DRILLING OPTIMIZATION

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Course Description:

This course is intended to train senior engineers in the identification, application and implementation of drilling optimization techniques. The intent is that participants in this class should satisfy some of the requirements for Well Engineering, Drilling Fluid Engineering and Well Construction Engineering.

Course Outline:

Define Concept

Compare to other goals and objectives of well drilling and construction

Overview of various areas where we have control over the well construction process:

- Type of well
- Accurately define well objective(s) and service life
- Identify mandatory and optional elements of well design

Hole diameter

Pressure capacity

Well inclination with the reservoir/target

Casing/hole diameter clearance

Casing or liner?

Mud type/rock interaction

Logistics issues (storehouse, quality assurance, property protection, etc.)

- Well location
- Spud/Completion deadlines
- Data requirements (also level of accuracy needed)
- Contract and agreement terms
- Etc.

Overview of various areas where we do not have control

- Weather
- Regulatory restrictions
- Company policies and procedures
- Legal requirements
- Location (sometimes)
- Etc.

Overview of statistical analysis

- Probability
- Mean distribution
- Standard deviation
- Determinist

Theory of risk, elements, control methods, measurement or evaluation of risk

- Methods of data collection and data management
- Importance of accurate reporting

Identification of Key Performance Indicators (KPI)

- Techniques to identify KPIs
- Quality assurance of measurements and data
- Range of error or accuracy of measurement of KPI

Common KPI

- Time based
- Progress based
- Cost based
- Event based

Benchmarking

- How is benchmarking performed
- Accuracy or reliability of benchmarks

Technical limits and quantum change in limits

- Methods to define technical limits
- How do we know this is the current technical limit?

Mechanical Earth Model (MEM)

- Elements of MEM
- Example MEM (to be used in later exercises)

Real time management of well construction performance

- Monitoring
- Management
- Comparison with predicted
- Alarms
- Revision of predicted performance

Typical drilling plan prior to optimization

- Discussion of this typical drilling plan

Elements missing

Elements poorly or inaccurately quantified

Elements not critical or needed in plan

Optimization Elements

1. LWD/MWD
2. ECD
3. Hole cleaning monitoring
4. Torque and drag
5. Stuck pipe prevention
6. Drill String Design

7. Objective of optimal drill string/BHA design
8. Tools to optimize design
9. Bit selection
10. Use of MEM
11. ROP and bit run prediction

Optimization Elements

1. Operation Planning
2. Critical path issues
3. Non-critical path issues
4. Drilling Fluid
5. Environmental constraints
6. Wellbore stability
7. Cuttings protection
8. Fluid management

Optimization Process

1. Software tools
2. Lessons learned
3. Task analysis

Workshop putting it all together

1. Using real data provided by Petronas and proposed well (fictional well proposal):
2. Organize data into useful format.
3. Extract information from data set to use and define technical limits of various phases of well construction.
4. Decide on KPIs.
5. Identify Lessons Learned from data set.
6. Identify contingencies requiring pre-planning.
7. Create time schedule of well (time/depth curve, identify major timeline events and planning decision Points).