# Water Flooding Management

## INTRODUCTION

- 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 training seminar is primarily on the mechanics of oil recovery by water flooding.
- The aim of this Water Flooding Management training seminar 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 training seminar, the participants should have a solid grounding in the understanding of the purpose, operation and inspection of water injection systems for enhanced oil recovery. This Water Flooding Management training seminar will also illustrate potential problems and their resolution.

This training seminar will feature:

- Rock and fluid properties for better reservoir characterization
- Water flood data, acquisition, analysis, and management
- Factor influencing water flood recovery
- Water flood production performance and reservoir forecast
- Water quality and monitoring
- Water flood project optimization
- EOR applications is an extension to the water flooding
- Field examples and case histories

## OBJECTIVES

- 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
- Demonstrate understanding of the principals involved in pressure maintenance & oil displacement by an injected fluid
- Describe the process of waterflooding by identifying its design, operation and monitoring
- Acquaint the participants with the concept of immiscible gas injection in oil reservoirs by discussing the techniques & calculation methods used in immiscible gas / oil displacement and identifying the compositional effects during immiscible gas displacement
- Explain concepts utilized in monitoring the displacement process
- 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
- Discuss the thermal methods of EOR including hot water and steam injection and get important tips of the polymer injection process

## TRAINING METHODOLOGY

- This Water Flooding Management training seminar will utilize a variety of proven adult learning techniques to ensure maximum understanding, comprehension and retention of the information presented. The training seminar is designed as a blended environment of presentation; workshops; group work; practical exercises; field application / analysis and several industry videos showing all processes; and general discussions.

## WHO SHOULD ATTEND?

- This training seminar is suitable to a wide range of professionals (especially the engineers and technical staff whose responsibilities include the safe and cost effective operation of water injection systems) but will greatly benefit:
- Petroleum, Production & Reservoir Engineers
- Process Engineers and Field Operation Staffs
- Geologists and Geophysicists
- Engineers who are new to the profession
- Corrosion Personnel and Chemical Engineers

## Course Outline

### Water Flood Data Management - Data Acquisition, Analysis and Integration

- Reservoir Rock Properties
- Reservoir Fluids Properties
- Factors Affecting in Water Flooding

### Screening for Waterflooding

- Drive Mechanisms
- Reserves Estimate and Remaining Reserves
- Reasons for Water Flooding and History
- Secondary Recovery and Pressure Maintenance Concept
- Reservoir Engineering Aspects and Screening for Water Flooding
- Water Injection Systems – Water Source: Produced Water, Aquifers and Seawater - nature and composition of waters and seawater - matching reservoir requirements - water compatibilities and scale
- Water Injection Systems – Basic Water Treatment - Basic Seawater Treatment: Filtration and Deaeration

### Design Aspects of Water Injection System

- Reservoir-geology Considerations in the Design and Operation of Water floods
- Immiscible Displacement Theory
- Immiscible Displacement in Two Dimensions-areal
- Vertical Displacement in Linear and Areal Models
- Fractional Flow and Performance Measures
- Waterflood Performance Efficiencies
- Microscopic Efficiency of Immiscible Displacement
- Macroscopic Displacement Efficiency of a Linear Waterflood
- Waterflood Design
- Heterogeneity, Flood Pattern, Recovery Efficiency
- Candidates, Patterns, and Factors affecting Pattern Selection and Well Spacing
- Factor Influencing Water Flood Recovery
- Waterflood Production Performance and Reservoir Forecast

### Water Flooding Quality & Monitoring – What's Next?

- Water Quality and Monitoring
- Corrosion Problems (reasons and solutions)
- Field Operation, Water System, Compatibility and Treatment
- Various EOR Processes and their Recovery Expectations, Optimum Time
- Introduction to Chemical Enhanced Oil Recovery Techniques
- Polymer Flooding

## Enhanced Oil Recovery (EOR) Applications as an Extension to the Waterflooding

- Surfactant Flooding
- Alkaline Fooding
- Hot Water Flooding
- Steam Injection
- Water Flood Project Optimization and Economic Evaluation
- Field Examples and Case Histories