



info@mineoil.com

+44 (790) 991 9419

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[www.mineoil.com](http://www.mineoil.com)

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This may also be of interest

Simulation of Enhanced  
Oil Recovery Methods

Oil Recovery Methods

Water Alternate Gas  
EOR

EOR

Waterflooding from A to  
Z

## Specialist Trainer

Nelson Guerra

Nelson is a Petroleum Engineer graduated at the Universidad de Oriente, Puerto La Cruz Venezuela, with more than 30 years in the upstream oil and gas industry, worked in Energy Services as General manager operating 20 drilling and workover rigs providing services to REPSOL, OXY, PAE, CAPSA and ENAP-SIPETROL in Chubut and Santa Cruz Comodoro Rivadavia Argentina

In Venezuela worked for Reimpet Holding Group, for PDVSA E&P, Lagoven S.A. an Sinclair Oil, he was Principal Operations Coordinator for crude oil custody transfer to terminals, refineries and shipping terminals managing 3.5 million barrels per day; his expertise includes economics, investments, planning, thermal projects for EOR in heavy oil fields.

Currently provides consultancy to the oil industry in Venezuela and internationally, cooperates with the "Plan País for the recovery of the Venezuelan oil industry", and lectures in technical subjects to Universities and oil companies including Heavy Oil and Thermal Methods associated to MineOil Limited.

## Description

This training is focused in theoretical and practical aspects of the technologies applied in the exploitation of heavy and extra heavy oils resources, the training is composed by lectures based on observations and learnings from historical operations undertaken in various experimental projects, research studies, laboratory studies and field development activities implemented in the years 1975 to 2003 by the three PDVSA affiliated operational companies responsible for the exploration, appraisal and development of the heavy and extra heavy oil resources identified in the Eastern Venezuela in the so called Orinoco Bitumen Belt.

The course includes a description of important heavy oil developments based on Thermal and Chemical processes implemented in Asia, Africa and other South American countries, with emphasis in design and implementation failures and success cases. This training can be lectured in house in English and/or Spanish according to the client preferences.

## Objectives

The objectives of this training are to provide the delegates with a complete and broad vision of the main methodologies to appraise, develop and operate a heavy and extra heavy oil resources, including:

- Heavy oils fields characterization
- Coring operations in unconsolidated sands
- Oil and gas sampling operations for representative PVT characterization.
- Well testing in heavy Oil wells
- Production methods
- Impact of the Horizontal wells in the development of heavy and extra heavy oil reservoirs.
- Treatment and transport methods
- Methods for heavy oil upgrade

## Audience

- Petroleum and Drilling Engineers,
- Drilling and Operation Managers
- Reservoir Engineers, Geologists, and other Geoscientists



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## Audience (cont.)

- Commercial personnel entering in tasks of finance, economics and planning.
- The course is designed for personnel working in geosciences, engineering, finance or commercial departments of oil and gas companies, companies that provide financing or services to the oil and gas industry.

This training can be done in house based on workshop sessions for groups of delegates with interest in understanding the principles and applications of drilling engineering fundamentals and practices.

## Content

### Day 1

#### I. Introduction and scope

- Economic of heavy oil production.
- Typical heavy oil reservoirs, areas with heavy oil reserves in the world.
- World statistical data on oil recovery by thermal methods.
- II. Heavy Oils Technical Fundamentals
- Origin and characterization of different types of heavy oil, Chemistry of various categories of heavy oil (elemental composition: carbon, hydrogen, nitrogen, oxygen, sulphur (CHNOS), SARA analysis: saturated, aromatic, resins and asphaltenes.
- Thermal effects on rock and fluid properties. Density, Thermal expansion, Correlations of crude oil viscosity vs. temperature
- Heavy oil characteristics: Thermal Variables: Enthalpy, Internal energy, Temperature
- Heat capacity (specific heat), Latent heat of vaporization, Thermal conductivity, Thermal diffusivity
- Thermal properties of reservoirs fluids and rocks. Effects of the water and rocks in thermal processes and correlations of rock s and fluid properties
- PVT diagrams and PV diagram. Determination of steam quality.
- Thermodynamics of steam and water tables
- Calculating the saturated steam temperature and pressure and steam vaporized
- Steam process control by steam tables
- III. Viscosities, Theoretical and Practical Aspects
- Concept and definition of viscosity. Absolute viscosity, Kinematic viscosity. Say bolt Universal Viscosity. Furol viscosity
- Viscosity units and conversion equations. Viscometers, Uses and Limitations
- Viscosity Correlation – Temperature and use of ASTM-341 graphics

### Day 2

#### IV. Characteristics of High Viscosity Crude Oil / Typical Components

- Viscosity of a mixture of heavy crudes. Mathematical aspects of the viscosity of a mixture of heavy crudes. Laboratory studies: Effect of diluents on heavy crudes. Deviations in viscosity in heavy crudes.
- V. Commercial Aspects of Viscosity in the Transportation and Sale of Heavy Crude Oil
- International contract for the transport of heavy oil based on viscosity. Adjusting the viscosity for loading large tankers. Examples and Exercises.
- VI. Heavy Crude Transportation Methods and Technologies
- Fusion technologies: Determination of the viscosity of a mixture of crude oil and diluents
- Simulation of diluent consumption. Laboratory tests to test the model. Results and application of the analytical model
- Other technologies: Heating, Emulsification, Partial Classification Field,



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## Content (cont.)

- **Annular Core Flow and Combinations**
- **Examples and Real Field Cases**

Day 3

### VII. Heavy Oil and the Crystallization Phenomenon of the Asphaltenes and Paraffins Flocculation.

- The chemical conformation of paraffins. Causes of paraffin problems. Historical method for the control of paraffins On-site heat generation and inert gas recovery and displacement method for Paraffin control.
- Formation damage related to treatment and stimulations using hot oils.
- Asphaltenes chemical composition and molecular structure.
- Asphalt and resin interaction.
- “ADE” methods for the exploitation of asphaltene reservoirs.
- “NIR” infrared spectroscopy technology to determine crystallization and flocculation.
- Paraffin – Asphaltene, behavior curves with P-T
- Effects of the diluent mixture on the flocculation of an asphaltene crude.
- VII. Emulsions and Heavy Crudes Introduction. Brief theory of emulsions and their types.
- Inverse emulsions and their importance in the transport of heavy crude.
- Stable micro emulsions and their commercial importance.
- Effect of emulsions on the viscosity of a crude.
- IX. Heavy Oil Operations, Tested and Untested Thermal Operating Technologies
- Proven thermal technologies (applicable to sandstone and carbonate deposits)
- In Situ Combustion, air injection
- Steam flooding process
- Steam stimulation cycle (CSS)
- Gravity assisted steam drainage (SAGD)
- Description and design stages, drilling and processing wells, development phases, performance indicator, economic key parameter, field examples.
- Emerging Thermal Technologies Test (general description)
- Combustion in Situ or air injection, VAPEX, Solvent / hybrid steam processes, N2 – double steam injection process, CO2 – N2 – steam injection process, Combustion gas vapor injection process,
- Electro-thermal heating processes and other technologies.

Day 4

### X. Heavy Oil Operations No thermal technologies (general description)

- Solvent injection
- CO2 injection cycle (Huff and Puff injection)
- MEOR (Microbial Enhanced Oil Recovery) Experience in Heavy and Extra-Heavy Crudes
- Canadian Experiences with Heavy and Extra-Heavy Crude
- Venezuelan field experiences with heavy crudes.
- Experiences from China with steam and nitrogen injection simultaneously.
- XI. Well Completions in Heavy Oil Reservoirs
- Design in heavy crude completions.
- Completion and cementing techniques in heavy crude oil wells.
- Types of completions.
- XII. Production Methods in Viscous Oils
- Water injection and adjustments with thin diluent or crude oil injection.
- Medium and light crude oil injection.
- Injection and recycling of thin diluent or crude oil.
- Heating and injection of diluent or light crude.



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### Content (cont.)

- Bottom packing and diluent injection / adjustment with light crude.
- Emulsification method using non-ionic emulsifiers.
- Comparative analysis of heavy crude production methods.
- Selection of the most appropriate method for a specific field.
- Advantages and disadvantages of heavy oil production methods

### Day 5

#### XIII. Economic Study and Viability to Produce Heavy Oils based on Field Experiences in Venezuela and Mexico

- Economics, and operational viability
- XIV Effects of Water Cut in the Oil Viscosity in Heavy Oil
- Pseudo-dynamic emulsion concept, online pressure effects and controls.
- Impact of paraffin and asphalt in an emulsion and transport of heavy crude.
- Impact of paraffin and asphalt in an emulsion and transport of heavy crude.
- Demonstrations, exercises and discussions.
- XV Mathematical Simulation of the Diluent or Light Solvents Consumption in the Heavy Oil Exploitation Operations.
- Mathematical basis of the computer program to predict the viscosity of a mixture.
- Prediction of the viscosity of a mixture under dynamic conditions.
- Effect of non-Newtonian heavy crude oil on the viscosity of a mixture.
- XVI. Heavy Oil Project Study: Analysis and Design of a Diluent Injection System to Optimize Heavy Oil Production.
- Definition and scope of the project.
- Measurement, Storage, Power and distribution systems.
- Prediction of the production of a new well using the mathematical simulator and the initial production of the well.
- Comparative study between water injection and diluent injection to produce heavy crude.
- Method to select a diluent based on efficiency and economic impact.
- Brief economic analysis of the project.
- XVII. General Discussion of the Applicable Technologies to Produce Heavy Oils.

End of the training