleum** industries. His wide expertise includes **OIP Estimation & Range** of **Uncertainty**, **Waterflood** Management, **Water Flooding**, **Water Flooding & Reservoir** Sourcing Issues, **Water Flooding**, **Reservoir** Souring & Water Breakthrough, **Well & Reservoir Management** and Monitoring, **Fishing Operations**, **Drilling & Work-Over Operations**, **Workover Best Practices**, Well Testing, Completion Design & Operation, Well Stimulation and **Workover**, **Well Stimulation & Workover** Planning, **Well Completion**, **Servicing & Work-Over** Operations, **Completions & Workover**, HSE in **Work-Over & Drilling** Operations, **Well Testing Completion & Workover**, Basic **Drilling**, **Completion & Workover** Operations, Advanced **Drilling**, **Completion & Workovers Fluids**, **Cementing** Integrity Evaluation, **Cementing** Design, **Cement** Integrity Assurance & Evaluation, Basic **Cementing** (Operations) & Basic Acidizing, **Advanced** Cementing Technology, **Casing & Cementing, Advanced** Cementing & Stimulation, **Artificial Lift** Systems, New Technology in **Artificial Lift Systems**, **Artificial Lift** Methods, **Crude Oil Artificial Lift** Operations, **Artificial Lift** Systems, **Artificial Lift** & Challenges, **Artificial Lift** Systems & Optimization Technology, Production Optimization with **Artificial Lift** System, **Well Integrity & Artificial Lift**, **Formation Damage** & Flow Assurance Issues, **Formation Damage** Evaluation, Prevention, Remediation & Control, **Formation Damage** (Causes, Prevention & Remediation), **Well Completion** Design & Operations, Crude **Oil Market**, Oil **Reserves**, Global Oil **Supply & Demand**, Government Legislation & Oil **Contractual** Agreements, Oil **Projects & Their Feasibility** (Revenue and Profitability), Oil & Gas **Exploration** and **Methods**, Oil & Gas **Extraction**, Oil **Production & Refining**, Technology Usage in Industrial Security; **Oil & Gas Economics** Modelling Evaluation Decision Making & Risk Analysis, **Economic Evaluation** & Global Profitability Criteria, **Petroleum Economics**, Fluid Properties & Phase Behaviour (**PVT**), **Workovers & Completions**, Acidizing Application in **Sandstone & Carbonate**, **Well Testing** Analysis, **Reserves** Evaluation, **Reservoir** Fluid Properties, **Reservoir** Monitoring, **Heavy Oil** Technology, Applied **Water Technology**, **X-mas Tree & Wellhead** Operations & Testing, **Artificial Lift** Systems (**Gas Lift**, **ESP**, and **Rod Pumping**), **Well Cementing**, **Well Completion** Design, **Slickline** Operations, **Cased Hole Logging** and **Production Logging**. Further, he is actively involved in **Project Management** with special emphasis in production technology and field optimization, performing conceptual studies, economic analysis with risk assessment and field development planning. He is currently the **Senior Petroleum Engineer & Consultant** of **Abu Dhabi National Oil Company** (**ADNOC**) Group of companies wherein he is involved in the mega-mature fields in the Arabian Gulf, predominantly carbonate reservoirs; designing the acid stimulation treatments with post-drilling rigless operations; utilizing CT with tractors and DTS systems; and he is responsible for gas production and preparing for reservoir engineering and simulation studies, well testing activities, field and reservoir monitoring, production logging and optimization and well completion design.

During his career life, Mr. Zorbalas worked as a **Senior Production Engineer**, **Well Completion Specialist**, **Production Manager**, **Project Manager**, **Technical Manager**, **Trainer**, **Technical Supervisor** & **Contracts Manager**, **Production Engineer**, **Production Supervisor**, **Production Technologist**, **Technical Specialist**, **Business Development Analyst**, **Field Production Engineer** and **Field Engineer**. He worked for many **world-class oil/gas companies** such as **ZADCO**, **ADMA-OPCO**, **Oilfield International Ltd**, **Burlington Resources** (later acquired by **Conoco Phillips**), **MOBIL E&P**, **Saudi Aramco**, **Pluspetrol E&P SA**, **Wintershall**, **Taylor Energy**, **Schlumberger**, **Rowan Drilling** and **Yukos EP** where he was in-charge of the **design and technical analysis** of a gas plant with capacity **1.8 billion m3/yr gas**. His achievements include **boosting oil production 17.2% per year** since 1999 using **ESP** and **Gas Lift systems**.

Mr. Zorbalas has **Master's** and **Bachelor's** degrees in **Petroleum Engineering** from the **Mississippi State University**, **USA**. Further, he is an **SPE Certified Petroleum Engineer**, **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), an active member of the Society of Petroleum Engineers (**SPE**) and has numerous scientific and technical publications and delivered innumerable training courses, seminars and workshops worldwide.

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 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	***Reservoir Drive Mechanisms & Producing Characteristics: Introduction***
0930 – 0945	*Break*
0945 – 1015	***Enhanced Oil Recovery - Preamble*** *Types of Reservoirs: Limestone and Sandstone ● Function of EOR: Pressure Maintenance and Displacement ● Options Available: Gas Injection and Re-Injection (Including Carbon Dioxide), Water, Polymer, Microbial*
1015 – 1045	***Enhanced Oil Recovery - Injectivity*** *Injectivity Requirements and Limitations ● Breakthrough ● Fracturing ● Loss of Injectivity ● Scale Formation ● Prevention of Scale Formation ● Recovering Injectivity By Acid Treatments*
1045 – 1115	***Describing Water Flooding*** *Definition. Objectives ● Candidates ● Patterns ● Factors Affecting Pattern Selection ● Well Spacing ● Oil, Water, and Gas Saturations ● Fractional Flow ● Performance Measures ● Practices and Problems ● Reservoir Monitoring*
1115 – 1215	***Waterflood Performance Efficiencies***
1215 – 1230	*Break*
1230 – 1330	***Design Aspects of Water Injection System***

1330 – 1420	***The Influence of the Reservoir Characteristics on Injection Process***
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 – 0800	***The Influence of the Fluid Characteristics on the Injection Process***
0800 – 0830	***Relation Between Reservoir Engineering Data & Injected Water***
0830 – 0930	***Reservoir Management Concepts & Water Injection Projects***
0930 – 0945	*Break*
0945 – 1015	***Waterflood Monitoring & Management***
1015 – 1100	***Effects of Water Injection on the Recovery Factor& Reserves***
1100 – 1215	***Water Injection Systems – Water Source*** *Water Source: Produced Water, Aquifers and Seawater ● Nature and Composition of Waters and Seawater ● Matching Reservoir Requirements ● Water Compatibilities and Scale*
1215 – 1230	*Break*
1230 – 1420	***Water Injection Systems – Basic Water Treatment*** *Basic Seawater Treatment: Filtration and Deaeration ● Water Depth Selection ● Prevention of Macrofouling ● Winning Pumps ● Chlorination*
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 – 0930	***Water Injection Systems - Filters & Deaeration*** *Types of Filters: Cartridge, Gravity, Upflow, Mixed Media, Rotating Drum ● Filter Aids: Ferric Salts, Bentonite, Polyelectrolytes ● Chlorination and Upfilter Biocide Treatments ● Deaeration: Gas Stripping and Mechanical Vacuum Deaeration ● Chemical Scavengers and Catalysts ● Effect of Temperature ● Interaction of Chlorine and Scavenger ● Bacterial Growth Through Plant Chlorination ● Biocide Treatment ● Types of Biocide ● Variations inBiocide Use ● Interaction of Scavenger and Biocide*
0930 – 0945	*Break*
0945 - 1115	***Seawater Corrosion*** *Corrosiveness of Seawater ● Typical Corrosion Rates ● Oxygen Corrosion ● Effect of Flow ● Effect of Temperature When Seawater Used as Primary Coolant ● Winning Pumps ● Annular Restrictions Around Winning Pumps ● Flow Tubing: Mortar Lined Carbon Steel, Duplex Stainless Steels, Titanium, Copper Nickel Alloys, Non-Metallic Materials ● Filter Containers and Coatings ● Deaeration Towers and Coatings ● Downstream Flowline Systems. Injection Tubing*
1115 – 1215	***Buried & Subsea Pipelines*** *Soil Corrosiveness ● Enhanced Corrosion Around Water Pipelines ● Seawater Corrosiveness ● Seabed Sediment Corrosiveness ● External Coatings and Cathodic Protection to Prevent Corrosion ● Coating and CP Interactions ● External Damage to Pipelines ● Internal Coating of Pipelines ● Refurbishment of Pipelines ● Repair of Pipelines ● Replacement of Pipelines*

1215 - 1230	Break
1230 – 1420	***Microbiological Growth & Corrosion*** *Structure and Growth of Diatoms, Bacteria and Algae ● Growth Requirements ● Interactions Between Organisms ● Microbiological Corrosion ● Sessile and Planktonic Bacteria ● Biofouling inFilers, Deaerators, Flowlines ● Injectivity Loss ● Reservoir Souring*
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

0845 - 0930	***Steam & Hot Water Injection***
0930 – 0945	*Break*
0945 – 1015	***Hot Water & Thermal EOR***
1015 – 1100	***Characteristics of Steam Injection***
1100 – 1215	***Tests Used to Evaluate Water Quality*** *Lab Tests and Field Tests ● Test Point ● Collecting Samples ● Transport of Samples Test Frequencies for Particle Counts, Filtration Efficiency, Millipore Filtration Tests, Chlorine, Oxygen, Residual Oxygen Scavenger, Total Iron ● Treatment Issues: Residual Biocide, Hydrogen Sulphide, Sulphate-Reducing Bacteria (SRB), General Aerobic Bacteria (GAB), pH*
1215 – 1230	*Break*
1230 – 1420	***Water Treatment Chemicals Used in Water Injection Systems*** *Chlorine ● Bentonite ● Polyelectrolyte ● Filter Aids ● Scavenger ● Biocides ● Selection of Biocides: Time to Kill, Field Tests*
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 – 0815	***Using Surfactant Solutions to Improve Water Characteristics (Improve Oil Recovery)***
0815 – 0900	***Why Polymers are Added to Water?***
0900 – 0930	***Effects of Salinity on the Surfactants & Polymers Behavior***
0930 – 0945	*Break*
0945 – 1100	***Inspection of Facilities*** *Using Iron Counts to Evaluate Corrosion ● Effects of Flow ● Areas of Corrosion ● Typical Corrosion Patterns ● Weld Decay ● Ultrasonic Testing ● X-Radiography ● Internally Coated Vessels and Lines ● Endoscopes ● Visual Inspection ● Inspection Frequency*
1100 – 1145	***Pigging & Cleaning of Pipelines*** *Identifying the Need to Pig ● Types of Pigs ● Risks Involved ● Pig Alerts ● Frequency of Pigging and Effectiveness ● Cleaning of Pipelines ● Measuring Effectiveness ● Intelligent Pigging ● Evaluation of Data*
1145 – 1215	***Economics of Water Flooding***

1215 – 1230	*Break*
1230 – 1345	***Case Studies***
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*

Practical Sessions

This practical and highly-interactive course includes the real-life case studies and exercises:-



Course Coordinator

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