

PetroSkills®

2016 Integrated - Heavy Oil Training Guide



OGCI®

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RDC



Integrated - Heavy Oil

Course Progression Matrix

The following instructors have been selected and approved by the PetroSkills Curriculum Network:

MR. SATINDER CHOPRA
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 MR. MEHRDAD SOLTANZADEH

MR. JEFF WEBBER

	Geophysics	Geology	Petrophysics	Reservoir Engineering	Well Construction / Drilling	Production and Completions Engineering
INTERMEDIATE				RESERVOIR MODELING OF HEAVY OIL RESOURCES (PAGE 3)		WATER MANAGEMENT IN HEAVY OIL RESOURCE OPERATIONS (PAGE 3)
FOUNDATION				GEOMECHANICS FOR HEAVY OIL (PAGE 3)		
BASIC	GEOLOGICAL AND GEOPHYSICAL CHARACTERIZATION OF HEAVY OIL RESERVOIRS (PAGE 2)			EVALUATING AND DEVELOPING HEAVY OIL RESOURCES (PAGE 2)		
	FIELD STUDY-HEAVY OIL RESOURCES (PAGE 2)					
	OVERVIEW OF HEAVY OIL RESOURCES (PAGE 2)					



Evaluating and Developing Heavy Oil Resources – HOED

FOUNDATION

Cold production, oil sands mining and in-situ thermal production methodologies are important contributors to the world's oil production. The course takes an unbiased practical approach to the applications, citing benefits and limitations. The course provides an overview and details of specific occurrences of the geology, evaluation, development and commerciality of heavy oil/in-situ oil sands resources. Each attendee should come away with a great foundational knowledge of the business of evaluating and developing heavy oil resources.

DESIGNED FOR

Anyone from any discipline who needs a better understanding of heavy oil/oil sands resources, but more specifically designed for geoscientists or engineers with a need to better understand the challenges of evaluating and developing heavy oil/oil sands resources.

YOU WILL LEARN HOW TO

- Evaluate and develop heavy oil/oil sands resources
- Understand the importance of heavy oil/oil sands in today's world energy market
- Contrast heavy oil/oil sands resources as compared to conventional and other unconventional resources with aspects of finding, developing and producing
- Understand the geology, critical attributes, and commerciality of the Canadian Heavy Oil/Oil Sands
- Collect the appropriate data and evaluate the critical geologic and reservoir parameters of various types of heavy oil/oil sands resources
- Recognize and evaluate the environmental challenges required to develop and produce heavy oil/oil sands resources
- Understand the process and methodology to evaluate, select, plan, design, and implement a heavy oil/oil sands recovery project
- Become knowledgeable of the worldwide distribution and geologic setting of the more significant heavy oil occurrences

COURSE CONTENT

Bitumen and heavy oil Introduction • Comparison of conventional and unconventional reservoirs • Worldwide heavy oil/oil sands resources and occurrences • Geology and overview of Venezuela and Trinidad heavy oil resources • United States heavy oil occurrences • Geology, history, and development of Canada heavy oil/oil sands • Heavy oil/oil sands characteristics and development strategies • Oil sands mining details and reclamation • Environmental challenges for oil sands resources • Heavy oil and in-situ oil sands recovery process review • Introduction to Steam Assisted Gravity Drainage (SAGD) • Other commercial thermal in-situ methodologies • Commercial application of Cold Heavy Oil Production with Sand (CHOPS) in Canada and other non-thermal heavy oil recovery methods • Field examples and development strategies of heavy oil and in-situ oil sands recovery projects • Overview of thermal well completions and production facilities • Reserves and economics

See website for dates and locations.

Field Study – Heavy Oil Resources – HOF5

BASIC

FIELD TRIP

This course is geologically and technically focused but instructed in such a manner that all disciplines and experience levels will understand. Mining and in-situ production of bitumen from the Athabasca oil sand region is currently a major contributor to the world's oil production. These technologies are reasonably recent commercial applications and the future levels of production face uncertainty because of highly debated environmental challenges. The field course takes the student to the rock; explaining complex relationships and issues emanating from the depositional and structural framework.

DESIGNED FOR

Anyone of any discipline who wants a hands-on understanding of the Athabasca Oil Sands.

YOU WILL LEARN

- How to understand the depositional and stratigraphic framework of the McMurray Formation
- How to understand the structural setting and relationships of timing, emplacement, and preservation of Alberta's bitumen/heavy oil resource
- The complex lithologic heterogeneities of the McMurray and their effect on mining and in-situ production
- To appreciate the challenges and progress of environmental preservation efforts for the development and production of Alberta's bitumen resource

COURSE CONTENT

Overview of the geology, history, and development of Canada oil sands • McMurray oil sand stratigraphy • Depositional details of the McMurray formation • Overview of structural evolution and bitumen resources • Oil sand mining methodology • Environmental challenges for Alberta's bitumen resources • Current status and future plans for reclamation mining activities

See website for dates and locations.

Geological and Geophysical Characterization of Heavy Oil Reservoirs – HORC

BASIC

With conventional hydrocarbon resources growing thinner, heavy oil and bitumen are being looked at as the next resource that could be exploited in the near future. As both heavy oil and bitumen are a global resource, they are fast becoming an asset base for many energy companies. Economical development of heavy oil reservoir requires accurate characterization of the rocks as well as the fluids contained therein. As heavy oil properties are different from conventional oil, its exploration and production requires special seismic strategies and rock physics models. Geophysical characterization of heavy oil reservoirs is therefore at the heart of production of this resource.

DESIGNED FOR

Seismic interpreters, seismic processors, stratigraphers, structural geologists, and reservoir engineers.

YOU WILL LEARN

- Evaluation of the available reservoir characterization options, and selection of the options suitable for the project
- To apply the appropriately chosen techniques to your data to extract meaningful information
- To evaluate the application of the various techniques discussed during the course
- The sweet spots within the reservoir zone based on characterization with application of different attributes
- To integrate the different attribute applications to generate a comprehensive characterization of the zone of interest

COURSE CONTENT

Mechanisms for the formation of heavy oil • General phase behavior of hydrocarbons and heavy oil • Properties of heavy oil and rock physics analysis • Geophysical approaches to characterization of heavy oil reservoirs • Measuring and monitoring heavy oil properties • Methods of extraction of heavy oil (CHOPS, SAGD, etc.) • Challenges for heavy oil production • Seismic monitoring of hot and cold heavy oil production • Optimization of Canadian heavy oil production through reservoir characterization • Environmental issues • Jeopardy exercises on each of these units

See website for dates and locations.

Overview of Heavy Oil Resources – HOOV

BASIC

Commercial mining and current in-situ thermal production methodologies are important contributors to the world's oil production. These technologies are reasonably recent commercial applications, and the future levels of production face uncertainty because of highly debated environmental challenges. This course takes an unbiased practical approach to the applications, citing benefits and limitations. Overview of Heavy Oil Resources provides an overview of the aspects of the geology, development, and commerciality of heavy oil resources. This course contains exercises and class problems to support the presentation. Each attendee will be given the facts to develop an overall understanding of heavy oil development.

DESIGNED FOR

Anyone from any discipline who needs a better understanding of heavy oil resources.

YOU WILL LEARN

- The geologic and engineering challenges to finding, developing, and producing heavy oil resources
- About the importance of heavy oil resources in today's world energy market
- How to evaluate the challenges and opportunities for understanding and improving the environmental footprint required to develop and produce heavy oil resources
- The contrast between heavy oil resources versus conventional and other unconventional resources with aspects of finding, developing, and producing
- The process and methodology to plan, design, implement, and evaluate heavy oil reservoirs
- About the geology and commerciality of the Canadian Oil Sands
- About the world-wide distribution and geologic setting of the more significant heavy oil occurrences including Venezuela

COURSE CONTENT

Comparison of conventional and unconventional reservoirs • Worldwide heavy oil resources and occurrences • Bitumen and heavy oil definitions and introduction • Geology, history, and development of Canada Oil Sands • Oil sand characteristics and development strategies • Oil sand mining details and reclamation • Oil sands in-situ project review • Introduction of Steam Assisted Gravity Drainage (SAGD) • Other commercial thermal in-situ methodologies • Environmental challenges for heavy oil resources • Geology and overview of Venezuela and Trinidad heavy oil resources • Commercial application of Cold Heavy Oil Production with Sand (CHOPS) in Venezuela • Introduction of United States heavy oil occurrences (Utah, California and Texas)

See website for dates and locations.

Geomechanics for Heavy Oil – HOGM

FOUNDATION

This course introduces an integrated workflow for reservoir containment evaluation and caprock integrity assessment in thermal operations such as SAGD and CSS in heavy oil reservoirs. The essential fundamentals of petroleum-related rock mechanics will be presented, and the processes of data collection, geomechanical characterization, and building Mechanical Earth Models (MEMs) will be discussed in details with an emphasis on data uncertainty. The course provides a comprehensive picture of the geomechanical behavior of heavy oil fields in response to thermal operations and shows how different modeling approaches, from simpler closed-form solutions to more cumbersome numerical models, may be implemented to predict this behavior and its associated geomechanical risks. It presents the application of modeling in mitigating the adverse effects of these risks and determining safe-operating criteria such as maximum operating pressure. Different aspects of field monitoring and real-time updating, as essential components of reservoir containment evaluation, are discussed. Several case histories and in-class exercises help participants grasp a practical perception of the course materials.

DESIGNED FOR

Geoscientists and reservoir engineers involved in heavy oil plays.

YOU WILL LEARN HOW TO

- Implement principles of rock mechanics and petroleum geomechanics in evaluation of reservoir containment in thermal operations

COURSE CONTENT

Reservoir containment evaluation • Caprock integrity assessment • SAGD and CSS in heavy oil reservoirs • Fundamentals of petroleum-related rock mechanics • Processes of data collection • Geomechanical characterization • Mechanical Earth Models (MEMs)

See website for dates and locations.

Horizontal Well Placement in Heavy Oil Reservoirs – HOWP

FOUNDATION

Conventional hydrocarbon resources are becoming more and more elusive with each passing year. Many oil and gas companies are reverting to heavy oil or bitumen as 'Resource' plays to be exploited. Often, the technical challenge lies in how best to extract the reserves. Optimal placement of a horizontal or deviated wellbore can impact the economics significantly. This course uses real examples to demonstrate some of the challenges faced, and progressive group and team exercises to learn the skills needed to plan and coordinate the geological aspects of horizontal drilling.

DESIGNED FOR

Geoscientists, technologists, and/or junior engineers involved in planning and implementing deviated or horizontal drilling programs.

YOU WILL LEARN HOW TO

- Distinguish and understand which information is pertinent when working with drillers to plan your well path
- Communicate effectively as part of a multidisciplinary team in order to make timely, effective decisions, then implement them
- Interpret surveys and log data in real time during drilling in order to understand the position of your well versus the planned trajectory, and/or the planned position within the reservoir
- Compare the resulting logs against modelled responses in order to determine whether your current well path needs to be adjusted
- Evaluate the resulting data set to prepare recommendations for placement of perforations post drill

COURSE CONTENT

Fundamentals of directional drilling with mud motors • Bent housing vs. rotary steerable systems • Measurement While Drilling tools • Surveys and ellipse of uncertainty • Logging While Drilling tools • Dogleg severity • Target planning and 'Geo-Steering' • Landing intermediate • Modifying horizontal targets • Class and team example • Post well review and perforation discussion

See website for dates and locations.

Reservoir Modeling of Heavy Oil Resources – HORM

INTERMEDIATE

As with conventional oil, the reservoir engineering aspects of the development of heavy oil and bitumen is aided by modeling of various kinds. For heavy oil and bitumen, the modeling is complicated by the high oil viscosity and the need for enhanced oil recovery techniques, usually involving heating of the reservoir to produce the oil at commercial rates. In this course, modeling is understood as a part of reservoir engineering and includes the use of analogues and analytical modeling, as well as numerical simulation. The emphasis is on numerical simulation, but analytical techniques are also examined in some detail, since they provide considerable insight into the recovery process. The emphasis of the course is on HOW to perform a successful heavy oil simulation study, including factors to be considered, pitfalls to avoid, testing of models, examination of output, and ensuring results are reliable.

DESIGNED FOR

Petroleum and reservoir engineers who will be actively working on studies, and be involved in assessing the results of studies.

YOU WILL LEARN HOW TO

- Select the type of modeling required to meet the aims of the study
- Design different types of modeling studies to achieve the aims of the study (feasibility, operating strategy, development plan, ultimate recovery, etc.)
- Collect and select the data for the study
- Incorporate field observations into the study (production data, pressure data, 4D seismic, observation well data)
- Set up, run, and test the model(s)
- Assess the adequacy of the history match(es)
- Create and run different development options and assess the results
- Assess the results of third party studies (in-house or external)

COURSE CONTENT

Introduction (definitions of heavy oil, types of study, types of modeling, design of study, grid effects, binary screening) • Basic reservoir engineering and reservoir characterization (overview of reservoir engineering techniques and their limitations for heavy oil, types of geological models, introduction to geostatistical models) • Rock and fluid data for heavy oil (oil viscosity, thermal properties of reservoir, temperature dependence of relative permeability, etc.) • Non-thermal recovery of heavy oil (cold heavy oil production with sand, chemical flooding, VAPEX, immiscible gas flooding) • Thermal recovery using steam (cyclic steam stimulation, steamflood, steam-assisted gravity drainage) • Thermal recovery without steam (in-situ combustion, electrical heating, hot water flood, steam with additives)

See website for dates and locations.

Water Management in Heavy Oil Resource Operations – HOWM

INTERMEDIATE

This course will review the basics of heavy oil extraction and the characteristics, quality, and quantities of waters in heavy oil resource operations. It will examine the interpretation of analytical results and simulation resources including heavy oil and bitumen extraction use of water, limitations, and typical ratios. The scientific basis and principles of de-oiling technologies, chemical (hot and warm) lime softening (including sludge disposal), ion exchange SAC and WAC technologies, BFW chemistry, and OTSG boilers. Equipment scaling and corrosion problems will be included. It will review technologies of evaporators. Recent and developing new technologies for produced water recovery will be discussed. Real life cases will be reviewed and evaluated. Finally, this course will review the most prominent environmental limitations.

DESIGNED FOR

Process designers and CPF operators dealing with heavy oil produced water separation, recovery and treatment for reuse or disposal. Personnel involved in establishing, improving or supervising the implementation of technology improvements. This course will be useful to managers in completion, production and optimization of operations.

YOU WILL LEARN HOW TO

- Understand technology options, advantages, and limitations
- Choose the most advantageous technology given the site conditions
- Design or specify the equipment capable to fulfill the operations intended
- Optimize design conditions and operating efficiency
- Troubleshoot field situations
- Understand water mass and ionic/solids balance
- Review field cases

COURSE CONTENT

Heavy oil review • Water properties and analytical key parameters, review of analytical results, what is logic, what is out of line? • Thermo-extraction produced water, the process (SAGD and CSS), ratios • De-oiling technologies, traditional, deviations, and future • Softening and silica removal, hot and warm lime softening • Ion exchange technology, SACs and WACs technologies, the out of vessel regeneration • Backwash, regeneration and separation sludge: collection, thickening, and dehydration • Boiler feed water final treatment, standard requirements and chemical conditioning • Evaporator alternatives and ZLD technology • Tube corrosion and scaling in boilers and evaporators • Mining bitumen extraction, tailings pond, process affected waters, their treatment and reuse • Cooling tower requirements, water conditioning, and treatments • Deep well injection of waste water: requirements and treatment

See website for dates and locations.



TO VIEW OUR COURSES IN OTHER DISCIPLINES, VISIT:

Subsurface

- Introductory/Multi-Discipline
- Geology
- Geophysics
- Petrophysics
- Reservoir Engineering
- Well Construction/Drilling
- Production & Completions Engineering
- Unconventional Resources
- Integrated - Heavy Oil
- Petroleum Data Management

Facilities

- Gas Processing
- Process Facilities
- Water & Corrosion
- Offshore
- Pipeline
- Instrumentation, Controls, & Electrical
- Mechanical
- Reliability Engineering
- Procurement/Supply Chain Management
- Refining

Operations & Maintenance

Health, Safety, Environment

Petroleum Business and Professional Development

- Petroleum Professional Development
- Petroleum Business
- Project Management

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