Advanced Drilling Engineering

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Introduction:

This course will cover selected areas of drilling engineering such as horizontal and extended reach drilling. The course is structured by reviewing some fundamental areas such as trajectory design, torque and drag calculations and hydraulics. The candidates will develop an understanding of the fundamental principles and perform calculations to experience the behavior of the drilling system in practical terms.

You will be able to design a trajectory, select an adequate drill string for the problem, considering drilling string tension and compression (buckling). You will also be able to determine system pressure losses, annular velocities to evaluate cuttings transport, as well as ECD in comparison with a pore pressure and fracture gradient.

This course will address advanced drilling topics which is essential and timely in today's drilling technology climate. These topics were carefully selected to add to the skill set of a novice as well as advanced drilling engineer. The course intends to stress the appreciation of the complexity of the management of the drilling process to better integrate with company strategic goals. Key drilling efficiency improvements areas were presented in a way to emphasis real time drilling problems diagnostics, mitigations, prevention, and problem solving. Issues concerning technical limits, advanced wellbore stability analysis, pore pressure and fracture gradient estimation strategies. The course will typically provide theoretical background in the morning session and focus on exercises and problem solving in the afternoon session.

Objectives:

By the end of this course delegates will learn about:

- Important topics of drilling engineering
- Drill string mechanics: loads, cause of failure, design concepts
- Mechanized drilling operations: makeup of tubular, mechanized drilling rigs
- Drilling problems: stuck pipe situations, fishing operations
- Advanced drilling technologies - casing drilling, HPHT, coiled tubing drilling
- Proper selection of drilling technology for shale gas, geothermal drilling, etc.
- Non-conventional drilling methods and equipment including environmental aspects of drilling activities
- Drilling through gas hydrates

Who should attend?

Drilling Engineers, Senior Drilling Engineers, Drilling Supervisors, Work over Engineers, Petroleum Engineers, Completion Engineers, Tool Pushers, Reservoir and Senior Reservoir Engineers, Geologists, Production Engineers & technologists, Well site Engineers, Lifting Personnel, Maintenance Engineers, Foremen, Industry Personnel.

Course Outline:

Drilling Analysis and Benchmarking

- Data collection and QC process
- Interactive learning curve analysis
- Expectation and resulting drilling performance
- Best composite time
- AFE statistical approach
- Drilling process management
- Drilling the technical limit
- Real time drilling performance monitoring

Advanced Topics in Pore/Fracture Pressure Gradient Estimation

- Pore pressure generation mechanisms
- Classical pore pressure theories
- Pressure data analysis
- Rock physics of pore pressure
- Pore pressure in carbonate
- The Centroid concept

- Seal integrity evaluation
- Real time pore pressure estimation from drilling data
- Classical fracture estimations
- Minimum horizontal stress estimation from frac data

- LOT analysis
- Calibration of fracture gradient model
- Pre drill fracture gradient estimation

Wellbore Stability Analysis

- Introduction to rock mechanics
- Vertical stress
- Maximum and minimum horizontal stresses
- Wellbore stresses
- Rock strength
- Rock failure criteria
- Wellbore stability models (linear elastic)

- Calibration of wellbore stability model
- Shale and drilling fluid interactions
- Caving analysis
- Class problems

Advanced Topics in Drilling Fluids Management

- Drilling fluid selection
- Barite sag
- Hydraulic optimization
- Solids control economics
- Rig auditing for solids control efficiency

Advanced Topics in Drilling Mechanics and Hole Problems

- Loss of circulation contingency planning
- Selection of loss circulation materials
- Shale problems
- Stuck pipe
- Bit optimization

- Drilling rate optimization
- Mechanical specific energy

Health, Safety and Environmental Consideration in Drilling Operation