

RMR is the simple solution to tophole instability problems

PROJECT AGR provided RMR services to CNR UK for the ongoing development of the Northern Northsea assets in 2007.
KEY WORDS Tophole Stability * Solution to hole problems * Riserless drilling with mud returns * Reduced risk in drilling * Simple solution to major problem

Executive Summary

CNR had serious hole instability problems causing stuck pipe leading to well abandonments. AGR provided the Riserless Mud Recovery (RMR) system so that a closed system with full specification mud was used with the RMR pumping mud back to the rig. This resulted in a stable hole with no sticking problems and the fastest 20" casing run. RMR was cost effective on a single well and would produce greater savings on a batch setting job.

The Problem

CNR drilled subsea wells in 2006/2007 as part of the ongoing development of their Northern Northsea assets. The top hole sections, for 30" conductor and 20" surface casing, were batch set. Of the eight wells spudded, four did not achieve their objectives and were abandoned. In cases AA, AB & AE the drill string stuck and in case BB the 20" casing was stuck and could not be retrieved (see table 1).

On the first well, BA, the 26" drilling assembly stuck at 1,200ft (366m) and the hole packed off

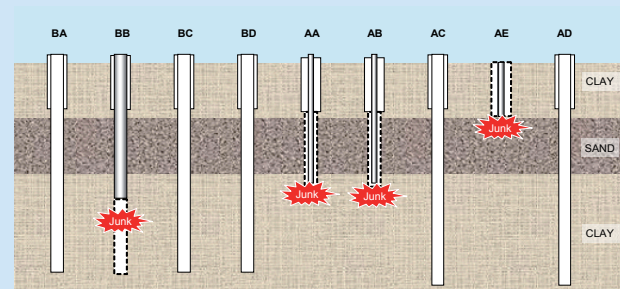


Table 1: Final Well Tally with 4 'junked' wells.

completely with no warning. After backing off the drill string, open ended drill pipe was washed to bottom past the fish without difficulty. The drill string was fished out with an overshot and the 20" casing run. The seabed was raised about 6ft around the wellhead due to the large volume of cuttings pumped from the well.

The solution

AGR's RMR system was used on well (AD). The 26" section was drilled, and the 20" surface casing run, without any hole problems. The Suction Module (SMO) was installed on the Low Pressure wellhead using drill pipe. The 26" section was then drilled with full specification mud. As the mud level reached the SMO, the RMR pump was used to pump the mud and cuttings up a mud return line to the rig shale shakers for re-use. The mud/seawater interface was observed in the SMO with cameras. A weighted (9.1ppg) mud was used to start drilling and circulation was lost at 1,268ft, a similar depth to the first problems in the previous wells. The mud weight was reduced and Lost Circulation Material (LCM) added to the mud. Drilling continued with 8.9ppg mud and manageable losses of ~30bbls/hour to the planned casing point. There was no tight hole on the trip out and so no wiper

"By challenging conventional wisdom we have implemented a simple solution to resolve a problem that has plagued North Sea drillers for decades. The authors believe that this technique will become standard practice for drilling difficult top holes in the future"

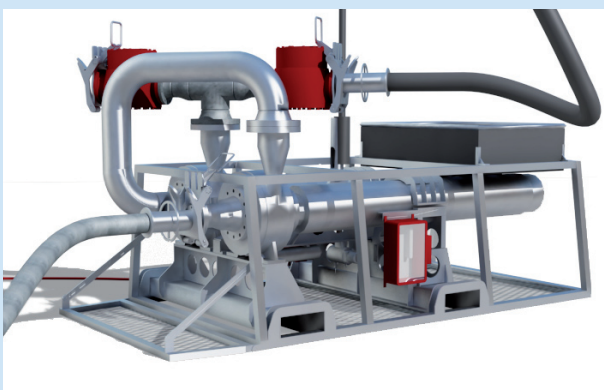
SPE 111422; Roger Vernon, Stewart Buchan, CNR (UK); Jim Hewson, Marianne Halland, AGR

trip was needed. The casing was run to bottom with no hole problems in record time.

Cause of problem

The results of the RMR well helped CNR engineers understand the causes of the problems in the 26" section. There are massive, unconsolidated, high-permeability sands below 950ft (290m). Water ingress destabilised the sands, either through fractures or porosity. The sand then collapsed or 'flowed' into the well bore. This could occur suddenly with the sand trapping the pipe and packing off the annulus, but the loose sand could be easily washed out with a jetting run.

The RMR system allowed fully engineered mud to be used in top hole with returns to the rig. The mud had a lot of fluid loss control additives and LCM to minimise filtrate losses to the sand. The mud weight was adjusted to minimise whole mud losses to the formation. This prevented water ingress and kept the sand stable. Drilling, tripping and casing running operations were problem free and quick.



Subsea Pump Module

Future improvements with RMR

It was also found that the high pump rates rates of 1200gpm (4500lpm) used previously with seawater were not required. With RMR and a closed mud system, 500gpm (1900lpm) was enough to clean the hole of cuttings. A stable gauge hole was drilled and so no wiper trips were required. All cuttings were returned to the rig and so there was no build up cuttings around the well head requiring rig time to jet away.

Using RMR on a single well was cost effective. Using it as part of a batch setting operation could be significantly cheaper and more efficient than drilling with seawater. If RMR was part of the original well planning, the 20" shoe could be pushed much deeper with confidence that the hole would remain stable. With a stable, gauge hole plus engineered mud, directional drilling is much more reliable. For cluster /template drilling, RMR prevents hole instability which could compromise the development. It also prevents cuttings build up around the wells. Cementing is much more reliable in a gauge hole reducing the need for squeezes or 'top-up' jobs. This ensures a stable foundation for subsea trees for safe long term production.

Time and cost comparison

CNR concluded that RMR was cost effective for a single well despite extra rig time running the equipment due to crew unfamiliarity with the system. It would produce much greater savings for batch drilling as well as reducing risks of problems and providing a more stable well.

See SPE paper 111422 for more details.

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