N008: An Introduction to Reservoir Appraisal and Development

Format and Duration
Classroom - 5 Days

Instructor(s): Howard Johnson

Summary

The course teaches the principles and techniques necessary for a geoscientist to work effectively within a multi-disciplinary field development team. Emphasis is placed on the fundamentals of appraisal, field development planning and reservoir management, supported by field case studies. On completion, participants will understand the multi-disciplinary nature, of the workflows that underpin oil and gas field development projects.

Learning Outcomes

Participants will learn to:

1. Demonstrate the use of routine core data analysis data and its utilisation in measuring and understanding the controls on porosity and permeability and understand the depositional and diagenetic controls on the porosity and permeability of sandstones and carbonates.
2. Apply special core analysis data to understand concepts of capillary pressures, rock wettability and relative permeability. Also, to relate these rock properties to the estimation of hydrocarbon saturation and column height, seal capacity and pore-scale fluid displacement processes.
3. Distinguish hydrocarbon-water contacts and understand how these vary in response to different fluid types and rock properties.
4. Analyse the PVT relationship of reservoir fluids and see how variability in fluid properties impacts on field development planning and production.
5. Analyse reservoir energy and drive mechanisms and their effect on reservoir performance and hydrocarbon recovery.
6. Examine the principles of reservoir management including well pattern options, production forecasting and uncertainty.
7. Demonstrate the use of 3D static reservoir models and assess the role of input parameters, especially depositional controls on reservoir quality distribution, in calculating deterministic and stochastic hydrocarbon-in-place estimates.
8. Distinguish flow and non-flow lithological units (net pay versus non-pay) and the role of reservoir heterogeneities, including barriers and baffles, for dynamic reservoir simulation. Relate these to stratigraphic and structural processes.
9. Verify size limitations on dynamic simulation models and the main techniques for the effective up-scaling of geological data.
10. Contrast field appraisal and development strategies using different case studies, including volumetric and economic considerations and the effectiveness of multi-disciplinary teams to production optimization throughout field life.

Training Method

A five-day classroom course with case studies and exercises throughout the lecture programme.

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Who Should Attend

The target audience for the course are those geoscientists who have not worked in development but require a broad introduction to this area of the business.

Course Content

The class covers the broad spectrum of activities of a multi-disciplinary team, but with emphasis on the geoscience aspects and their applications:

- Determining the volume of the reservoir and contained fluids and conveying the uncertainty in those quantities.
- Evaluating and describing the reservoir from the pore-scale through to the full field-scale in order to optimize sweep efficiency, well design, production performance and ultimate recovery.
- Key processes in field life, covering appraisal, well planning, field development, reservoir management and corporate reserves reporting.

1. Introduction
Aims and schedule, Hydrocarbon resources, Reserves growth, Necessary skills,Teams and the field life cycle

2. Case Studies
Technology-led development of a low-perm carbonate reservoir in an onshore field, emphasising recovery process and well design
Reviewing the history of a small onshore field with low recovery from tight sand: what would you do, starting over?
4D extending the life of a large offshore field with high-quality reservoir

3. Rocks As Pore Systems
Properties of pore systems, Sandstone and carbonate pore types, Darcy's Law, Core analysis, Care with core, Corrections to in situ, Interpreting porosity v permeability plots, Capillary pressure, Wettability, Relative permeability, Electrical properties and the Archie equation, Acoustic properties and the seismic response

4. Delta P
Reservoir fluids, PVT, Reservoir energy, Drive mechanisms, performance and recovery factor, Global RF, 1-RF, Well patterns, Reservoir simulation, Production forecasts and uncertainty, Reservoir management

5. Your Reservoir
Reservoir mapping, 3D geocellular models, Volumetrics, NTG and saturation, Uncertainty reduction in appraisal, Reserves v time, Correlation, Layering and flow units, Heterogeneity, Averaging, Pseudo rel-perm, Upscaling, Fractured reservoirs, Types and recovery processes, Fracture porosity, Discrete fracture network modelling

6. Drill It

Well costs, Drilling hazards and the geoscientist, In-situ stress, Well planning, New technology, ERD, Rotary steerable, Multi-laterals, UBD, Smart wells, Expandables

7. The Business

Appraisal strategy, planning and economics, Value of information, Reserves classification, Future trends. Summaries and conclusions