N980: Petroleum Reservoir Fluids

Instructor(s): Mark McClure

3 Days	Competence Level: Skilled
Classroom Course	

Summary

This course provides advanced training in the properties and behavior of black and volatile oils, dry and wet gases, retrograde gases, and water. Ideal and real gases, phase equilibrium, flash separation, laboratory PVT studies, and liquid-gas separation are discussed. Included are properties of volatile oils and liquid-rich fluids, which are especially important in unconventional plays. Fluid models using both the black oil model and compositional simulation are covered.

Learning Outcomes

Participants will learn to:

1. Assess the components and types of reservoir fluids and how these relate to physical properties.
2. Develop intuitive and practical understanding of the phase behavior of reservoir fluids.
3. Perform calculations involving mixtures and phase behavior with compositional and black oil models.
4. Estimate the properties of reservoir fluids, including: compressibility, viscosity, Z-factor, and formation volume factor.
5. Understand the black oil model: assumptions and limitations, how it is built, and how it is used.
6. Understand compositional fluid models: assumptions and limitations, how they are built, how they work, and how they are used.
7. Understand and apply results from a PVT report.
8. Perform practical engineering calculations with any type of reservoir fluid: black oil, volatile oil, retrograde gas, wet gas, or dry gas.

Duration and Training Method

This is a three-day classroom course consisting of lectures with worked exercises and discussion.

Who Should Attend

This course is designed for engineers of all levels of experience who apply properties of reservoir fluids in production optimization, reserve estimation, and reservoir development studies.

Prerequisites and Linking Courses

Familiarity with reservoir engineering principles, as presented in N967 (Introduction to Reservoir Engineering), is assumed.

The course links to the other Nautilus courses such as N900 (Applied Reservoir Engineering) and N904 (Integrated Reservoir Analysis).

Course Content

1. Naming and general classification of hydrocarbons
2. Phase behavior and reading charts of thermodynamic data
3. Mixtures
a. Mixture calculations

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b. Ternary diagrams
4. Practically applying the real gas law
5. Theoretical background for flash calculations and differential vaporization experiments
6. Classification and properties of different petroleum fluids
7. Calculating reservoir properties of dry gases
8. Calculating reservoir properties of wet gases (gas condensates)
9. The black oil model
a. Assumptions and limitations
b. How black oil properties are derived from laboratory experiments
c. Mass balance calculations with the black oil model
10. Laboratory experiments specific for characterizing wet gases and volatile oils
11. Calculating reservoir properties of black oils
12. Calculating compressibility of different reservoir mixtures
13. Calculating reservoir properties of reservoir waters
14. Compositional fluid simulation
a. Fluid sampling methods
b. Compositional analysis techniques
c. Compositional lumping
d. Regression for EOS tuning
e. Applications to flow assurance