Case History

High-Performance Water-Based Drilling Fluid System Saves Rig Time on Exploration Well, Onshore Indonesia

High-performance water-based mud (HPWBM) maintained wellbore stability and improved ROP, enabling the operator to reach total depth objective 3 days ahead of plan

CHALLENGE	SOLUTION	RESULT
• Wellbore instability anticipated when drilling through highly reactive shales • NPT recorded while drilling offsets due to bit balling, tight hole and poor hole cleaning • Extended logging runs increased risk of differential sticking and excessive overpull • Over pressure sand expected while drilling production interval	• Extensive pre-project laboratory testing, shale study analysis and planning • Customized HPWBM formulated, including NewPerm™ and NewTex™ as shale inhibition additives • Risk of differential sticking mitigated using tailored design of bridging solids package • Hole cleaning properties optimized using proprietary ClearTrack™ hydraulics modelling software	• Well completed 3 days ahead of planned schedule • Excellent wellbore stability noted while drilling • Reservoir interval drilled with no incidents of differential sticking • Wireline logging operations were conducted without incident - no overpull recorded

OVERVIEW

Matra Unikatama and Newpark Drilling Fluids were chosen for the one well exploration drilling campaign in PHR WK Rokan area thanks to our extensive drilling experience in this area as well as our extensive logistics network and facilities infrastructure. Drilling in this area is characterized by reactive 'gumbo' shale in the top-hole intervals, followed by long layer of sandstone and over-pressurized formations in the production interval.

The goal was to design a High-Performance Water-Based Mud that provides excellent wellbore stability, specifically good shale inhibition through the upper hole section, good hole cleaning through the long deviated section and an optimized blend of bridging solids to minimize fluid loss, reducing the risk of differential sticking and protecting the production zone.

All fluid formulations were designed using data from offset wells to inform the software modelling and laboratory testing. Once fluid design was completed, a detailed drilling fluid program was developed and delivered to the customer to support flawless execution.

NEWPARK FLUIDS SYSTEMS

PT. MATRA UNIKATAMA

Case History

CHALLENGE

Serindit Merah well is a vertical well located in the Pudu Field, Riau Province, Indonesia, drilled to a TD of 3,595 ft MD. During pre-planning, the potential drilling hazards identified from offset wells included the presence of highly reactive shale ('Gumbo'), leading to high risk of bit balling, tight hole, wellbore instability, poor hole cleaning, differential sticking, mechanical pack-off and lost circulation.

Shale formation instability is a significant contributor to Non-Productive Time (NPT) and unplanned project costs in the area. Effective shale inhibition in water-based drilling fluids is critical to limit the chemical interaction with shale formations. The operator challenged Matra Unikatama and Newpark Drilling Fluids to provide an engineered High-Performance Water-Based Mud (HPWBM) system that would optimize wellbore stability, hole cleaning and overall drilling performance. An extended logging programme was planned at the end of the drilling operation; hence the fluid was required to maintain stable hole conditions during lengthy periods without the opportunity to circulate and condition.

A detailed analysis of data gathered from offset wells was conducted to accurately design and formulate the drilling fluid for this challenging well. The HPWBM system was designed to improve wellbore stability by providing a high level of chemical inhibition to reduce the rate of shale hydration. The resulting drill cuttings were firm and dry, facilitating good hole cleaning efficiency, increasing Rate of Penetration (ROP) and so reducing the overall time that the shale was exposed.

SOLUTION

Laboratory testing primarily focused on the reactivity of the shale and the best chemical treatment to manage inhibit swelling under both static and dynamic conditions.
Shale samples from offset wells were analyzed to determine physical properties and chemical composition using Cation Exchange Capacity (CEC) and Capillary Suction Testing (CST).
Once the shale properties were better understood, fluid/shale interaction was then evaluated under both dynamic and static conditions using laboratory-scale tests including Shale Dispersion/Erosion, Linear Swell Meter (LSM) and Accretion testing.

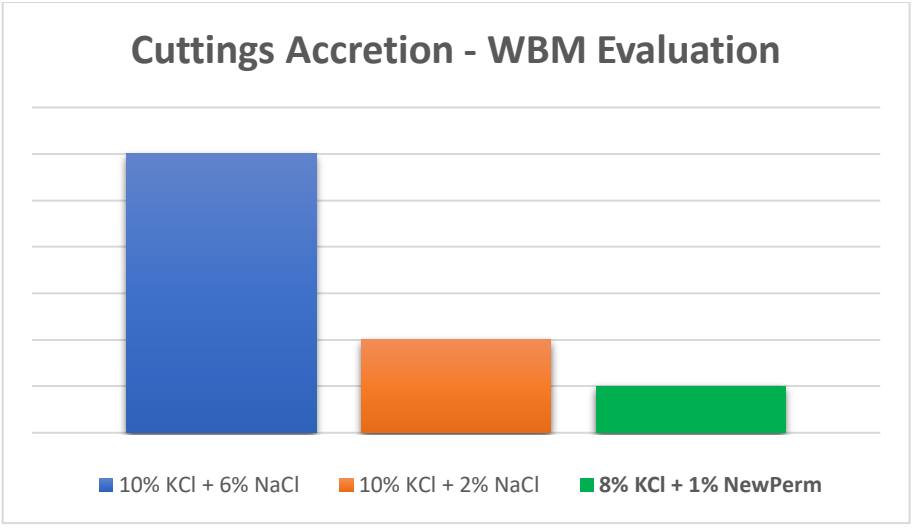

Figure 1. Accretion test results on shale cuttings from offset well

The data gathered during the laboratory testing confirmed the selection of the following additives:

- A blend of potassium chloride and sodium chloride brine as the base fluid
- NewPerm proprietary shale inhibitor to control highly reactive clays
- NewTex fluid conditioner designed to further stabilize shale formations by enhancing filter cake properties, thereby reducing fluid loss and controlling the risk of sloughing shale.
- Designing the bridging package for an optimum blend to bridge on the formation improved filter cake quality, minimizing fluid loss and the risk of differential sticking

The results of the laboratory testing were used to inform the selection of an HPWBM system for optimal field execution for both overburden and reservoir sections.

RESULTS

Using the designed HPWBM system helped the operator to achieve operational objectives and successfully reach well TD in a safe and efficient manner. Overall drilling performance was aided by following good drilling practices, while regular additions of NewTex prevented the occurrence of wellbore instability.

Figure 2. Cuttings from shale shaker clearly showing preserved condition, illustrating the superior inhibition achieved from utilizing the customized HPWBM system

Figure 3. Clean BHA observed at surface

All key properties were kept within desired specifications, with the mud weight being carefully managed to mitigate borehole instability.

The dry, firm cuttings generated using the HPWBM system through the shale section greatly assisted drilling performance. The interval was drilled with an average ROP in range from 90.3 to 124.1 ft/hr., significantly reducing open hole time. Efficient hole cleaning was achieved through a combination of monitoring performance using ClearTrack™ proprietary fluids engineering software, maintaining fluid rheological properties within specification, the pumping of regular sweeps and adherence to good drilling practices.

Drilling reached the planned TD at 3,595 ftMD, including a total of 1,864ft in the final 8 ½" section. Following a wiper trip and multiple logging runs without indications of overpull, casing was run to TD and cemented as per plan. All fluid related goals of this project were achieved, and the well was completed 3 days ahead of schedule, with no recorded Non-Productive Time (NPT) nor fluids-related issues. Project cost savings related to rig time are estimated at a total of c. US$ 155,000.

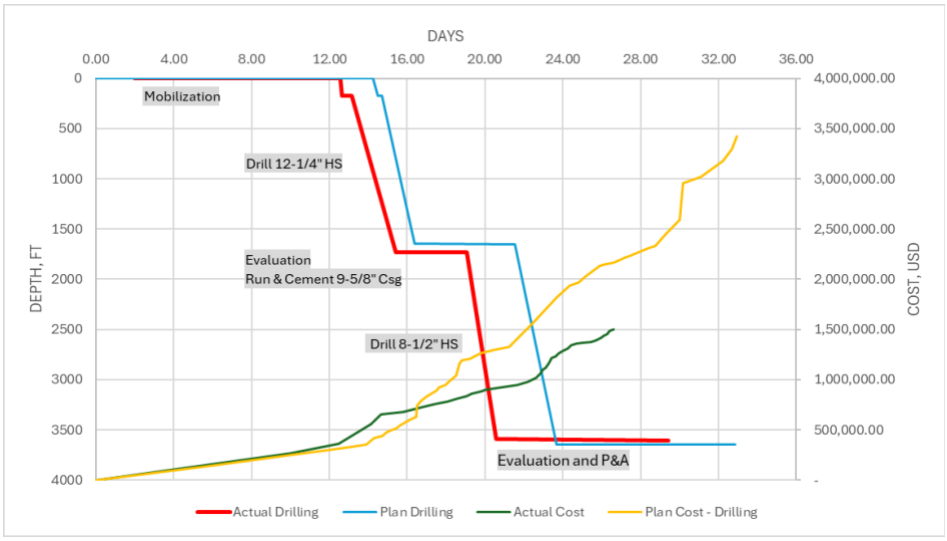

Figure 4. Clean Time and Depth Curve, Planned v Actual

About ClearTrack

ClearTrack™ proprietary fluids engineering software enables the Fluids team - both onsite and remotely - to easily model fluid hydraulics with varying drilling parameters and mud properties, predicting performance and allowing adjustments to be made in real time to optimise drilling performance. ClearTrack was utilized to support the successful delivery of this well.

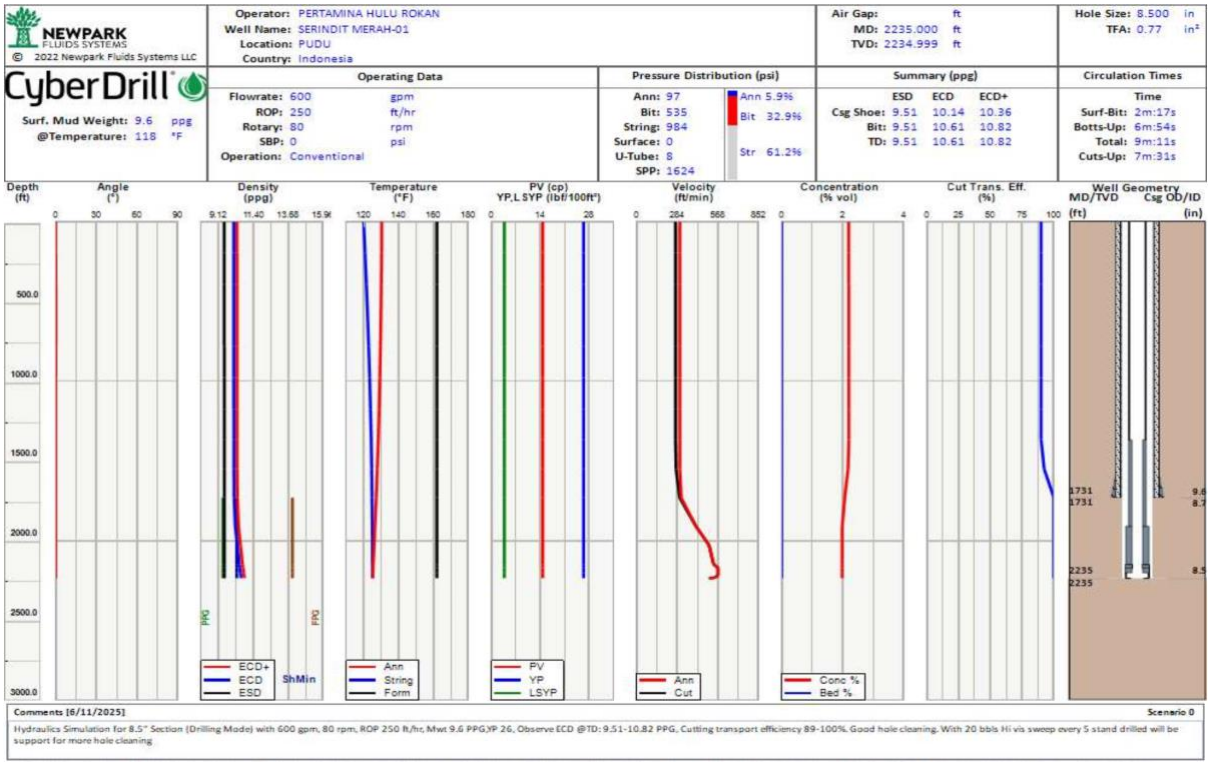

Figure 5. Example of ClearTrack Snapshot from 8 ½" Section