# ADVANCED DRILLING TECHNOLOGIES

# DRL040

## COURSE OVERVIEW

This course provides a comprehensive overview of drilling technologies currently available and covers the essential principles and practices of drilling engineering. The course provides participants with an introduction to advanced drilling topics such as High-Pressure High Temperature (HPHT) drilling, modern drilling technologies (i.e., casing drilling, unconventional drilling methods), special well design, drilling problems and their solutions. Throughout the course, delegates will be guided through the planning and evaluation stages of drill string design. They will learn how to perform simple calculations associated with well tubular design. Advanced drilling techniques such as casing drilling or coiled tubing drilling are also covered in the course. In addition, participants will become confident using the tools and techniques for casing or tubing drilling such as surface equipment, bottom hole assemblies (BHA), etc.

## COURSE OBJECTIVES

By the end of this course, participant will be able to:

- Recognize the non-conventional drilling methods and equipment including environmental aspects of drilling activities
- Recognize the drilling through gas hydrates
- Identify the proper selection of drilling technology for geothermal drilling, and depleted formations.
- Understand the casing drilling technology
- Understand the UDB and the MPD technology
- Identify and eliminate the drilling hazards and risks within HPHT wells to as low as practicable.

## WHO SHOULD ATTEND

- Drilling Engineers
- Completion engineers
- Exploration supervisors
- Managers concerned with advanced drilling technology

## COURSE DURATION

5 Working Days

## COURSE OUTLINES

1. Pre course evaluation

2. HPHT Well Drilling

- HPHT Well Overview
- Defining the HPHT Environment
- Why are HPHT wells different?
- HPHT well locations worldwide
- Well planning
- Issues for HPHT Drilling
- Planning for Success
- Geological & Geophysical Aspects of Abnormal Pressures
- Pore Pressure predictions
- Measurement and Estimation of In-Situ Stresses and Fracture Pressure
- Stresses Around Borehole and Borehole Stability
- Rock Mechanics Issues in HPHT Well
- Drilling in Unusual Stress Regimes – Overpressured Zones
- Well Design
- Casing design
  - Casing design specific to HPHT.
  - Casing Wear, H2S and CO2 Effects
  - Shoe Placement
  - HPHT Material Selection for HPHT Wells
- Rig, well equipment, integrity, concerns:
  - HPHT Well Control Layout
  - Rig, Equipment Audits, Assurance
  - BOP Equipment and Component Details
  - Cement (kill) Pumps, Cement Manifold, and Hook
  - Surface Well Control Equipment, Mud Gas Separators, De-gassers
  - Rig Instrumentation
  - HP Drilling Components and Well-Kill Facility
  - Downhole Tools and Equipment
- Drill String Design Specific to HPHT
- HPHT Drilling Fluids

- Mechanism of Thermal Degradation
- Aspects of Drilling Fluid Design, Rheology and Additives
- Drilling Fluid Selection and HPHT Testing
- Operational Considerations
- Stable Flat Rheology Synthetic-Based Drilling Fluid System

- HPHT Well Cement
  - HTHP Cementing Considerations
  - Strength Stabilizing Additives
  - Slurry Integrity Additives
  - Flow through Unset Cement
  - Hydrostatic Pressure Loss
  - Gas Migration through Unset Cement
  - Losses of Overbalance Pressure
- HPHT Well Control Management and Assurance
- HPHT Well Completion
  - Well Completion Challenges
  - HPHT Completion Fluid Selection
- Annular Pressure Build-Up (APB)
  - APB Design and Evaluation Methods
  - APB Failures
  - APB Mitigation Options
  - Worst Case Discharge (WCD)
  - DWEP APB mitigation methods and applicability
  - Wellhead Growth
- HPHT Well testing Challenges

3. **Underbalanced Drilling**

- Air, Gas and Mist Drilling
- Foam Drilling
- Aerated Fluid or Gaseated Fluid
- Equipment Selection
  - Gas Injection Equipment
  - Air compressors
  - Nitrogen Generation System
  - Booster Compressors

- Well Control Equipment
  - Rotating Diverters
  - Snubbing systems
  - Separation Equipment
  - Horizontal separators
  - Vertical Separators
  - UBD Choke manifold
  - Data acquisition Flares
- Flow Drilling
- Mudcap Drilling

4. **Managed Pressure Drilling (MPD)**
   - MPD Overview
   - Basis of Design (Design & Operational Elements)
   - Elements of Hydrodynamic Modeling
   - Required Surface Equipment
   - Surface Monitoring
   - MPD Variations
     - Varying Pressure
     - CBHP and Advanced MPD Techniques
     - PCP (Point of Constant Pressure)
   - MPD Sample Hydraulic Design

5. **MPD & UBD Selecting an Appropriate Technique**
   - Required Data for UBD Candidate Identification
   - Poor Candidates for UBD
   - Good Candidates for UBD
   - Candidate Decision Tree
   - Potential Applications and Candidate technique
   - Technical Feasibility
   - Economic analysis

6. **MPD & UBD Well Engineering**
   - Wellhead Design
   - Casing Design
   - Completion Design

- Bit Selection
- Underbalanced Perforating
- Drillstring Design
- Separator Design

7. UB Completion Types
    - General Considerations
    - Open Hole
    - Various Liners
    - Cased Hole
8. Casing Drilling
9. Extended Reach Drilling
10. Post course evaluation.