## Completion Fluid Services

# Successful removal of N-Solate® 275 insulating gel leads to estimated savings of US$10-15 million on a deepwater well

Location: Gulf of Mexico

### Overview

An operator in the Gulf of Mexico wanted to remove 10.0 pg of N-Solate® 275 insulating gel that was placed in one of its wells so that tubing could be cut and pulled. The primary objective was to perform a permanent "plug and abandon" (P&A) of the well. To effectively remove the insulating gel, Halliburton Baroid recommended that the operator reverse-circulate the N-Solate 275 gel out of the well and then follow that operation by inserting a 60-bbl cleaning pill consisting of a mixture of water and Halliburton's ViCon NF™ breaker. The ViCon NF breaker was found to dissolve the N-Solate 275 gel when mixed at 10 percent by volume in water. In addition, 13.1-ppg CaBr was used as kill-weight fluid to P&A the well.

*The effectiveness of the solution is evident when viewing the cleanliness of the removed production tubing.*

### Hazardous conditions

Water depth to the wellhead was 3,356 ft, and bottomhole temperature (BHT) was 175°F in the deepest annulus containing the N-Solate 275 gel. The wellbore consisted of 6,816 ft of 10-3/4-in. 73# casing and 9,585 ft of 9-7/8-in. 62.8# casing with 4-1/2-in. 15.1# chrome tubing. Total depth of the N-Solate 275 gel to be removed was 15,651 ft (a total of 917 bbl). A 750-ft, 50-bbl pad of 9.5-ppg CaBr viscosified with BRINEDRIL-VIS® drilling fluid and containing 46% MEG was in the annulus from the wellhead to the top of the N-Solate 275 gel. A total of 150 0.22-in. ID holes at 6 spf were punched in the 4-1/2-in. tubing from 19,935 ft to 19,960 ft. The differential pressure between the 13.1-ppg CaBr in the tubing and the 10.0-ppg N-Solate 275 gel in the annulus was approximately 2,960 psi. Additional pressure of 500 psi was applied down the tubing for a total differential pressure of 3,460 psi.

### According to plan

The flow path was lined up so that the N-Solate 275 gel would flow through the subsurface wellhead and back up the choke line. A high-pressure pump was employed to pump 13.1-ppg CaBr down the tubing. Once the holes were punched in the tubing, it immediately went on vacuum to pressurize the choke line and initiate well flow. The pump was then engaged and caught up with the CaBr in the tubing.

The well was shut in, which only allowed 40 bbl of the 50-bbl pad to flow back through the wellhead, blowout preventers (BOPs), and choke line. The flow path was then reversed, and the pump was lined up on the choke line and annulus, allowing returns to flow out of the tubing. Then, a solution of 60 bbl of water mixed with 10 percent ViCon NF breaker and approximately 1,400 bbl of 13.1-ppg CaBr was pumped to displace the N-Solate 275 gel from the annulus. Pump rates varied from as high as 6,200 psi at 0.5 bpm to as low as 0.27 bpm at 6,100 psi. An oil and grease analysis conducted on the N-Solate 275 gel showed 9.5 mg/L. The remaining N-Solate 275 gel, CaBr/MEG pad and ViCon NF breaker were then disposed of in an economical and environmentally responsible manner.

## Successful conclusion

After the N-Solate 275 gel was circulated out, the 13.1-ppg CaBr was displaced to 13.1-ppg water-based mud. The tubing was then cut and pulled, and the P&A process continued. The 4-1/2-in. tubing proved to be clean once it was pulled out of hole, and a minimal amount of N-Solate 275 residue was found on some of the control line clamps from the outside of the tubing.

By recommending the use of the ViCon NF pill, Baroid helped the operator to effectively remove the N-Solate 275 residue from the exterior of the production tubing. Upon futher inspection of the drillpipe from the well, there were no visible signs of N-Solate 275 residue.

| CHALLENGE | SOLUTION | RESULT |
|---|---|---|
| Remove insulating gel, and plug and abandon the well. | Reverse-circulate the fluid and use a cleaning pill to dissolve the fluid. | ViCon NF pill effectively reversed out the N-Solate 275 insulating gel without issue. Successful removal of N-Solate 275 gel led to estimated savings of US$10-15 million. |

## Economic value created

Using the ViCon NF pill, the N-Solate 275 gel was reversed out exactly as planned without issue. If the operation had been unsuccessful, the operator would have faced costly rig time to cut and pull short pieces of 19,900-ft tubing. This would have also generated a large amount of waste. In addition, because there were several ½-in. stainless-steel control lines strapped to the outside of the tubing, making clean cuts would have been very difficult.

The successful removal of N-Solate 275 gel led to an estimated savings of US$10–15 million. Because N-Solate 275 gel is environmentally safe, it was safely dumped overboard after passing oil and grease and static sheen testing, thereby saving the operator thousands of dollars in rig cleanup, disposal and boat cleaning costs.