Heavy Oil Pipeline Transport Methods and Design

Course Price

£3050

Course Description

This course is an introduction comprehensive study of heavy oil transportation. 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 and transportation of heavy crude oil areas and reduce significantly the high cost of producing and transporting high viscosity crude oil.

Course Objectives

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

Other objectives are:

- Study the rheology of heavy oils, Application of technical of Dilution by using diluents to optimize the transportation
- Pipeline design including thermal insulation calculation and power pumping system and at the same time to study the new technology to transport heavy oil and Paraffinc crude oil
- The study of conventional methods and operational problems associated use of those with the use of those methods in the production of heavy oil areas
- The 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

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 and Transport of heavy oil.

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

Topic 2: Heavy Oil and Paraffinic Crude Oil Characterisation

- Concept and definitions of Viscosity
  - Flow patterns
    - Annular Flow
  - Paraffin Fraction and Characterization
  - Composition of Paraffin crude Oils
  - Crystallization Process in Paraffin
  - Aggregate and Disaggregate Theory
  - Pour Point
  - Cloud Point
  - Viscosity behaviour in Paraffin Crude Oils

Topic 3: Viscosity: Theoretical and Commercial Aspects

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

- 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 4: 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
- Examples and Exercises
Topic 5: Production Methods of High Viscosity Crude Oils

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

Topic 6: 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 of Flow Improver to produce efficiently heavy crude oils according the experience in Venezuela.

Topic 7: Water Cut effect on Viscosity of Heavy crude oils and transport Efficiency of crude oils

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

- Concept of Emulsions and Types of emulsions
- Uses, Practical aspects and Creating similar emulsions in the field.
- Concept of pseudo- dynamic emulsions/ Effects on the line pressure and its control.
- Impact of Paraffin and Asphaltenes on Emulsions and transport of heavy crude oils.
- Demonstrations; Exercises and discussions.

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: Design and Planning for the Construction of a Pipeline for Distribution of Diluent to Optimize a Field in Venezuela an Actual Field Case.

Objective: The practical application of the mathematical model and the design of a production system to produce heavy oil efficiently.

- Analysis and design of A PIPELINE AND A DISTRIBUTION SYSTEM of Diluent Injection to optimize a heavy crude oil field.
- Application of the Mathematical model for calculation of Diluents
- Optimization Process for selection of Diluents by using the mathematical model
- Analysis of the results and general discussion

Topic 10: Transportation Alternative Methods

1. Heat treatment
2. Dilution
3. Emulsion
4. Partial Upgrading
5. Core Annular Flow

**Topic 11: Mathematical aspects of Transporting Detailed Study paraffinic Crude Oil (800 Miles pipeline crossing the Artic) using heat and flow velocity**

1. Equations to describe Mechanisms of lateral transport and deposition of paraffin
2. Rate of deposition of paraffin for combined mechanisms
3. Comparison of laboratory measured and predicted deposition rates
4. Study of a major field case - Discussion
5. New Software available for prediction of paraffin deposition

**Topic 12: Pipeline Design for Heavy Crude Oil and Paraffin Oil**

- Areal, Buried and under water pipes. Pipe Floatability.
- Design Of. Spacing “H” structures.
- Pipes Heat Transfer Calculations and determination of temperature profile.
- Design for Thermal Isolating Material
- Cost of Operational Transport and selection of optimum pipe diameter.

**Topic 13: Study and Design of the Power System**

- Pumps, Design and Selection
- Calculation of NPSH and BHP required
- Starts and Stops of Transport of Paraffinic Non Newtonian A Crude Oil
- Design of Pumping Stations
- Friction Reductors, Selection and design
- Required Equipments and Operative Costs of different methods of Transportation of Heavy Crude Oils
- Pipeline Control

**Topic 14: Pipeline Problems and Field Cases**

- Examples and Exercises for Field case Pipeline Design
- Software applications available in the market.
- Academic software application

**Topic 15: 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