An Application of Reactive Charge Technology to High Strength Formation and High Overbalance Environments: Charge Design and Operational Challenges

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Agenda

• Challenges Facing Schooner Field
• Testing Criteria
• Test Results
• Test Conclusions
• Proposed Way Forward
• Proposed Field Deployment
Schooner Field

- Schooner Field discovered in 1987
- Developed in the mid 1990’s
- Carboniferous Schooner Formation
- Fluvial deltaic channel sandstones
- Initial reservoir pressure 6,564 psia
- Hydrocarbon 51° API Condensate
Challenges of Schooner Field

- Reservoir Pressure - 2,900 psia
- Maximum Overbalance - 3,500 psi
- Rock strength Max UCS - 22,000 psi
- Permeability Min - 1 mD
Test Criteria

• Rock selection to match Schooner
  • Identify rock targets to match
    • Permeability - 10mD
    • Porosity – 11%
    • Rock Strength - 18,000 - 22,500psi

• Preliminary Testing
  • Permeability - 2.7 mD
  • Porosity - 5.1%
  • Rock strength (UCS) - 17,000psi

• Actual Test Cores
  • Permeability - 0.29mD
  • Average porosity - 6.55%
Test Criteria

• **Charge Type Selection**
  • 4 ½” Gun type with either 23g or 39g system
  • Conventional and Reactive Deep Penetrating charge types

• **Test Conditions to Match Schooner**
  • Pore pressure 2,900 psi
  • Overburden 12,500psi
  • Wellbore pressure 6,400 psi
  • Overbalance 3,500 psi
Test Results

<table>
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<tr>
<th>Test</th>
<th>Charge</th>
<th>PR</th>
<th>I Perm</th>
<th>Penetration</th>
<th>Clear</th>
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<tr>
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<td>39g Conventional</td>
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<td>8.200</td>
<td>6.000</td>
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</tbody>
</table>
Test Results

- Difficulty in examining targets due to fracturing occurring when stresses relieved.
- Plugging existed in all tunnels to some degree
- Inflow performance did not correlate to clear tunnel length.
Test Results

- Inhomogeneity in target cores affected:
  - Total Depth of Penetration
  - Post perforation flow results
Test Results

• Reactive tunnels appeared to have circumferential fracture along the tunnel length.
• Fracturing found at the end of the reactive tunnels
Test Conclusions

• CT Scanning Recommended for future testing.
• Limit on performance of all charges
• Limits of reactive clean up with high level of overbalance.
• Reactive charges did still yield better clear tunnel.
• Radial Flow testing more appropriate?
• Streamline testing?
Proposed Way Forward

• Utilise 4 ½” 39g Gun system to perforate the well.
• Utilise Reactive charges
• Utilise a Perf Pill -
• Conduct Shoot and Pull Operation Pre completion
Proposed Improvement Considerations

• Reduction in level of overbalance?
• Underbalance?
  • Static
  • Dynamic
• Employ additional stimulation?
  • Propellant Stimulation
  • Hydraulic Fracturing
  • Acidisation
Questions