Enhanced Oil Recovery using Thermal Methods

Course Description

The Enhanced Oil Recovery using Thermal Methods course builds your competence, confidence, and credibility through a strong theorical framework as well as examples, exercises, and case studies discussions designed to consolidate and reinforce learning and identify solutions to specific challenges associated with oil recovery process.

This course provides a holistic approach of the enhanced oil recovery (EOR) using thermal methods. It is known steam injection methods are the ones with highest level of maturity and understanding.

The course will develop concepts, technologies and application of thermal processes. An overview of EOR methods, screening criteria, advantages and disadvantages of each method also will be addressed.

During this course, the rocks and fluids physical properties as well as the steam and water thermal properties will be studied to perform oil recovery calculations. This course convers the continuous steam injection, cyclic steam injection, in situ combustion, SAGD, HASD, and others technologies that use heat to reduce oil viscosity to produce in situ crude oil.

Main monitoring techniques, completions strategies, and key performance indicators will be analyzed.

The course will be supplemented by practical example problems, case studies analyses, group exercises, and interactive group discussion designed to consolidate and reinforce learning and identify and offer solutions to specific problems associated with Enhanced Oil Recovery using Thermal Methods.

Who Should Attend?

This course is designed for professionals with background in Engineering (Petroleum, or Chemical), geologist and other professionals whom are responsible for maintaining or increasing oil production.

1. Preferably, attendants should have some basic knowledge of reservoir characterization and simulation.

What You Will Gain:

1. Learn and understand drive mechanisms related to thermal EOR methods
2. Understand the screening criteria for gas, chemical, and thermal EOR.
3. Understand reasons of main difference of laboratory and field implementation results
4. Learn how to estimate steam volume requirements, water quality, incremental oil cost for thermal EOR processes
5. Learn how calculate the rock, and fluids physical properties
6. Learn how estimate the steam and water thermal properties
7. Identify major risks in thermal EOR implementation and plans for mitigation
8. Estimate average recovery factor for each thermal EOR methods
9. Learn key concepts of thermal EOR pilot design
10. Prepare reservoir surveillance and monitoring plans, completion technologies and key performance indicators to measure reservoir performance.
11. Learn best practices and lessons learned from case studies

Training Methodology

The training course will combine lectures (30%) with workshop/work presentations (30%), interactive practical exercises and case studies (20%), supported by video material, software and general discussions (20%)

Course Content

Day 1. Introduction to Enhanced Oil Recovery (EOR)

- History of EOR
- Definitions of Primary, Secondary Recovery and IOR/EOR
- Target of EOR
- Key definitions related to EOR
    - Incremental Oil
    - Vertical, Areal, and Volumetric Sweep Efficiency
    - Mobility Ratio, Residual Oil Saturation and Recovery Factor
- Effect of Reservoir Heterogeneities on EOR processes
    - Dykstra Parson, And Lorenz Coefficients, Koval Factor
    - Injection Patterns, Mobility Control
    - Factors affecting recovery factor

Day 2. Screening Criteria, overview of chemical, miscible, and thermal EOR methods

- Review of EOR screening criteria
- Chemical Flooding processes
    - Polymer Flooding
    - Surfactant flooding
    - Alkalis, Surfactant flooding (ASP)
    - Case studies and best practices
- Miscible gas injection EOR
    - Phase Behavior overview
    - Minimum Miscibility Pressure
    - Dimensionless numbers
    - Kr and Pc considerations for Miscible Process
    - CO2, N2 , gas injection process overview
    - Miscible WAG overview
    - Guidelines for Designing Miscible Processes
- Thermal EOR
    - Steam Injection overview
    - Drive mechanisms
    - Continuous Steam Injection, Cyclic Steam Injection
    - Recovery factor of EOR thermal methods
    - Case studies

Day 3. Thermal EOR. EOR pilot design

- Thermal EOR
    - Thermal properties of water, oil, gas, and reservoir rock
    - Specific heat, thermal conductivity
    - Water quality
    - Heat transfer mechanisms
    - Cyclic steam injection process
    - Continuous Steam Injection
- Thermal EOR Pilots
    - Pilot objective
    - Pilot design
    - Well completion types
    - Monitoring plan
    - Consideration for full field implementation
    - Case studies and best practices

Day 4: SAGD, HASD, in situ combustion, bottomhole electrical heating.

- SAGD/HASD
    - Screening criteria

- Drive mechanisms
  - Well design considerations
  - Reservoir simulation of SAGD strategies
- In situ combustion
  - Screening criteria
  - Types of in situ combustion processes
  - Drive mechanisms
  - Well design considerations
  - Reservoir simulation of SAGD strategies

Day 5: Field Development Plan of Thermal EOR projects. surveillance and monitoring. Case Studies

- Project surveillance
  - Data collection and interpretation
    - Injector and Producer monitoring variables
    - Monitoring dashboards
  - Saturation measurements, tracers
  - Data Acquisition Plan

- FDP uncertainty and decisions overview
  - Risk of implementing thermal EOR processes
  - Mitigation plan of identified risks
  - Thermal EOR Planning, from pilot to full field
- Fluid Injection System
  - Injection source analysis, fluid treatment and injection fluid quality control
  - Transport of injection fluids, surface facilities considerations
  - Incremental oil cost analysis
- Environmental and Economic Aspects of thermal EOR Methods
- NPV Optimization of thermal EOR Processes
- Case Studies Analysis and Discussion