

# High Viscosity Crude Oils Optimization Production Technology

## Course Price

£3050

## Course Description

Experience in the production of heavy crude oils has demonstrated that the majority of conventional production systems and treatments are highly inefficient. The production, treatment, storage and fluid transference through pipelines of high viscosity crude oils are associated to severe and costly technical problems. The main objective of this course is to increase the efficiency in the production of heavy crude oil areas and reduce significantly the high cost of producing high viscosity crude oil. Other objectives are; the study of conventional methods and operational problems associated with the use of those methods in the production of heavy oil areas. A study of all methods available to handle high viscosity production areas in the world. Simplified mathematical aspects of the simulation of diluent fluid consumption. Study of theoretical field constituted by six wells producing different types of heavy crude oils at different rates of production. A study in depth of an actual field case. This course includes a discussion on “Paraffin and Asphaltene deposition in the production of heavy crude oils”.

## Course Objectives

The main objective of this course is to learn how to increase the efficiency in the production of heavy crude oil areas and reduce significantly the high cost of producing high viscosity crude oil.

### Specific Objectives:

- Analysis for the world areas major reserves of heavy oil and economic impact in the production of heavy oil.
- To learn the technical, mathematical and commercial aspects of heavy oil for field application.
- To learn the technical and legal aspects of transporting heavy oil by super tankers.
- Paraffin Crystallization and Asphaltene Flocculation/ Chemical of Paraffin and Technology.
- To study Emulsions and to learn how and why the content of water in the crude oil affects the production efficiency.
- To perform an in depth study of all the methods applied in field operations to produce heavy crude oil.
- To learn how the Flow improver works and when to be used in heavy oil Production
- To learn the mathematical principle of a heavy oil production model and how to apply it to field conditions.
- The practical application of the mathematical model and the design of a production system to produce heavy oil efficiently.
- To design and how to implement in the field an optimization system to produce heavy oil.
- To review and clarify important concepts and mathematical aspects related to heavy oil

production.

## **Who Should Attend**

This course is designed for Production and Reservoir Engineers and their supervisors; Chemical Engineers Associated with crude oil production in areas of high viscosity. Technical field personnel and services companies representatives to obtain or increase the understanding of the overall concepts and principles of improving the efficiency of production, treatment and the handling of heavy crude oils.

## **Course Content**

### **Topic 1: Introduction**

Objective: Analysis for the world areas major reserves of heavy oil and economic impact in the production of heavy oil.

- Scope and Objectives of the course
- Production of high Viscosity Crude Oils Economic Impact
- Heavy Oils, Typical Heavy Oil reservoir/ World Areas major reserves of Heavy Oils

### **Topic 2: Viscosity: Theoretical and Commercial Aspects**

Objective: To learn the technical, mathematical and commercial aspects of heavy oil for field application.

- Concept and definitions of Viscosity
- Absolute Viscosity; Kinematics Viscosity; Saybolt Universal Viscosity; Saybolt Viscosity Furol
- Viscosity Units, equations and Conversions
- Viscometers, Uses and Limitations
- Viscosity-Temperature Correlation and use of ASTM-341 charts
- Characteristics of High Viscosity Crude Oils/ Typical Components.
- Mixing Viscosity of Heavy Crude Oils
- Mathematical Aspects of Mixing Viscosity of Heavy Crude Oils
- Laboratory Study analysis: Effect of Diluents on Heavy Crude Oils
- Deviations of Viscosity in Heavy Crude oils.

### **Topic 3: Commercial Aspects of Viscosity on Heavy Crude Oils Transportation and Sales**

Objective: To learn the technical and legal aspects of transporting heavy oil by super tankers.

- International Contract Crude oil Transport based on Dynamic Viscosity.

- Adjusting Viscosity for Super-tankers Loading
- Examples and Exercises.

#### **Topic 4: Paraffin Crystallization and Asphaltene Flocculation Phenomena**

- The Chemistry of Paraffin
- Solubility of Waxes in Heptane
  
- Causes of Paraffin Problems
- Historic Methods Used to control Paraffin
- In Situ Chemical Heat Generation and Recovery Method and Inert Gas Displacement
- Formation Damage related to Hot Oiling
- Microbial Enhanced Oil recovery to Control Paraffin
- Magnetic and Electromagnetic to control Paraffin
- Asphaltene Chemical Composition
- Asphaltene and Resin Interaction
- ADE Methods for Exploitation of Asphaltene Reservoirs
- NIR Infrared Spectroscopy Technology to Determine the Crystallization and Flocculation Paraffin-Asphaltene Curves and Combination with P-T Phase
- Behavior of Crude Oils.
- Effect of Emulsion on Viscosity of Crude Oils

#### **Topic 5: Water Cut effect on Viscosity of Heavy crude oils and transport Efficiency of crude oils**

Objective: To study Emulsions and to learn how and why the content of water in the crude oil affects the production efficiency

- Introduction to Emulsions
- Brief theory of Emulsion and types of emulsions
  
- Reverse Emulsions and its importance in Heavy Oil Transport.
- Stable emulsion and its commercial importance
- Paraffin as emulsifying agents and prevention of Emulsions
- Concept of pseudo- dynamic emulsions/ Effects on the line pressure and its control.
- Effect of Emulsion on Viscosity of Crude Oils
- Demonstrations; Exercises and discussions.

#### **Topic 6: Production Methods of High Viscosity Crude Oils**

Objectives: To perform an in depth study of all the methods applied in field operations to produce heavy crude oil.



- Water Injection and Adjustment with Diluent./ Light oil
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Production Wetting System

– Description, operation method and diagrams/ Application, Advantages and disadvantages of the method

- Intermediate and Light Crude Oil Injection Method
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Down hole Diluent / Light oil Adjustment Method
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Injection and Recycling of Diluent or Light oil Method.
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Heating and Diluent/ Light oil Adjustment Method
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Down hole Pack and Diluent/ Light oil Adjustment
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method
- Down Hole Emulsification using non-ionic Emulsifiers
- Description, operation method and diagrams/ Application, Advantages and disadvantages of the method.
- Comparative Analysis of the method to produce high viscosity crude Oils.

## **Topic 7: Flow Improver to handle heavy crude oil production**

Objective: To learn how the Flow improver works and when to be used in heavy oil Production.

- Study of the results and economic feasibility of the use of Flow Improver to produce efficiently heavy crude oils according the experience in Mexico.
- Study of the results Flow Improver to produce efficiently heavy crude oils according the experience in Venezuela.

## **Topic 8: Mathematical Simulation of Consumption of Diluent or Light Crude Oils**

Objective: To learn the mathematical principle of a heavy oil production model and how to apply it to field conditions.

- Mathematical Basis of the computer program to predict Mixing Viscosity.
- Prediction of Mixing Viscosity under Dynamic conditions.
- Non-Newtonian heavy crude oil effect on Mixing Viscosity.

## **Topic 9: Study of an actual field project**

Objective: The practical application of a mathematical model and the design of a production system to

produce heavy oil efficiently.

- Analysis and design of system of Diluent Injection to optimize a heavy crude oil field.

### **Topic 10: Definition and project scope**

Objective: To design and how to implement in the field an optimization system to produce heavy oil.

- Projects Systems: Measure System, Storage System, Power System and Distribution System.
- New well Production prediction by using the Simulator
- Comparative study between water injection and Diluent system to produce a heavy oil field
- Method to technically select a diluent based on efficient and economic impact.
- Brief economic analysis of the project.

### **Topic 11: Final Discussion and Conclusions**

Objective: To review and clarify important concepts and mathematical aspects related to heavy oil production.

## **CPD Unit**

### **Continuing Professional Development**

**35 HOURS CPD**