COURSE OVERVIEW DE0511
Thermal Injection - Steam Flood
(E-Learning Module)

Course Title
Thermal Injection - Steam Flood
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Course Reference
DE0511

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

This E-Learning course is designed to provide participants with a detailed and up-to-date overview of steam flooding using thermal injection. It covers the steam assisted gravity drainage (SAGD) well completion design considerations and well completion planning; the injection process, cyclic steam stimulation, steam zone development, displacement of oil and wettability alteration; the hot water flood, steam injection and screening for steam-flooding; the optimal recovery and enhanced oil recovery via steam injection; the methods of EOR and cyclic steam stimulation; the heavy oil data, basics of steam injection, alternate, stages and criteria; the approximation of RF by mechanisms in heavy oils; the hot water injection and air injection; the ICS process scheme, scheme of oxygen consumption profile and screening of EOR thermal methods; and the geologic screening criteria and screening criteria for steam injection methods and horizontal wells.

During this course, participants will learn the EOR thermal methods, high pressure air injection (HPAI), EOR recovery mechanisms, hot water flooding, in-situ combustion and thermal heavy oil recovery (THOR); the conventional thermal EOR and the key benefits of THOR; the different kinds of reservoirs recovery, recovery parameters screening and recovery parameters for enhanced oil recovery methods; and the primary methods of production from the reservoir, natural mechanisms and gas cap drive mechanism.

Course Objectives

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

- Apply and gain an in-depth knowledge on steam flooding using thermal injection
- Discuss the steam assisted gravity drainage (SAGD) well completion design considerations and data-driven well completion planning
- Illustrate injection process, cyclic steam stimulation, steam zone development, displacement of oil and wettability alteration
- Differentiate hot water flood versus steam injection and carryout screening for steam-flooding
- Ensure optimal recovery and apply enhanced oil recovery via steam injection
- Apply various methods of EOR, cyclic steam stimulation and EOR thermal methods comprising of heavy and viscous crude
- Discuss heavy oil data and the basics of steam injection covering alternate, stages and criteria
- Estimate approximate RF by mechanisms in heavy oils and employ hot water injection and air injection
- Review ICS process scheme, scheme of oxygen consumption profile and screening of EOR thermal methods
- Recognize geologic screening criteria and screening criteria for steam injection methods and horizontal wells
- Illustrate EOR thermal methods, high pressure air injection (HPAI), EOR recovery mechanisms, hot water flooding, in-situ combustion and thermal heavy oil recovery (THOR)
- Differentiate THOR versus conventional thermal EOR as well as identify the key benefits of THOR
- Identify the different kinds of reservoirs recovery and explain recovery parameters screening and recovery parameters for enhanced oil recovery methods
- Apply the primary methods of production from the reservoir, natural mechanisms and gas cap drive mechanism

Who Should Attend

This course provides an overview of all significant aspects and considerations of steam flooding using thermal injection for petroleum production and reservoir engineers and their supervisors, chemical engineers associated with crude oil production in areas of high viscosity and technical field personnel and services company representatives to obtain or increase the understanding of the overall concepts and principles of thermal injection processes.

Course Fee

As per proposal

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association 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 1-2013 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 1-2013 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 Association 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.

- 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.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Contents

- SAGD Well Completion Design Considerations
- Data-Driven SAGD Well Completion Planning
- Let Well Performance Guide SAGD Strategy
- Steam Flooding
- Introduction
- Quiz 1, 2 & 3
- Injection Process
- Cyclic steam stimulation
- Steam Zone Development
- Displacement of Oil
- Wettability Alteration
- Light-Oils
- Fracture
- Gravity Over-Ride
- Infill Drilling
- Hot Water Flood vs Steam Injection
- Screening for Steam-flooding

- Quiz 4
- Optimal Recovery
- Quiz 5
- Enhanced Oil Recovery – Steam Injection
- What is Enhanced Oil Recovery (EOR)?
- Methods of EOR
- Steam Injection
- Cyclic Steam Stimulation
- Quiz 6 & 7
- Advantages
- Disadvantages
- Quiz 8, 9 & 10
- Economic Considerations
- Quiz 11
- EOR Thermal Methods - Heavy, viscous crude
- Quiz 12
- Introduction to EOR Thermal Methods – Estimated Heavy Crude Oil World Reserves
- Comparison of Heavy Oil Data (some fields)
- Thermal Methods
- Steam Injection Calc
- Basic of Steam Injection- Alternate
- Basics of Steam Injection- Stages
- Basics of Steam Injection- Criteria
- Cyclic Steam Injection Calc
- Approximate RF by Mechanisms in Heavy Oils
- Steam Assisted Gravity Drainage (SAGD)
- SAGD Steam {Schematic} Chamber
- Main Reservoir Properties of International – as of 2011 SAGD Projects
- (SAGD)Scheme
- SAGD Numerical Simulation: Impact of Reservoir Permeability (Kv/Kh = 0.6)

- SAGD Numerical Simulation
- Hot Water Injection
- Simulation Data (ISC): Air Injection - Typical Oxidation Temperature vs Recovery
- ICS Process Scheme
- Scheme of Oxygen Consumption Profile
- Screening of EOR Thermal Methods
- Geologic Screening Criteria: Heterogeneity
- Screening Criteria for Steam Injection Methods and Horizontal Wells
- Quiz 13, 14 & 15
- Overview of EOR Thermal Methods
- Example of RDP under Steamflooding: Mukhaizna Heavy Oil Field, Oman
- Overview of EOR Thermal Methods SAGD
- High Pressure Air Injection (HPAI): Cedar Hills, North Dakota)
- Final Comments
- Thermal EOR
- Types of EOR
- EOR Recovery Mechanisms
- SAGD
- CSS
- Hot Water Flooding
- In-Situ Combustion
- Thermal Heavy Oil Recovery (THOR)
- Why Heavy Oil?
- Why Thermal EOR?
- THOR vs Conventional Thermal EOR
- THOR Key Benefits
- THOR: Initial Geoscientific Modelling
- Projected Production of UKCS Heavy Oil Field
- EOR Methods
- Different Kinds of Reservoirs Recovery

- Recovery Parameters Screening
- Recovery Parameters for Enhanced Oil Recovery Methods
- The Study of Enhanced Oil Recovery Project, by Considering Depth and API (Halliburton)
- Oil Recovery Rate in Each Method - National Iranian Oil company (NIOC)
- Primary Methods of Production from the Reservoir
- Natural Mechanisms
- Gas Cap Drive Mechanism
- Solution Gas Drive
- Gravity Drainage Drive
- Reservoir Pressure Maintenance Mechanism
- Water Injection in Order to Maintain Pressure
- Water Injection to Reservoir in Small Fields (Left) - Water Injection in Large Fields (Right) (NIOC)
- Methods of Advanced Enhanced Oil Recovery (EOR)
- Gas Injection in Miscible Way
- Nitrogen and Flue Gases
- Mechanisms
- Limitations and Problems
- Hydrocarbon Gas Injection
- CO_2 Injection
- Limitations and Problems
- Gas/CO_2 Injection in Immiscible Way
- Water Injection
- Waterflood Progression
- Injection Paths
- Permeability
- Injection of Chemical Materials
- Polymer Injection
- Technical Description
- Mobility Ratio

- Water and Gas Alternative Injection (WAG)
- Mechanism and Process
- Microbial EOR Methods
- Microbial Enhanced Oil Recovery Mechanisms
- MEOR Advantages
- MEOR Disadvantages
- Recovery in Fractured Reservoirs
- Fractured Reservoirs are Divided to Four Classes
- Fractured Reservoirs of 2nd Type
- Fractured Reservoirs Type 3
- Heavy Oil Reservoir Recovery Methods
- Heavy Oil Definition
- Recovery of Heavy Oil
- Cold Heavy Oil Production with Sand (CHOPS)
- Limitations
- Surface Mining
- Thermal Methods
- In-Situ Combustion
- Technical Description
- Restrictions and Problems
- Steam Injection
- Cyclic Steam Simulation/Injection, Steam Soaked, Huff and Puff
- Limitations
- Water Flooding by Steam
- Hot Water Injection
- SAGD Process
- Environmental Impact
- VAPEX Process
- Environmental Advantages
- Economical Advantages

- The Similar Characteristics of SAGD and VAPEX
- The Process of Oil Recovery from Mund Field
- Geological Setting of Kuh-e-Mund Oil Field
- Reservoir and Fluid Properties of the Kuh-e Mond
- STOIIP
- Petrophysical Modeling
- Best Enhanced Oil Recovery Method for Kuh-e-Mund Field of Sarvak Reservoir
- Steam Injection Simulation with SAGD Method in Kuh-e-Mund Field
- Thermodynamic Properties of Oil and Steam
- Steam Quality
- Research Method
- The Model Description
- The Model Network
- Results and Discussion
- Base Case Analysis
- Steam Injection Rate
- The Position of Injection and Production Wells in the Reservoir
- Surveying the Distance Between Injection and Production Wells (Vertical)
- The Total Range of Produced Water by Considering Vertical Distance of Production and Injection Wells
- The Survey of Matrix Porosity
- The Survey of Matrix Permeability
- Conclusion and Recommendations
- Conclusion
- Recommendations