WAG-Water Alternating-Gas EOR Processes

Course Price

£3050

Course Description

Water alternating gas (WAG) injection are improved oil recovery methods that involve three-phase fluid flow. It was originally proposed as a method to improve the sweep efficiency of gas by using water to control the mobility ratio and to stabilize the front (Caudle and Dyes, 1958; Christensen et al., 1998). WAG injection can lead to improved oil recovery by combining better mobility control and contacting upswept zones, and by leading to improved microscopic displacement. WAG flooding has been successfully applied to more than 60 oilfields worldwide. This course will present WAG Miscible, WAG Immiscible, WAG alternating different types of Hydrocarbon Gases and Non-HC such as N2 and CO2 Gases. Also, the course will present and study the Factors Influencing Wag Process Design such as Fluid properties and rock-fluid, Availability and composition of injection gas, Heterogeneous Permeability, Injection Pattern, Capillary pressure, Relative permeability and Wettability. A WAG Process is presented and discussed in the course as well as Field cases and Laboratory research cases and results.

Course Objectives

• Comparative of EOR methods and use of Waterflooding
• Study of the EOR Mechanism in Chemical and Miscible and WAG Methods
• EOR Screening Criteria and technical constrains for Chemical and WAG methods.
• Study of an actual case WAG Miscible and WAG immiscible processes
• Comparison between WAG Alternating and Continue Injection Gas
• Technically Review and Study of the Factors Influencing WAG Process Design (Fluid properties and rock-fluid, Availability and composition of injection gas, Heterogeneous Permeability, Injection Pattern, Capillary pressure, Relative permeability, and Wettability)
  o Perform an Analysis of the Water-Alternating-Gas (WAG) Process
  o Technically review and practice of the Effect of capillary number and mobility ratio on residual oil recover
  o A comparative study of FIELD CASE AND LABORATORY CASE OF WAG and SWAG.
  o Miscibility Concepts and Mathematical Background review
  o Discussion of “The Need for Miscibility Development ”
  o Effect of Brine Composition
  o Importance of CO2 as Injectant Gas
  o Problems Associated with the WAG Process
  o The impact of the following parameters on WAG processes:
    o WAG ratio
Injection pattern  
Injection / production pressure and rates  
WAG cycle time  
Time to Initiate WAG process  

- Presentation and discussion of technical information on Chemical Flooding:  
- Objectives of Chemical Flooding  
- Chemical EOR Screening Criteria  
- Processes Evaluations  
- Chemical success evaluation with WAG using CO2 Immiscible Processes  

Who Should Attend  
Petroleum engineers, Reservoir engineers, Production engineers, Facilities engineers, Drilling (well) engineers, Development and exploitation engineers, Geoscientists, New venture managers, Asset development managers, Employees new to the industry or with limited industry experience, Government officials, Others involved or interested in EOR technologies and strategies for improving  

Course Content  

I. Introduction to Enhanced Oil Recovery (EOR) Methods  
Introduction to EOR methods  
Comparative Performance of Different EOR Methods.  
Study of Mechanisms of EOR in Chemical and Miscible and WAG methods  
Screening Criteria and Technical Constraints.  

II. Wag Processes and Factors Influencing Wag Process Design  
- Water-Alternating-Gas (WAG) Process  
- Effect of capillary number and mobility ratio on residual oil recovery  
- Factor influencing WAG process design  
  - Fluid properties and rock fluid interaction  
  - Reservoir Heterogeneity and Stratification  
  - Availability and composition of injection gas  
  - WAG ratio  
  - Injection pattern  
  - Injection / production pressure and rates  
  - WAG cycle time  
  - Time to Initiate WAG process  
- Advantages and Disadvantages of the WAG techniques  

III. Field Case and Laboratory Case of Wag and Swag  

• Original wells
• Configuration of the new injection well
• Configuration of the re-completed wells and a new well location
• Comparison of WAG and SWAG Recovery Techniques Conclusions

IV. Wag Miscible and Immiscible Displacements

• Introduction
• Background
• Objective
• Miscibility Concepts and Mathematical Background review
• The Need for Miscibility Development
• Effect of Brine Composition
• Importance of CO2 as Injectant Gas
• Problems Associated with the WAG Process
• Literature Review
• Summary and Conclusions

V. Chemical Eor Methods Utilized In Wag Projects

• Polymers
• Surfactants
• Alkaline agents
• Combinations of such chemicals:
  • ASP (Alkali-Surfactant-Polymer) flooding MP (Micellar-Polymer) flooding
  • Chemical Flood History in USA and China
  • Objectives of Chemical Flooding
  • Chemical EOR Screening Criteria
  • Processes Evaluations
  • Chemical success evaluation with WAG using CO2 Immiscible Processes

VI. Discussion and Conclusions

CPD Unit

Continuing Professional Development

35 HOURS CPD