Drilling Projects and Risk Management

Monografia de Engenharia de Petróleos
1. INTRODUCTION

2. DRILLING PROJECTS

3. RISK MANAGEMENT
1. INTRODUCTION
INTRODUCTION

1.1 DRILLING IN OIL AND GAS

1ST WELL - 1859
EDWIN DRAKE
PENNSYLVANIA

UPSTREAM

ONSHORE

OFFSHORE
INTRODUCTION

1.2 LIFE OF A WELL

- PLANNING
- DRILLING
- COMPLETION
- PRODUCTION
- INTERVENTION
- ABANDONMENT

WHERE TO DRILL?

WELL READY TO PRODUCE

PRODUCE OIL AND GAS

MAINTENANCE

STOP PRODUCE OIL AND GAS

DRILL

WHERE TO DRILL?

WELL READY TO PRODUCE

PRODUCE OIL AND GAS

MAINTENANCE

STOP PRODUCE OIL AND GAS

DRILL
1.3 Type of Well

- **Wildcat Well**: Drilled outside of and not in the vicinity of known oil or gas fields.
- **Exploration Well**: Drilled purely for exploratory (information gathering) purposes in a new area.
- **Appraisal Well**: Used to assess characteristics of a proven hydrocarbon accumulation.
- **Production Well**: Drilled for producing oil or gas.
- **Injector Well**: Injected water or gas into the formation to maintain reservoir pressure.
- **Abandoned Well**: Wells permanently plugged in the drilling phase for technical reasons.

- **Horizontal Well**
- **Vertical Well**
- **Directional Well**
- **Multilateral Well**
2. DRILLING PROJECTS
2. Drilling Projects

2.1 How to Design a Well

- Well Prospect
- Acquisition Data
- Trajectory Study
- Deep of Foundation
- Pipe Type
- Time and Cost
- Project Well
- Completion Program
- Platform Choice
- Bottom Hole Assembly
- Drill Program
- Cementation
- Drilling Fluid
2. Drilling Projects

2.2 How to Drill

- Keep the vessel in the position
- Run down conductor pipe
- Run down drill bite
- Drill by drill bite
- Run down casing pipe
- Cementing
- Run down and connect BOP
- Run down drill bite
- Drill by drill bite and mud
- Run down casing pipe
- Cementing
3. RISK MANAGEMENT
3. Risk Management

3.1 Common Drilling Problems

- Differential Sticking
- Geopressure
- Unconsolidated Zone
- Pack Off
- Key Seating

Desmoronamento do Poço

Diferença de Pressão

Má Limpeza
3. Risk Management

3.1 Common Drilling Problems

- Reactive Formation: Fechamento do Poço
- Mobile Formation
- Collapsed Casing
- Loss Fluid: Perda de Fluido
- Cement Related
3. Risk Management

3.1 Common Drilling Problems

- Wellbore Geometry
- Poor Hole Cleaning

Má Limpeza do Poço
3. Risk Management
3.2 Drilling Data

PERFORM DAILY REPORT

MUDLOGGING

- MAIN SUPPORT FOR LESSONS LEARNED
- FOLLOW PROCESS DRILLING
- PREVENT PROBLEMS

PERFORM Daily Report

24-Hour Summary

24-Hour Forecast

This is a tough section. Depleted zone at 7275 ft is next major hazard.
PERFECT WELL | INVISIBLE TIME LOST | CONVENCIONAL TIME LOST

REAL TIME

NORMAL TIME

TECHNICAL LIMIT | REMOVABLE TIME

1 DAY DELAY

- JACK-UP = 60 MIL DOL.
- VESSEL = 513 MIL DOL.
3. Risk Management

3.4 Risk Assessment Tool

Typical Industry Risk Assessment Tool

- Fluid loss in hole section

Identify

Project Risk Management

Monitor

Evaluate

Mitigate

Table 2: Typical industry risk assessment tool

<table>
<thead>
<tr>
<th>Consequences</th>
<th>1.01</th>
<th>1.02</th>
<th>1.03</th>
<th>1.04</th>
<th>1.05</th>
<th>1.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-productive time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slight loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy mud loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Existing mitigation(s) in place

<table>
<thead>
<tr>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
<th>Must program, lost circulation procedure and materials, EOP equipment, pit drills</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Consequence (rating 1-4)</td>
<td>Consequence (rating 1-4)</td>
<td>Consequence (rating 1-4)</td>
<td>Consequence (rating 1-4)</td>
<td>Consequence (rating 1-4)</td>
<td>Consequence (rating 1-4)</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Accept</td>
<td>Accept</td>
<td>Accept</td>
<td>Accept</td>
<td>Accept</td>
<td>Accept</td>
</tr>
<tr>
<td>Cost of mitigation(s) needed</td>
<td>Cost of mitigation(s) needed</td>
<td>Cost of mitigation(s) needed</td>
<td>Cost of mitigation(s) needed</td>
<td>Cost of mitigation(s) needed</td>
<td>Cost of mitigation(s) needed</td>
</tr>
<tr>
<td>$100,000</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
<td>Likelihood of event occurring</td>
</tr>
<tr>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
<td>Likelihood of event occurring with mitigation in place</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
<td>New risk rating factor</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Extra cost if event occurs, $</td>
<td>Extra cost if event occurs, $</td>
<td>Extra cost if event occurs, $</td>
<td>Extra cost if event occurs, $</td>
<td>Extra cost if event occurs, $</td>
<td>Extra cost if event occurs, $</td>
</tr>
<tr>
<td>$16</td>
<td>$16</td>
<td>$16</td>
<td>$16</td>
<td>$16</td>
<td>$16</td>
</tr>
<tr>
<td>Risked time, hr</td>
<td>Risked time, hr</td>
<td>Risked time, hr</td>
<td>Risked time, hr</td>
<td>Risked time, hr</td>
<td>Risked time, hr</td>
</tr>
<tr>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Risked cost, $</td>
<td>Risked cost, $</td>
<td>Risked cost, $</td>
<td>Risked cost, $</td>
<td>Risked cost, $</td>
<td>Risked cost, $</td>
</tr>
<tr>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Benefit-to-cost ratio</td>
<td>Benefit-to-cost ratio</td>
<td>Benefit-to-cost ratio</td>
<td>Benefit-to-cost ratio</td>
<td>Benefit-to-cost ratio</td>
<td>Benefit-to-cost ratio</td>
</tr>
<tr>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Comments</td>
<td>Comments</td>
<td>Comments</td>
<td>Comments</td>
<td>Comments</td>
<td>Comments</td>
</tr>
</tbody>
</table>

This indicates that the risk profile is improved, but the risk is still high.

This indicates that the risk profile is not improved, but the risk is still high.

This indicates that the risk profile is improved, but the risk is still high.

This indicates that the risk profile is improved, but the risk is still high.

This indicates that the risk profile is improved, but the risk is still high.

This indicates that the risk profile is improved, but the risk is still high.

This indicates that the risk profile is improved, but the risk is still high.
REFERENCES

ALDRED, W.; PLUMB, D.; BRADFORD, I; COOK, J; GHOLKAR, V; COUSINS, L; MINTON, R; FULLER, J; GORAYA, S; TUCKER, D.: MANAGING DRILLING RISK. OILFIELD REVIEW, SUMMER, 1999. TEXAS, USA.


IF YOU CAN DREAM IT, YOU CAN DO IT!

WALT DISNEY