

# HORIZONTAL AND EXTENDED REACH DRILLING (ERD) SCHOOL

## DRL047

### COURSE OVERVIEW

Directional drilling technology is being pushed further with increasingly complex well paths, distant targets, and more difficult drilling environments. This technology is the heart of many unconventional resource plays. It is only with a full appreciation of the scope and limitation of directional techniques will drilling teams achieve success and avoid costly and time-consuming mistakes. As existing fields mature and the complexity of new field development increases, the directional driller is no longer alone in determining the wellbore trajectory. An increasingly multidisciplinary team is now involved in each and every well design and placement decision. This course will deliver an advanced understanding of modern directional drilling techniques and the industry standards used in well placement.

By the end of the course the participants should be able to apply the correct surveying techniques and directional placement methods to ensure the safe and accurate placement of complex and ERD wells, whilst making informed choices about the BHA design and selection of steering technology. Participants will learn different methods to deflect and steer wells to the target. Well placement calculations will be covered and attendees will learn to appreciate the importance of collision avoidance and learn the methods used to evaluate these risks. Hole cleaning problems and solutions will be addressed to ensure the participants appreciate the impact that this can have on the success of the well construction process. Several examples and exercises will be worked throughout the course.

### COURSE OBJECTIVES

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

- Recognize the high angle drilling
- Understand main concepts associated to well path planning
- Identify the recommend suitable measures to mitigate operational issues related to high angle wells
- Understand main concepts associated to well construction of multilateral wells
- Determine the maximum reach from your location
- Interpret torque and drag and what factors affect those in the drilling process
- Monitoring and Management of Hole Cleaning and Hole Condition
- Casing and liner design, running and cementing and Casing Flotation
- Understand and identify the drilling problems of ERD
- Recognize the key planning considerations to delivering trouble free wells

- Identifying minimum equipment specifications for ERD projects
- Identify the latest tools and techniques used to reliably deliver ERD projects
- Minimize downtime due to 3rd party tools

## WHO SHOULD ATTEND

- Drilling engineers
- Well site supervisors
- Rig managers
- Tool pushers
- Field support personnel
- Geo-scientists and reservoir engineers looking to get better value from the
- Interactions with the drilling team
- Anyone involved with improving drilling performance and cutting drilling costs

## COURSE DURATION

5 Working Days

## COURSE OUTLINES

1. **Pre course evaluation**
2. **How Do We Know Where We Are and Where We Are Going?**
  - Introduction to directional drilling concepts
  - Geodesy, cartography, surveying and uncertainty
  - North references
  - Surveying the well, the key technologies used to survey the well and how mistakes in well positioning are made.
  - The fundamental quality assurance and quality control of wellbore surveys. How the accuracy of MWD surveying can be improved by advanced survey processing techniques.
  - The principle of uncertainty and its effect on probability for well Anti-collision and target sizing.
  - Well positional calculations and how our best techniques can be undermined by poor rig site practices.
3. **Tools and Equipment**
  - Basic equipment explanations for key directional drilling tools
  - Introduction to directional operations
  - The role of directional driller through the life of well from planning to completion

#### 4. How Do We Steer the Well?

- How wells are deflected and steered, using magnetic, gravity and inertial tool face measurements Tool face and steering
- Mag and gravity tool face definition and use
- Tool face correction
- Reactive torque and slide drilling

#### 5. Dogleg, Torque and Drag Calculations

- Factors that Affect Torque and Drag
- Friction Coefficient
- Directional Profile
- String Weight
- Directional Drill String Design
- Conventional Directional well
- High Angle or Horizontal Well
- Problems & Case History

#### 6. Planning Directional and Horizontal Wells including Extended Reach Wells (ERD)

- Determining Directional Well Plan
- Planning Directional Well with Single Equation
- Planning Horizontal Wells
- Planning ERD

#### 7. Rotary BHA

- The evolution of directional drilling technology, the key drivers for this and why so many wells are now drilled with high-cost rotary steering tools
- How to design the Bottom Hole Assembly (BHA) for low angle wells and how this fundamental design must change as the well inclination increases
- Introduction to Rotary BHA design
- Bit design and considerations for DD selection
- Evolution of BHA steering
- Hole cleaning as hole angle increases

#### 8. Safety in Steering Wells

- Anti-Collision – Avoiding well to well collisions
- Side-tracking a well
- Whipstocks and section milling
- Traveling cylinder plot

## 9. Understanding Risks and Drilling Limits

- The risks of using the positive displacement motor for steering
- Limits on wellbore strength and the issues of losses,
- ECD, swab and surge pressures. Managing these issues with UBD and MPD technologies.
- Geomechanics for directional drillers
- Stuck pipe avoidance
- Drilling limits and risk reduction
- Multilateral wells, their place in reducing production costs. Their drilling and economic risks and benefits

## 10. Hole Cleaning Practices in Deviated and Horizontal Wells

- Hole Cleaning Problems Associated with Inclination
- Annular Velocity
- Flow Regime and Viscosity
- Drill Pipe Rotation and Reciprocation
- Multi-lateral Wells Concepts and Application
- Horizontal and Multilateral Drilling Technology
- Methods & Applications
- Levels of Multilateral Wells
- How to Perform a Multi-lateral Well
- New Technologies Application (Rotary Steerable, Thin Wall Motors, etc.)

## 11. Drilling Optimization

- Shock and Vibration of the downhole equipment, its origins, its impact and how to reduce or remove this unwanted problem, reduce NPT and improve performance.
- Shock and vibration of the bit and drill string types of vibration
- Introduction to rotary steering systems
- How the tendency of the Bottom Hole assembly to build, drop or hold angle must be designed to match the desired well profile and how this is achieved to deliver wells with the lowest tortuosity.
- Delivering world beating ERD wells with limited rig capabilities
- Drill bit design and features
- Measuring shock and vibration

## 12. Completion for Horizontal and Multi-lateral Wells

- The Difference of Production between Horizontal and Vertical
- Difference of Production between Horizontal and ERD
- Difference of Production between Horizontal and Multi-lateral

## 13. Post course evaluation.