

COURSE OVERVIEW DE0815
Water Flooding: Understand Water Flooding,
Reservoir Souring & Water Breakthrough

Course Title

Water Flooding: Understand Water Flooding, Reservoir Souring & Water Breakthrough

Course Date/Venue

November 17-21, 2024/Samriya Meeting Room, Doubletree By Hilton Doha-Al Sadd, 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

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

- Apply and gain an in-depth knowledge on water injection technology and determine the water flooding process from “A” to “Z” as a major method of enhanced oil recovery (EOR)
- Recognize the various elements of reservoir drive mechanisms and producing characteristics
- Employ the methods pertaining to water flood performance efficiencies and discuss the design aspects of water injection system
- Distinguish the influence of the reservoir and fluid characteristics on injection process and determine the relation between reservoir engineering data and injected water
- Evaluate the different effects of the recovery factor and reserves as well as explain the aspects of water injection systems according to water source by identifying the various matching reservoir requirements
- Explain the functions of water injection systems through filters and deaeration and identify the various types of filters
- Detail the different qualities of seawater corrosion and distinguish the relationship of microbiological growth and corrosion in line with the structure and growth of diatoms, bacteria and algae
- Apply the several tests used to evaluate water quality including process of collecting samples, transport of samples and test frequencies for particle counts
- Use the different types of water treatment chemicals including chlorine, bentonite and polyelectrolyte
- Discuss the thermal methods of EOR including hot water and steam injection and get important tips of the polymer injection process
- Implement the process of pigging and cleaning of pipelines as well as list the various types of pigs

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.

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: -


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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.

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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.

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.

Accommodation

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

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:



Dr. Chris Kapetan, PhD, MSc, is a **Senior Petroleum Engineer** with over **30 years** of international experience within the **onshore and offshore oil & gas** industry. His wide experience covers **Decision Analytic Modelling Methods for Economic Evaluation, Probabilistic Risk Analysis (Monte Carlo Simulator) Risk Analysis Foundations, Global Oil Demand, Crude Oil Market, Global Oil Reserves, Oil Supply & Demand, Governmental Legislation, Contractual Agreements, Financial Modeling, Oil Contracts, Project Risk Analysis, Feasibility Analysis Techniques, Capital Operational Costs, Oil & Gas Exploration Methods, Reservoir Evaluation, Extraction of Oil & Gas, Crude Oil Types & Specifications, Sulphur, Sour Natural**

Gas, Natural Gas Sweeting, Petroleum Production, Field Layout, Production Techniques & Control, Surface Production Operations, Oil Processing, Oil Transportation-Methods, Flowmetering & Custody Transfer and Oil Refinery. Further, he is also well-versed in **Enhanced Oil Recovery (EOR), Electrical Submersible Pumps (ESP), Oil Industries Orientation, Geophysics, Cased Hole Formation Evaluation, Cased Hole Applications, Cased Hole Logs, Production Operations, Production Management, Perforating Methods & Design, Perforating Operations, Fishing Operations, Well & Reservoir Testing, Reservoir Stimulation, Hydraulic Fracturing, Carbonate Acidizing, Sandstone Acidizing, Drilling Fluids Technology, Drilling Operations, Directional Drilling, Artificial Lift, Gas Lift Design, Gas Lift Operations, Petroleum Business, Petroleum Economics, Field Development Planning, Gas Lift Valve Changing & Installation, Well Completion Design & Operation, Well Surveillance, Well Testing, Well Stimulation & Control and Workover Planning, Completions & Workover, Rig Sizing, Hole Cleaning & Logging, Well Completion, Servicing and Work-Over Operations, Practical Reservoir Engineering, X-mas Tree & Wellhead Operations, Maintenance & Testing, Advanced Petrophysics/Interpretation of Well Composite, Construction Integrity & Completion, Coiled Tubing Technology, Corrosion Control, Slickline, Wireline & Coil Tubing, Pipeline Pigging, Corrosion Monitoring, Cathodic Protection** as well as **Root Cause Analysis (RCA), Root Cause Failure Analysis (RCFA), Gas Conditioning & Process Technology, Production Safety and Delusion of Asphalt.** Currently, he is the **Operations Consultant & the Technical Advisor at GEOTECH** and an independent **Drilling Operations Consultant** of various engineering services providers to the international clients as he offers his expertise in many areas of the **drilling & petroleum discipline** and is well **recognized & respected** for his process and procedural expertise as well as ongoing participation, interest and experience in continuing to promote technology to producers around the world.

Throughout his long career life, Dr. Chris has worked for many international companies and has spent several years **managing technically complex wellbore interventions** in both **drilling & servicing.** He is a **well-regarded** for his **process and procedural expertise.** Further, he was the **Operations Manager at ETP Crude Oil Pipeline Services** where he was fully responsible for optimum operations of crude oil pipeline, **workover and directional drilling, drilling rigs** and equipment, drilling of various geothermal deep wells and **exploration wells.** Dr. Chris was the **Drilling & Workover Manager & Superintendent for Kavala Oil** wherein he was responsible for supervision of **drilling operations and offshore exploration,** quality control of performance of **rigs, coiled tubing,** crude oil transportation via pipeline and abandonment of **well** as per the API requirements. He had occupied various key positions as the **Drilling Operations Consultant, Site Manager, Branch Manager, Senior Drilling & Workover Manager & Engineer and Drilling & Workover Engineer, Operations Consultant, Technical Advisor** in several petroleum companies responsible mainly on an **offshore sour oil field (under water flood and gas lift)** and a gas field. Further, Dr. Chris has been a **Professor** of the **Oil Technology College.**

Dr. Chris has **PhD in Reservoir Engineering** and a **Master degree in Drilling & Production Engineering** from the **Petrol-Gaze Din Ploiesti University.** Further, he is a **Certified Surfaced BOP Stack Supervisor** of **IWCF,** a **Certified Instructor/Trainer,** a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management (ILM)** and has conducted **numerous short courses, seminars and workshops** and has published several technical books on **Production Logging, Safety Drilling Rigs and Oil Reservoir.**

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 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, 17th of November 2024

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: Monday, 18th of November 2024

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: Tuesday, 19th of November 2024

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 in Biocide 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 in Filers, 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: Wednesday, 20th of November 2024

0730 – 0845	Water Quality Quality Issues and Associated Risk • Intake Water • Measuring Particle Counts • Millipore Filtration • Post-Filtration Water Quality • Residual Chlorine After Filtration • Residual Oxygen After Deaeration • Residual Scavenger • Water Quality At Receiving Wells • Effect of Injection Water Quality On Injectivity • Total Iron and Corrosion • Millipore Filtration At The Injection Wells • Calculating Volumes and Quantities
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: Thursday, 21st of November 2024

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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