

ENHANCED OIL RECOVERY FUNDAMENTALS

RSE029

COURSE OVERVIEW

This course includes a comprehensive summary of chemical, miscible, and thermal enhanced oil recovery processes. There will be a detailed illustration for reservoir engineering aspects governing EOR mechanisms such as fractional flow theory, Cyclic Steam Stimulation (CSS), Steam Assisted Gravity Drainage (SAGD), and some other hybrid newly-invented EOR methods including Low Salinity Waterflooding Techniques (LoSal™ and Waterflooding Designer) and Thermally Activated Particles (e.g. BrightWater™) techniques.

For each technique theoretical and practical aspects will be discussed in detail along with case studies and field examples.

COURSE OBJECTIVES

By the end of this course, participant will be able to:

- Understand EOR mechanisms and reservoir engineering aspects.
- Learn about chemical, thermal, and miscible EOR processes.
- Explore polymer, surfactant, alkaline flooding, and low salinity waterflooding techniques.
- Gain insights into gas recycling, CO₂ injection, and thermal EOR methods.
- Study heavy oil production and microbial EOR techniques.
- Understand EOR simulation, tracer usage, screening concepts, and failure analysis.
- Analyze case studies and field examples.
- Evaluate knowledge through pre- and post-course assessments.

WHO SHOULD ATTEND

- Petroleum engineers, reservoir engineers, and geologists
- EOR project managers and team members
- Technical professionals in the oil and gas industry
- Oilfield service providers and consultants
- Researchers and academics in the field of enhanced oil recovery
- Professionals in oilfield exploration and production

COURSE DURATION

5 Working Days

COURSE OUTLINES

Pre course evaluation.

1. Resources Definitions, Technology Guidelines, Reservoir Engineering & Geology Overview

In this part, SPE-PRMS system will be illustrated highlighting its guidelines in the regard of EOR. Basic concepts of reservoir engineering and geology will also be highlighted as a basis of EOR reaching to nodal analysis concept and its significance in productivity from hydrocarbon reservoirs.

This part will address and detail the following topics:

- Reservoir engineers deliverables
- Resources vs. Reserves
- Definition of EOR project
- Reservoir Classifications and categorizations.
- Chance of commerciality of EOR project
- Depositional Environment Impact
- Heterogeneity
- Overview about Nodal Analysis
- Review Rock and Fluid Properties

2. Basic Concepts in EOR, Oil Recovery and Lab Experiments.

In this part, basic concepts of EOR will be elaborated with special focus on driving forces and associated EOR mechanisms reaching to different laboratory experiments that usually being conducted as a step for EOR projects

Following are the main topics will be covered in this part:

- Driving Mechanisms and Forces
- Capillary Number
- Mobility Ratio and Interfacial Tension
- Why do you have low recovery?
- Lab Experiments: Core and PVT
- SARA analysis

3. Polymer Flooding, Surfactant Flooding and Alkaline Flooding

In this part, Chemical EOR methods will be detailed including polymer, surfactant and alkaline flooding, the following topics will be discussed:

- Polymer Flooding Mechanism
- Polymer Types

- Properties of polymers
- Polymer degradations
- Permeability reduction
- Screening criteria
- Case study (detailed)
- What is surfactant?
- Surfactant mechanisms
- Screening criteria.
- ASP
- Alkaline mechanisms
- Alkaline design considerations
- Alkaline screening criteria

4. **Smart Water: Low Salinity Waterflooding and BrightWater**

In this part, detailed discussion of low salinity Waterflooding will be presented starting from its physical and chemical fundamentals, lab experiments, pilot types, project planning and reaching to full case study. Thermally activated particles (TAP) will be presented also as a conformance technique that may help during EOR deployment.

Following are the main topics will be covered in this part:

- Fundamentals
- Mechanisms
- Lab experiments
- SWCTT and LIL
- Project design and planning
- Surveillance Strategy
- Low salinity Waterflooding Case study
- What is BrightWater?
- Case study

5. **Gas Recycling and Miscible CO₂**

In this part, Miscible/Immiscible gas injection EOR methods will be discussed highlighting main miscible methods, gas recycling applications and special illustration of CO₂ flooding applications and all its associated components.

Following are the main topics will be covered in this part:

- Miscible methods
- Condensate gas reservoirs
- Production problems

- Gas recycling
- Definitions and typical process
- Gas injections effects
- Pressure maintenance
- Vaporizing gas drive
- Pros and cons
- CO₂ flooding
- Ternary diagram
- Methods to achieve miscibility
- Flooding design
- Screening criteria

6. Thermal EOR: Steam, SAGD and In-Situ Combustion

In this part, Thermal EOR methods will be discussed presenting applications, screening and guidelines of hot Waterflooding, CSS, Steam flooding, SAGD and In-Situ Combustion.

Following are the main topics will be covered in this part:

- Hot Waterflooding
- Cyclic Steam Stimulation, CSS
- Steam Flooding
- SAGD
- In-situ combustion, ISC
- Lab experiments
- Mechanisms
- Design considerations
- Screening guidelines
- Pros and cons

7. Heavy Oil and Microbial EOR

In this part, Heavy Oil as a special topic in entire petroleum industry will be touched highlighting its definition and production methods, and then presenting the Microbial EOR technique with detailed case study.

Following are main topics will be covered in this part:

- Definition of heavy oil
- How to produce heavy oil?
- MEOR applications

- MEOR advantages
- MEOR Case Study
- Sampling
- Microbiological assessment
- Fermentation
- Lab experiments
- Pilot implementation
- Pilot results

8. EOR Simulation, Tracers for Monitoring, Screening concept, Why Failures and Case Studies (brief)

In this part, a few interesting important aspects related to EOR projects will be presented. EOR simulation, usage of tracer and reasons of failures are the main points in this part of the course.

Following are the main topics will be covered in this part:

- Main modifications for EOR methods (brief)
- Tracers
- How it works?
- Installation
- Sampling and analysis
- Examples.
- Screening concepts
- How screening is conducted?
- Why do many EOR projects fail?
- Notes and conclusions for each method
- Case Studies

Post course evaluation.

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