N539: Cased Hole Formation Evaluation for Reservoir Monitoring

Instructor(s): Gary Frisch and Gary Simpson

Format and Duration

Classroom - 3 Days
Virtual - 6 Sessions

Summary

Interpretation techniques using modern cased hole logging tools are presented to understand, analyze, and resolve a variety of reservoir and near-wellbore production situations. New or existing cement bond logs are used to determine possible completion strategies or help determine near wellbore conditions that are affecting well performance. Reservoir monitoring logs and production logging data can be used to evaluate both the wellbore and reservoir performance to extend or improve the economics of the well. Wellbore integrity logs will monitor the condition of the casing strings not only for completion operations but also HSE concerns for the life of the well. For each of these categories the proper design, tool selection and interpretation are covered.

Business Impact: After the well is completed both the well and reservoir will need to be monitored during the lifetime of that well to maximize the economic return of the investment. The use of cement evaluation, well integrity logs, reservoir evaluation logs and production logs will assure that the completion will achieve maximum production from both the initial and possible bypassed reservoirs while maintaining HSE requirements. These tools support the operational need to identify the location and quantity of remaining hydrocarbons, in support of improving oil and gas recovery from secondary and possible tertiary production of the well.

Learning Outcomes

Participants will learn to:

1. Formulate Cased Hole (CH) logging objectives to maximize results.
2. Conduct quality control of both various CH logging tools and operations.
3. Determine the proper tool selection for production logging
4. Assess well production profiles and zonal fluid contributions.
5. Select CH logging tools/techniques to evaluate the well and reservoir.
6. Evaluate formation fluid saturations and monitor fluid contact movement.
7. Assess multi-phase flow measurement results using a combination of PL and reservoir monitoring logs.

Training Method

This is a classroom or virtual classroom course comprising a mixture of technical interactive sessions with examples and discussion. The basic tool functions, design of the logging operations, and interpretation of the results will be followed by examples of the various tools. Attendees are highly encouraged to provide examples for their problem wells and possible solutions will be addressed by both the instructors and participants.

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Who Should Attend

The course is designed for mid- and senior-level engineers and engineering managers, reservoir and production engineers and geologists, petrophysicists, log analysts and others involved in well surveillance, maximizing recovery, identifying production problems, or planning workover operations.

Course Content

This practical course discusses Casing Evaluation including multi-finger calipers for internal corrosion, ultrasonic tools for both internal and external conditions, and other casing evaluation tools including magnetics, flux leakage and eddy current.

It also covers the full scope of Formation Evaluation through casing using pulsed neutron tools as well as basic and advanced technologies for Evaluation of Multi-Phase Fluid Movement in vertical, deviated, and horizontal production and injection wells. Production Logs using both center sample and full-bore tools are also discussed and provide a detailed view of the fluid profile.

Specific topics are:

- Cement Evaluation
  - Evaluation and QC of standard cement bond log
  - Evaluation and QC of radial and segmented cement bond log
  - Evaluation and QC of ultrasonic and rotating bond logs
  - Analyze cement evaluation logs to determine TOC and channels
  - Evaluation of complex completions and cements using computer programs or processes
  - Recognition of common pratfalls in cement evaluation
- Wellbore Integrity consisting of Casing Inspection
  - Tool operations
  - Candidate screening
  - Measurement quality control
  - Discussions of casing inspection tools to determine the corrosion of the wellbore including both internal and external corrosion using mechanical, ultrasonic, and other technologies
- Reservoir Monitoring with Pulsed Neutron Logging Measurements
  - Candidate screening
  - Basic operating physics of pulsed neutron tools
    - Types of detectors used in pulsed neutron tools
  - Types of pulsed neutron tools and the history of their development
  - Measurement quality monitoring and environmental corrections
  - Calculate reservoir saturations from Pulsed Neutron Logs
    - Correct petrophysical calculations for the influence of clays and shaliness
    - Distinguish gas from liquids
      - Gas Saturation measurements
      - Pseudo-density and porosity measurements

        - Compute oil saturation directly from Carbon/Oxygen measurements
        - Methods to compute simultaneous gas, oil and water saturations
    - Spectroscopy measurements with pulsed neutron logs
        - Minerology determination
        - Neutron cross section measurements
    - Additional applications
        - Locate water entry and judge zonal communication
        - Silicon Activation and gravel pack analysis
        - Specialty methods, such as Log-Inject-Log to estimate remaining oil vs. residual oil saturation
- Production Logging (PL)
    - Candidate screening
    - Proper tool selection for PVT, Holdup, and Flow measurements.
    - Measurement quality monitoring
    - Methods using Fluid Identification Logs to distinguish water, oil, condensate and gas entries in Deviated and Horizontal Multiphase flow
    - Methods using Fluid Flow Logs to distinguish water, oil, condensate and gas movement