



N940: Modern Completion and Production Enhancement Techniques

Instructor(s): Jonathan Bellarby

Format and Duration

Classroom - 5 Days

Virtual - 10 Sessions

Summary

Participants on this course will derive an understanding of wells and completions, allowing for more accurate production performance assessments, as well as better risk mitigation and management. Key topics include the completions scope and types, inflow performance, perforating, stimulation and sand controls, vertical and artificial lift, production chemistry, well integration and completion equipment and installation.

Learning Outcomes

Participants will learn to:

1. Characterise the causes of formation damage.
2. Be able to produce an optimum perforating strategy (perforation charges, interval and deployment method).
3. Predict the types of well completion that benefit from matrix and fracture stimulation and the types of fluids that are used.
4. Propose the optimum sand control method accounting for the geology, well management, and surface facilities.
5. Integrate vertical lift performance into reservoir performance analysis.
6. Assess where production chemistry problems can pose a major threat to productivity and propose mitigations.
7. Evaluate the risks to well integrity in order to ensure the threat to safety and productivity is managed.
8. Review the types of completion equipment commonly used and where/why they are used.

Training Method

A classroom or virtual classroom course comprising a mixture of informal lectures, videos, case studies, and practical exercises.

Who Should Attend

This course is primarily aimed at intermediate level petroleum and reservoir engineers. The course will also benefit geologists, petrophysicists, and production engineers who need to deepen their understanding of completion and production enhancement techniques.

Course Content

Completion scope and types

- Types, source, and uncertainty ranges for data affecting completion designs



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- Well types that require completions – oil producers, water injectors, disposal wells, wells associated with EOR
- Main types of completions (barefoot, open-hole, cased and perforated and sand control)
- Upper completions (tubing less, packerless, with packer, dual completions)
- Monobore completions

Inflow performance

- Formation damage - particulate invasion, wettability changes, relative permeability, emulsions, fines migration, clay swelling
- Non-Darcy flow and its effects
- Empirical inflow performance correlations – Vogel and Fetkovich
- Skin factor and flow efficiency
- Productivity in deviated, partially completed, and horizontal wells

Perforating

- Productivity of a cased and perforated well - Karakas and Tariq relationship
- Main methods of perforating
- Underbalance
- Choosing the optimum perforating interval when there are multiple objectives

Stimulation (proppant and acidisation)

- Equipment and procedures for proppant stimulation
- Productivity for a fractured well, fracture optimisation, tip screen fracturing
- Matrix and fracture acidisation
- Techniques for diversion and leak off control

Open hole completions

- Formation damage in an openhole completion and the methods to mitigate it
- Water and gas influx management - ECPs, openhole packers, swellable elastomers
- Removing drilling mud and the role of drill-in fluids

Sand control

- Standalone screens, openhole and cased hole gravel packs, frac packs, expandable screens
- Geomechanics data associated with sand control
- Limiting sand production without screens (well geometry and perforating considerations)



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Tubing sizing

- The role of PVT data in tubing sizing
- Multiphase flow and vertical lift performance
- Inflow performance (nodal analysis)
- Unstable flow in oil and gas wells

Artificial lift

- Integration of artificial lift into well performance assessments
- Gas lift
- Electrical Submersible Pumps (ESPs)
- Application of PCPs, HSP, and rod pumped wells

Production chemistry

- Fluid samples for production chemistry assessment - data sources and underlying uncertainties
- Oilfield scales; wax and asphaltene deposition; hydrates and tubing blockages
- Reservoir souring

Well integrity

- Double “barrier” principle
- Corrosion and erosion mechanisms

Completion equipment

- Trees, safety valves, packers, mandrels, gauges, reservoir isolation valves, nipple profiles

Completion installation

- Steps used in completion installation
- Completion fluids and their role in formation damage mitigation

Non conventional wells

- HPHT completions
- Downhole flow control ('smart' or 'intelligent wells') systems
- Multilateral and multipurpose wells
- CO₂ sequestration