



Offshore Malaysia: Cleansorb ORCA® Breakers Successfully Deployed on Record ERD Wells

Controlled and Effective Non-Aqueous RDF Filter Cake Removal on AICD Completion

CHALLENGE	SOLUTION	RESULT
- Extended-reach open-hole AICD completions - Reservoir section drilled with non-aqueous RDF - Delayed filter cake removal to control losses during completion - Design displacement within low pressure limit of completion screens	- ORCA for OBM® filter cake treatment designed and validated in the laboratory - GBC-1 buffer/catalyst used to extend breaker delay - Displacement optimized using ClearDepth™ hydraulics displacement software	- ORCA for OBM deployed on the first two wells - Efficient displacement achieved within 1,200 psi limit - Third well approved based on initial results - Production results meeting or exceeding expectations

OVERVIEW

An infill drilling campaign was planned for a mature shallow-water field offshore Malaysia. The program included two wells, with a third optional well to be completed depending on the results from the first two. The 7-in. open-hole reservoir sections, approximately 1,750 – 1,970 m long, were to be drilled horizontally through the target sand and completed using a 4½-in. Autonomous Inflow Control Device (AICD) completion assembly. A non-aqueous Reservoir Drilling Fluid (RDF) was selected for the reservoir section, and a filter cake breaker was required to remove drilling-fluid solids before production. Because the lower completion assembly did not include an isolation valve, controlled filter cake breakthrough and fluid-loss management before setting the upper completion production packer were critical to the breaker design.

Once drilled, these wells would represent the longest ERD wells drilled in Malaysian waters.

CHALLENGE

Cleansorb was asked to design a filter cake treatment that met the following key criteria:

- Effectively break down the emulsion in the non-aqueous filter cake
- Chemically remove 100% of the acid-soluble components of the filter cake
- Delay filter cake breakdown for 72 hours, allowing the breaker to be fully displaced and the upper completion to be run before breakthrough
- Bottomhole temperature: 190°F / 88°C

Another challenge was the requirement to design a displacement train to effectively displace the open hole to breaker fluid at a flow rate restricted by the pressure limitations on the lower completion. The displacement was designed using ClearDepth™, Newpark's proprietary Displacement Design Software. ClearDepth™ models displacement efficiency and plots pressure v's time and depth throughout the simulated displacement, allowing the engineer to optimize displacement performance while maintaining flow rates within tight pressure limitations.



SOLUTION

A series of laboratory tests was performed at the Technology Center using a sample of the RDF formulation. The objective was to identify an ORCA for OBM formulation that would meet the project criteria. The formulation was validated and recommended for field deployment. It contained the following additives:

- ORCA A: High temperature organic acid precursor
- ORCA E: Medium temperature organic acid precursor
- GBC-1: Proprietary pH buffer/catalyst
- ORCA 4: Microemulsion surfactant



Figures 1 and 2: Disk and ORCA breaker solution after soak

Next step was to design the displacement of the Non-Aqueous RDF from the open hole to the ORCA breaker pill, ensuring removal of all excess RDF and minimizing the risk of fluid commingling. Achievable flow rates were reduced due to pressure limitations on the lower completion, requiring careful selection of displacement pill properties. The following displacement train was designed and pumping schedule calculated using ClearDepth™ to ensure the Bottom Hole Pressure did not exceed 1,200 psi:

- RDF circulated and conditioned
- Weighted viscous push pill including 5% surfactant
- Sodium chloride brine
- ORCA breaker (open hole volume + agreed excess)

Case History

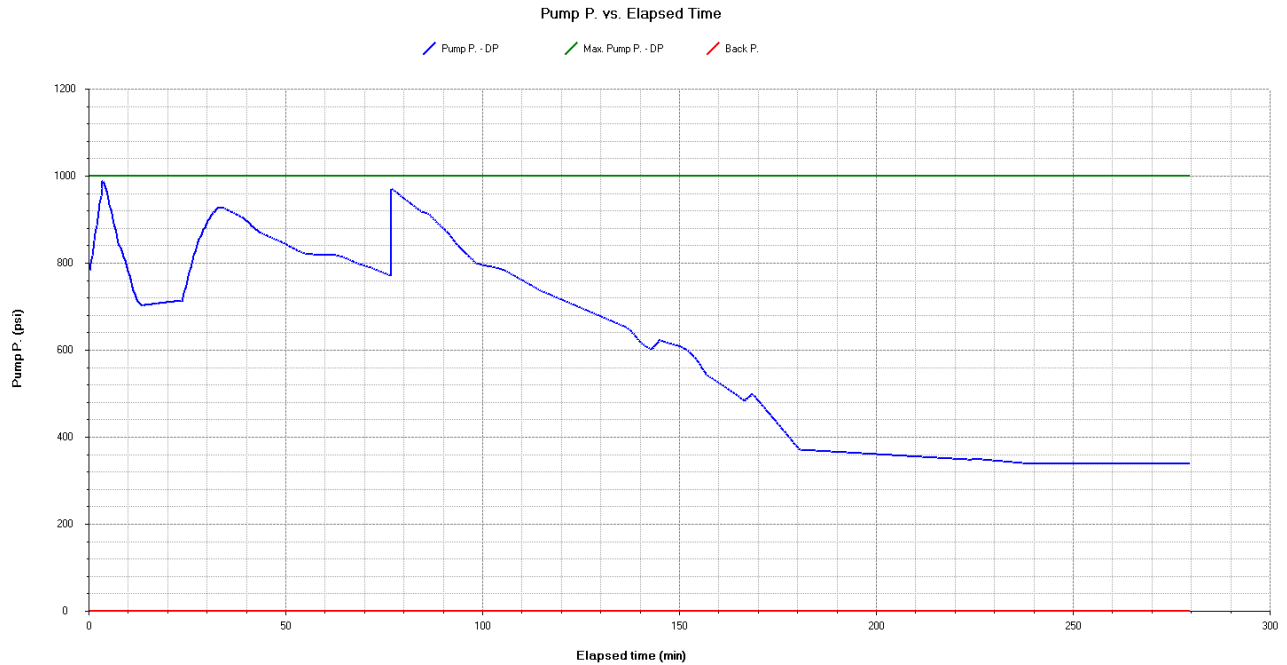


Figure 3: Pressure vs Time during displacement – limited to 1,000psi max.

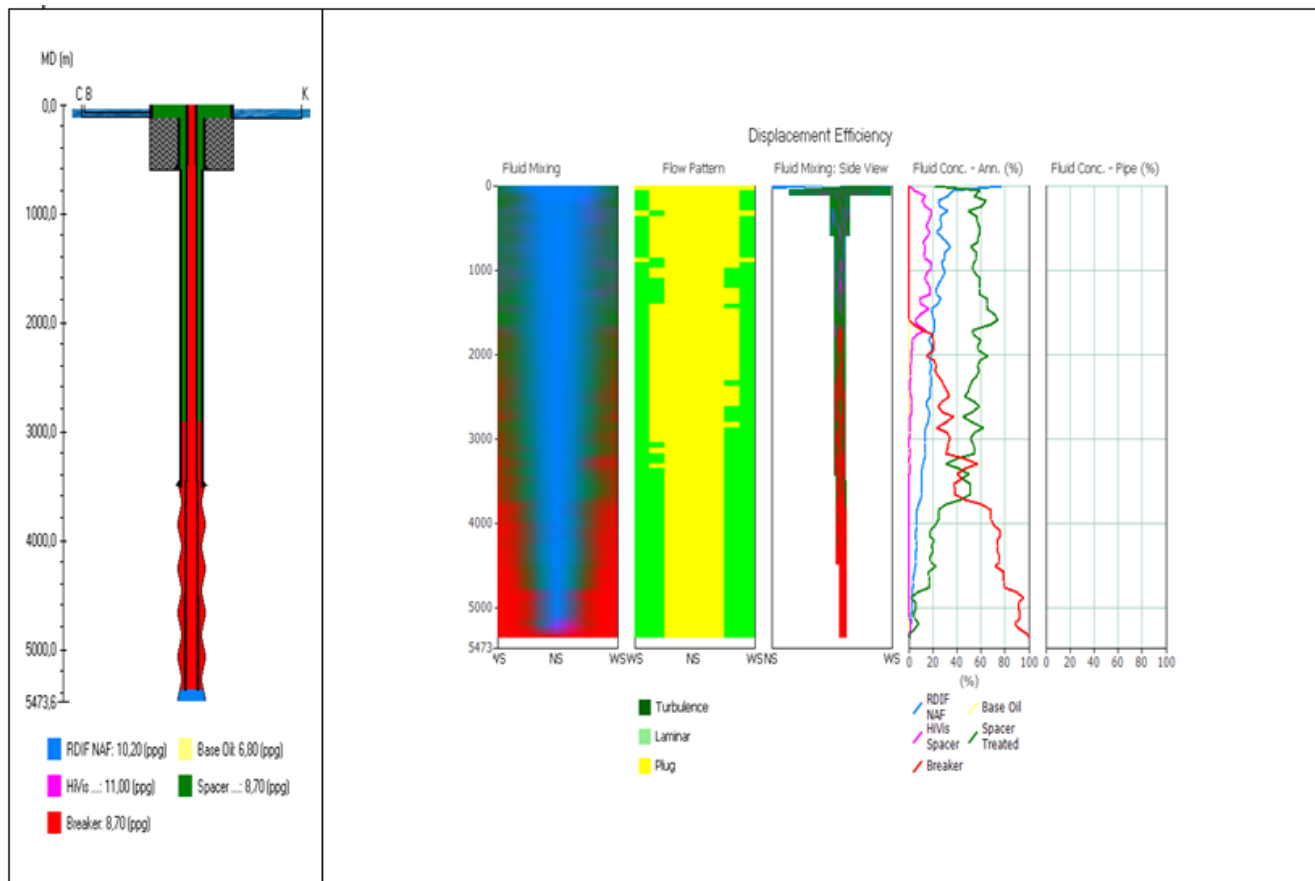


Figure 4: Displacement Efficiency simulation - post Breaker displacement



RESULTS

Three wells were drilled and completed during the infill program. ORCA for OBM filter cake treatment was successfully deployed on all three wells.

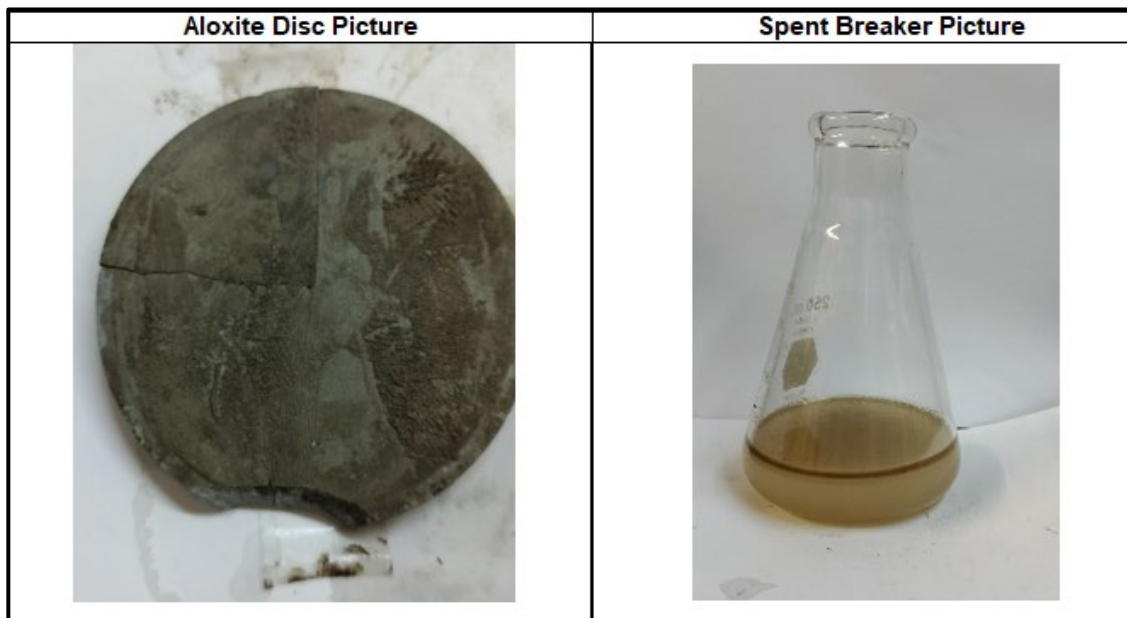
Well 1 – The ORCA pill was mixed and placed without GBC-1 due to a logistical delay. Breakthrough occurred earlier than planned, with losses increasing 17 hours after placement. The well was completed without incident, and initial production results were positive.

Well 2 – The recommended ORCA formulation was used on the second well. The spacer train pumped before the ORCA pill was modified to reduce filter cake erosion. The breaker was placed successfully, and breakthrough was not recorded before the production packer was set. Initial production results were in line with expectations.

Well 3 – Following successful completion of the first two wells, approval was given to complete the optional third well. The breaker was mixed and placed successfully. Seepage losses were observed while running the completion, but breakthrough was not observed before the production packer was set after 64 hours.

On all wells, the ORCA breaker fluid was mixed and quality-control checked for performance before placement.

All displacements were performed as per programme without incident. Pressure data recovered during these operations aligned closely with the values as predicted by ClearDepth™.



Figures 5 and 6: Results from rigsite breaker QC test; disks are water-wet, with only drilled-solids residue remaining.



WELL DATA	
Well Type	Oil Producer
Completion Type	4 ½" AICD Screens with Water Swell Packers
No. of Wells	3
Water Depth (m)	72
Reservoir Drilling Fluid Type & Density	RDF @ 10.2 ppg
Breaker Fluid Density	8.7 ppg
Completion Fluid Type & Density	8.7 ppg Treated Water
Hole Size	7"
Reservoir Section Length	1,745–1,894 meters
Max. Hole angle in Reservoir Section	90°
Reservoir Type	Sandstone
Reservoir Properties	185 – 3000 mD
BHST	160 / 190 °F
Pore Pressure/Frac Gradient	8.50 / 12.50 ppg

Table 1 – Well Summary