



IN-SITU COMBUSTION FROM PILOT TO COMMERCIAL APPLICATION

COURSE OUTLINE

This is a two-day course and will cover the reservoir engineering aspects of oil recovery by in-situ combustion (ISC), with emphasis on both the ISC fundamentals, physical simulation, and the field applications, including piloting and commercial scale. The use of horizontal wells in combination with in-situ combustion will be covered, as well. The first 9 chapters will be part of the main 2-day course, while the last chapter (chapter 10) can be presented separately. The course outline is as follows:

1. Qualitative Description of In-Situ Combustion Techniques

- Forward and Reverse Combustion
- Dry, Wet and Superwet Combustion
- Segregated In-Situ Combustion
- Cyclic In-Situ Combustion
- New approaches to In-Situ Combustion Process (THAI, COSH and Top-Down ISC)

2. The Mechanisms of the Forward Combustion

- The Main Chemical Reactions. HTO and LTO
- Kinetics of oxidation
- Calculation of the Apparent Atomic H/C ratio
- Fuel Availability and Air Requirement. Influence of LTO

3. The Laws of the ISC Front Propagation

- Dry Combustion
- Wet and Superwet Combustion
- Enriched Air ISC

4. Basic ISC Laboratory Tests

- Ramped Temperature Oxidation (RTO) of Oil in Porous Media
- Isothermal Oxidation of Oil in Porous Media.
- Spontaneous Ignition
- ARC technique and other techniques (TGA, DSC)
- Combustion Front Propagation in a One-Dimensional Cell –Combustion Tube Tests

5. Theoretical Aspects and Modelling of ISC

- 3-D Physical Models, Including those with Horizontal Producers
- Analytical Models
- Numerical Models; numerical simulation strategy
- Main limitations of the Models

6. Design of an ISC Field Project. Operation Procedures

- Start up operations (preparations)
- Ignition Operation
- Injection Program
- Performance Prediction Methods: Nelson & McNeil, Gates and Ramey, SelectEOR, etc.
- The most important parameters

7. Implementation, Monitoring and Evaluation of an ISC Pilot

- Screening Criteria
- Line Drive versus Pattern Application
- Choosing the Best Location of the Pilot
- Tracking the ISC Front. Gas Analyses, BHT Measurements and Coring Wells in the Burned Zone
- Evaluation of Air/Oil Ratio and Incremental Oil Recovery
- To go or NOT to go to the commercial scale?

8. Operation/Facilities Problems and Remedies

- Burning back the injector
- Risk of explosion
- Pollution by C and N oxides
- Corrosion
- Emulsion
- Sand production
- Poor injectivity/productivity
- Severe gas production
- Sources of failure

9. Current Status of ISC Projects. Commercial Application

- The World's Most Significant Commercial ISC Applications as of 1994 and as of 2005
- Medium Oil Shallow Reservoir Applications
- Horizontal Wells in ISC Processes
- Field Piloting of the Toe-To-Heel Air Injection (THAI Process); COSH, COGD and Top-down ISC
- Cyclic ISC Applications

10. ISC Process: How SelectEOR 1.0 Software Handles the Screening and Prediction

- General presentation of SelectEOR software
- Screening criteria for ISC application to heavy oil reservoirs (reservoir characteristics, fluid characteristics, reservoir history, etc.)
- Screening criteria for other thermal methods (CSS, steam drive, and SAGD)
- ISC prediction performance in SelectEOR: upsides and downsides (limitations)
- "Hands on" SelectEOR running of one case involving data from a target field