C-Seal Additive Reduces Non-Productive Time and Drilling Costs in Algeria

“A blend of C-Seal* additives and sized calcium carbonate allowed us to drill depleted reservoir with high overbalance till the planned liner point without any NPT.”

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**Well Information**
- **Location**: Hassi Messaoud, Algeria
- **Interval start depth**: 10,869 ft (3,313 m)
- **Casing size**: 7 in (6.45 cm)
- **Depth MD/TVD**: 11,499 ft (3,505 m)/11,037 (3,364 m)
- **Openhole size**: 8 ⅜ in (21.27 cm)
- **Inclination**: 79°
- **Fluid in hole**: Diesel-oil-based drilling fluid
- **Maximum bottomhole temperature**: 200°F (93°C)

**The Situation**
The operator planned to drill an extended 8 ⅜-in. hole section to the top of the Cambrian R2 formation in Hassi Messaoud field. For typical horizontal well profile drilling operations in this field, the 8 ⅜-in. section is drilled from the top of G35 to the top the reservoir Cambrian Ri, where the 7-in. liner is set and cemented. The section is drilled with the same mud weight of 1.40 SG.

The plan to drill the extended 8 ⅜-in. section introduced challenges in terms of potential for lost circulation associated with high ECD and differential stuck pipe while drilling the risky and depleted Cambrian Ri and Ra formations with 1.40 SG mud weight. The Cambrian Ri and Ra formations of low pore pressure (< 1.0 sg) EMW present a lower fracture pressure than that of the overlying formation. The overlying Trias Argileux/Gresseux carbonate formation would require a mud weight of 1.40 SG to avoid geomechanical problems. The overbalance associated with this was +/- 3,000 psi.

There was also a considerable risk that surge pressures would fracture the formation during liner running operations. In a previous trial in the same area, non-productive time and excessive drilling cost were experienced. This had been the result of high differential between the hydrostatic pressure and the depleted sand Ri and Ra formation. After the sidetrack operation, the liner was set in Cambrian Ra formation. The objective was to set the liner deeper in top Cambrian R2 formation.

**The Solution**
The M-I SWACO team in Algeria designed the conventional diesel-oil-based mud with loss prevention material (LPM) based on blends of C-Seal, C-Seal F, Safe Carb* 40 and Safe Carb* 20. Based on the ideal packing theory, the proposed blend is also the optimum for bridging; considering the permeability of Cambrian formation.
The Details
A steerable bottomhole assembly was used to drill the 8 ¾-in. section. The Trias Argileux G 35 till zone d’alternance formations were drilled with 1.40 SG without any LPM in the mud system. Prior reaching Cambrian R1 formation by 131.2 ft (40 m), the circulating system was treated by dilution with the C-Seal/Safe Carb loss prevention material pill.

To allow for depletion of the C-Seal/Safe Carb pill consumed downhole and lost over the shakers, the active system was continuously treated at a rate of 4 sx/hr. Any pre-mix that was used to maintain the volume in active system was treated with the LPM. LPM concentration is reported in Table 1. The configuration of the shaker screens had to be modified to retain a good part of the LPM in the mud. The two derrick shakers were dressed with 110-mesh screens.

The 8 ¾-in. interval was drilled in rotary and sliding mode. Mud properties and hole cleaning remained good while drilling the entire interval. The HTHP fluid loss of the system was also controlled below 5 cc at 200°F (93°C)/500 psi.

The 8 ¾-in. interval was drilled from 10,869 ft (3,313 m) MD to TD at 11,499 ft (3,504 m) MD 11,037 ft (3,364 m) TVD, at the top of Cambrian R2 formation, in a total of 88.75 drilling hours without any problems. A total of 627 ft (191 m) were drilled at 79° inclination.

Prior to pulling out of hole to run the 7-in. liner, a 07 m³ wellbore strengthening pill was spotted in the 8 ¾-in. open hole. The objective was to decrease the possibility of mud losses due to surge pressure induced fractures.

While running and cementing the 7-in. liner, no downhole losses were recorded. The job was considered successful and recommended as the proposed procedure for the incoming wells.

<table>
<thead>
<tr>
<th>Product</th>
<th>Concentration (kg/m³)</th>
<th>D50 (micron)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Seal</td>
<td>14</td>
<td>130</td>
</tr>
<tr>
<td>C-Seal F</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Safe Carb 20</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Safe Carb 40</td>
<td>21</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 1: LPM concentration

Questions? We’ll be glad to answer them.
If you’d like to know more about C-Seal and Safe Carb additives how they are performing for our customers, please contact the M-I SWACO office nearest you.