



# Drilling of 1st Horizontal well in Pinang Field Saving the Operator 12% of Well Cost

CUSTOMIZED AND ENGINEERED DRILLING FLUIDS SOLUTION TO IMPROVE HOLE CLEANING AND WELLBORE STABILITIZATION IN HORIZONTAL WELL - PINANG FIELD, INDONESIA

CHALLENGE	SOLUTION	RESULT
<ul style="list-style-type: none"> <li>• Drill through reactive shales</li> <li>• Mitigate hole cleaning issues and torque &amp; drag in 90-degree inclination, with a customized KCl-Polymer drilling fluid</li> <li>• Engineer one fluid for surface hole and reservoir drilling</li> </ul>	<p>Engineered solution, including:</p> <ul style="list-style-type: none"> <li>• Monitoring hole cleaning using proprietary hydraulics modelling software ClearTrack™, comparing predicted with actual ECD and carrying capacity of cuttings to avoid fluid related NPT.</li> <li>• Closed monitoring of fluids properties at rig site, taking random samples to Duri facility for deeper lab analysis and to validate fluids properties against field results and specifications.</li> <li>• A customized KCl-Polymer WBM to optimize rheological profile,</li> <li>• Dedicated sweep strategy to enhance hole cleaning.</li> </ul>	<ul style="list-style-type: none"> <li>• Reached an average ROP of 36.8 ft/hr, with no hole cleaning nor torque &amp; drag issues while drilling landing section</li> <li>• Maintained stable rheological and low fluid loss properties</li> <li>• Achieved low torque &amp; drag through landing section using lubricant in 9.6-ppg mud at 210°F downhole temperature and 88-degree angle.</li> <li>• Reduced drilling time, saving customer approximately 12% from planned AFE.</li> </ul>

## OVERVIEW

Pinang 24-H01 (Pinang-069) well was the 1st horizontal well drilled by IDESS in PHR area. The well is located in Pinang Field, South Area. The objective of this well was to drill to BK2470 formation with a maximum inclination around 90°. Offset wells in the same field experienced significant drilling challenges; Pinang-64 recorded overpull at several depths and excessive tagging through the production section, while differential sticking was suspected when drilling into the BK2980 formation on Pinang-63.

The anticipated bottom hole static temperature (BHST) was 210° F. The well was planned to build a 90-degree angle inclination to drill ± 1615 ft of lateral section into the Bekasap sand formation.

## CHALLENGE

In the region's offset wells, lateral sections are traditionally drilled utilising a KCl-Polymer water-based drilling fluid tailored to minimize the major challenges of shale inhibition and stabilization, insufficient lubricity, poor hole cleaning and tight hole through the reservoir section. In this drilling campaign, IDESS team challenged PT Matra Unikatama & Newpark to provide an engineered water-based mud (WBM) system designed to optimize hole cleaning and overall performance, minimizing drilling, circulating and tripping times.



## SOLUTION

Fluid design was based around the strategy of using the same system to drill reactive shales in the surface hole, then converting to a Reservoir Drill-In Fluid (RDF) for the horizontal reservoir section to ensure a higher production rate while still achieving excellent drilling performance.

A fluid system based on 7% KCl-Polymer was designed and implemented on Pinang 24-H01. While drilling surface hole, no drilling issues related to the presence of reactive clays were observed. The Solids Control Equipment (SCE) was optimized to minimize drill solids and MBT growth, dressing the shakers with finest screens together with a planned dump and dilution strategy. The result was maintenance of good fluid properties, with a maximum MBT value of 10 ppb recorded in surface hole. After converting the fluid to an RDF and drilling the lateral section, a maximum MBT of 3.75 ppb was recorded, while drilled solids concentration was maintained below 1%.

Filtrate loss was controlled within the specification of < 5.0 ml, with a maximum value of 4.4 ml recorded while drilling the section. Additions of fluid loss polymers and sized bridging material to maintain a concentration of 20 ppb in the active fluid system resulted in consistently thin, lubricious and compressible filter cakes. Addition of shale inhibitor were made to ensure wellbore stability and help control the mud weight, resulting in good drilling performance through the section.

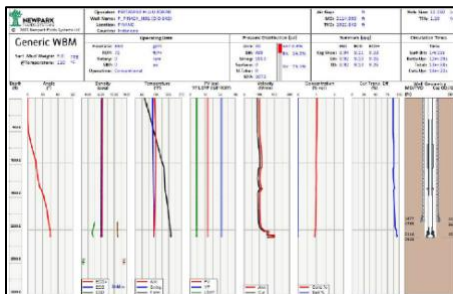
Hole cleaning optimization was achieved by maintaining a Low-Shear-rate Yield Point (LSRYP) of 10 lbs/100ft<sup>2</sup> while drilling the landing section and 8 lbs/100ft<sup>2</sup> while drilling the lateral one. Torque and drag was drastically reduced thanks to the use of a drilling performance enhancer lubricant at concentration of 1% v/v, starting from the landing interval. Maximum torque recorded was in the range of 6.8 – 8.8 Kft-lbs at Casing Point.

### Hole Cleaning Strategy

The landing section was drilled with a flow rate of 840 – 850 gpm, achieving an average ROP of 36.8 feet/hr. with a maximum Equivalent Circulating Density (ECD) of 10.48 ppg. Hole cleaning was monitored using ClearTrack™ proprietary hydraulic modelling software, with forecast vs. actual results showing close correspondence. A dedicated sweep procedure using 20 bbl lo-vis/hi-vis sweeps was planned and implemented as soon as the hole inclination exceeded 45°.

### Well Monitoring using proprietary Software ClearTrack™

Using the proprietary hydraulic modelling software ClearTrack™, hole conditions were analyzed several times a day to check cleaning efficiency and to provide early warning of the potential formation of cuttings beds. Drilling data, (ROP, flowrate, cutting size, RPM, fluids properties, etc.), is inputted to the ClearTrack model, ensuring that the simulation gives results close to actual well conditions. As a result, excellent hole cleaning was achieved, with cutting transport efficiency always over 85% through the landing section.



Hydraulic simulation showing good hole cleaning with drill solids concentration 1%, annular velocity at 154 fpm and cutting transport efficiency over 85% in landing



Cuttings from the Shale Shaker clearly showing preserved condition, normal-dry



The trip out at TD was smooth, with no over-pull and clean BHA observed at surface. Casing was run to bottom and set with no issues.



### Fluids Properties Monitoring

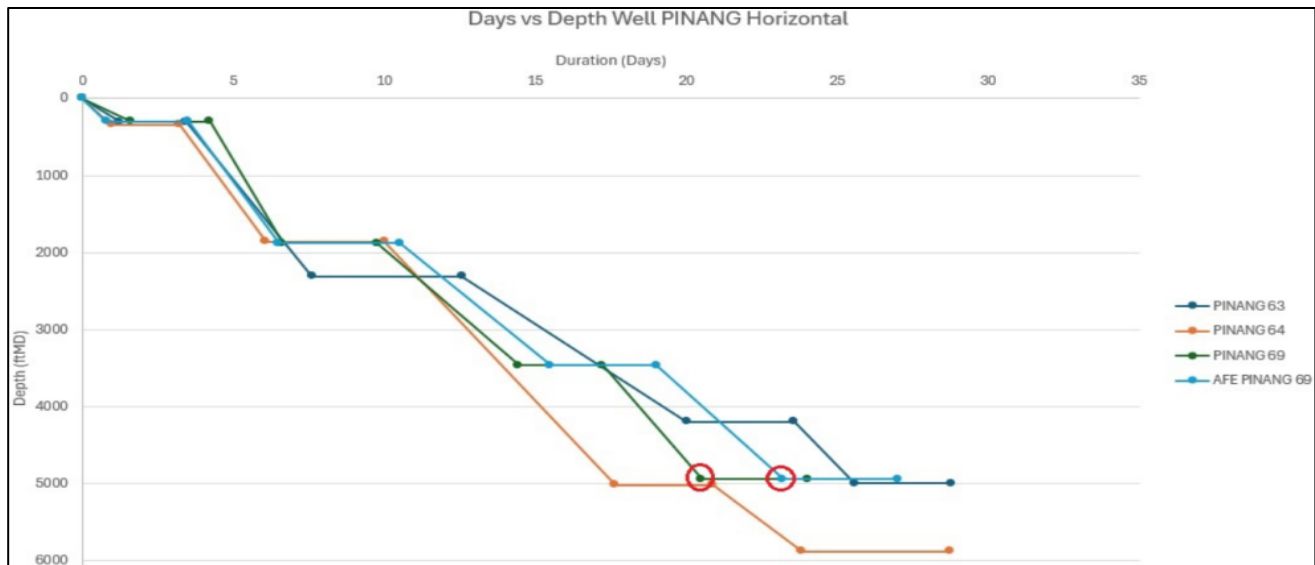
Several mud verification tests were conducted in the laboratory based in Duri with the objective of validating fluids properties recorded in the field. These tests results corresponded accurately with the properties recorded in the field on the Daily Mud Report (DMR).

### RESULTS

The customized and engineered KCl-Polymer provided adequate shale inhibition and high lubricity resulting in low torque & drag while drilling the Pinang 24 H01 well. Rheological fluid profiles were carefully managed and monitored to ensure sufficient hole cleaning while drilling at high inclination and within the allowable standpipe pressure threshold. No hole cleaning issues were recorded during drilling, circulating, and pipe/casing tripping operations.

### ECONOMIC VALUE

The operator saved 6 days of rig time through successful implementation of the hole cleaning strategy on this Horizontal well, saving 12% from AFE planned on spread rate (i.e., considering rig and other service companies deployed). The well was drilled and completed with no recorded Non-Productive Time (NPT) nor fluids-related issues.



Graphic Days vs Depth of Pinang Horizontal well