TETRA TECH RPS ENERGY | TRAINING

N742: Directional Drilling

Instructor(s): Robello Samuel

Format and Duration

Classroom - 2 Days
Virtual - 4 Sessions

Summary

This course provides a comprehensive treatment of the design, model, and practices with theoretical underpinnings for directional, horizontal, and multilateral wells. Participants will explore various methods that offer a more comprehensive view of trajectory designs for well construction. It also covers well engineering principles, enabling participants to understand the importance of different well designs.

Additionally, the curriculum includes concepts related to bottom hole assembly (BHA) design, drill-ahead techniques, and drillstring dynamics. An examination of the most recent well construction technologies will be conducted, focusing on the design of horizontal and multibranch wells. Specialized drilling strategies, including horizontal drilling, extended reach, geosteering, and the use of special downhole tools for complex and advanced wells, will also be discussed.

Business Impact: Participants will learn to design high-angle and complex wells that maximize reservoir contact, improve wellbore stability, and enhance drilling efficiency. By applying advanced trajectory planning, BHA optimization, and geosteering techniques, they'll reduce drilling time, lower operational risks, and boost production outcomes across a variety of well construction projects.

The training includes a copy of the "Horizontal Drilling: Theory, Methods and Applications" textbook (400 pages) authored by Dr. Robello Samuel.

Learning Outcomes

Participants will learn to:

1. Synthesize the design principles for directional and horizontal wells.
2. Comprehend various trajectory models used in well construction.
3. Contextualize the application of various downhole tools in drilling operations.
4. Demonstrate the importance of well engineering in relation to high-angle wells.
5. Develop a broader knowledge base for the application of principles and methods in directional drilling.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussions, case studies, and practical exercises.

Who Should Attend

This course is intended for drilling engineers, well operations personnel, rig supervisors, drilling supervisors, and pipe manufacturers who seek to gain a deeper understanding of directional well designs and their applications in drilling high-angle wells.

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Course Content

- General Introduction and History
- Basic Definitions
- Planning and Surveys
  - Coordinate Systems
  - Surveys
  - Survey Tools
  - Survey Tool Errors
- Wellpath Planning
- Horizontal Drilling Methods
- Considerations in the Selection of a Horizontal Drilling Method
- Wellpath Design
  - 2D Design
  - 3D design
  - Catenary Design
  - Profile Quantification
    - Tortuosity
    - Wellbore Torsion
- Uncertainty of Vertical Target Depth
- Wellpath Error Analysis
- Probability of Intersection
- Ranging Factor
- Level of Risks
- Minimum Fracture Separation Distance
- Multilateral wells, New Generation Horizontal Wells
- Complex Well Designs
  - Designer Wells
  - Horizontal ERD Wells
  - Well Twinning
  - Horizontal Interconnected Well
  - Sidewinding or Serpentine Wells
  - Horseshoe wells
  - Fishhook Wells
- Pads and super pads
- Special Tools for horizontal drilling
  - Bent Sub, Kick Pad, Eccentric Stabilizer, Double Bend Assembly
  - Agitators
  - Motor Assembly
  - RSS assembly
  - Ranging tools and other downhole tools
- Automation – surface and downhole

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- Other special operations
  - Sliding
  - Rocking and sliding
- Torque and Drag
  - Complexity of Friction
  - Drag and Torque in Horizontal Well Drilling
  - 2D & 3D Models of Down-hole Drag and Torque
  - Hook Load Calculation for Directional Well
  - Buckling in Horizontal Wells
  - Broomstick plots
- Specific Energy – MSE & HMSE
- Hole cleaning and Borehole Stability
- Casing Wear
  - Wear Estimation Models
  - Casing Wear in Horizontal and ERD Wells
  - Collapse Strength Calculation
- Numerical examples
  - Detailed, step-by-step worked out examples and design are presented at appropriate places throughout the course.
- Case studies
  - Few case histories are presented to demonstrate how the various designs are applied and team exercise to get participants can apply certain methods.