Implementing Drilling Practices in Cased Hole
Overview

- Introduction
- Problem
- Cause Identification
- Comparison of Hole Cleaning Practices
- “New” Hole Cleaning Procedure
- Conclusion
“If you could kick the person in the pants responsible for most of your trouble, you wouldn't sit for a month.”

Theodore Roosevelt, 1858 – 1919
26th President of the United States
Financial Impact

Between Jan 2014 to April 2015

• Completed 230+ operated wells
• 11 stuck coiled tubing events
• Impact to well costs: $5,674,000
• Expected cost for coiled tubing operation - $100,000 - $250,000
Drilling Operation
Coiled Tubing Operation

Power System

Pressure Control System
Coiled Tubing Operation

Hoisting System
Coiled Tubing Operation

- Circulating System
- Rotation System
Coiled Tubing Operation

Circulating System
Coiled Tubing Operation

- Many similarities to drilling operations

- Notable differences
  
  - Constrained by the inability to rotate pipe
  
  - Able to pump steadily while tripping pipe
  
  - Pressure/hydrocarbons limit access to returns
Coiled Tubing Drill Out

Frac plugs
Coiled Tubing Drill Out

Frac plugs
Coiled Tubing Drill Out

Debris/Sand
Causes of Stuck Coiled Tubing

- Generally occurred while tripping
- Lack of engineering in hole cleaning practices
- Hole cleaning was inadequate
<table>
<thead>
<tr>
<th>Drilling Operation</th>
<th>Completion Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on K&amp;M Guidelines</td>
<td>Based on supervisor / vendor experience</td>
</tr>
<tr>
<td>No sweeps</td>
<td>Sweeps to clean lateral</td>
</tr>
<tr>
<td>No short trips</td>
<td>Short trips to clean lateral</td>
</tr>
</tbody>
</table>
Comparison of Hole Cleaning Practices

Drilling Operation
- Engineered and monitored fluids
- Several bottoms up before trip
- Procedure for overpull situations

Completion Operation
- Fluid quality visually monitored
- No clean up time before trips
- No overpull guidance
Comparison of Hole Cleaning Practices

If downhole physics are the same, why are practices so different?

- Vendors focused on tools / equipment
- Engineering tends to be focused on stimulation
- Horizontal “science” based on conventional reservoirs
Comparison of Hole Cleaning Practices

If downhole physics are the same, why are practices so different?

We failed to capitalize on our knowledge and apply it to like situations.
“New” Hole Cleaning Procedure

1. Periodic sweep procedure with quantitative fluid monitoring

2. Specific plug drill times
   - Used to control debris size
   - Used to allow clean up between plug drilling
“New” Hole Cleaning Procedure

3. No short trips for hole cleaning
   • Short trips used to check hole cleaning rate

4. Specific trip procedure
   • Limit trip speeds
   • Clean up procedure

5. Overpull guidance
Conclusion

No stuck pipe incidents when procedure followed

- Successful drill out on 70+ wells in various environments

Learning curve

- Buy-in from ALL supervision
- Optimizing details of procedure
Conclusion

- Identified other “drilling norms” that would be beneficial for completions
  - Real-time data monitoring
  - Third-party fluids engineering
Questions?