



When drilling hot wells an oil base drilling fluid systems is usually the only option for oil and gas reservoir drilling. On the other hand, for geothermal reservoir drilling, the oil based systems cannot be an option due to reservoir and reservoir characteristics. HOT-DRILL water based drilling fluid provided stability and performance in a very challenging environment.

Situation:

The case is the longest and deepest geothermal drilling, which exceeded 4,300 meters with more than 2,298 m open hole section, in Turkey.

Well Information:

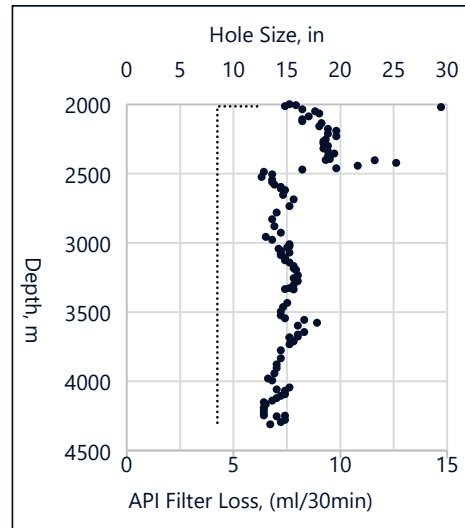
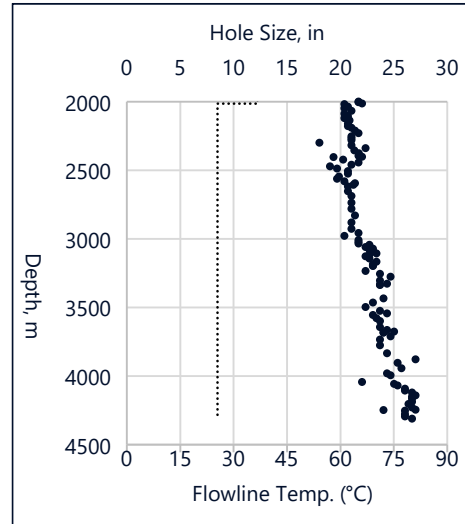
Interval drilled: 8 ½ in hole for 2,298 m
 Max. F.L. Temp.: 81 °C
 Total Well Depth : 4,312 m
 Max. Angle: 12.3 deg.

Challenges and Problems:

- High bottomhole temperature
- Hole Stability. Long open hole section; about 2,300 m. 8 ½ in. drilling in 65 days
- High torque

Solutions:

Flow-line temperature profile, started to increase from the beginning of the interval. Even though, there was a cooling unit operated, temperature kept increasing to 81 °C at flow-line. Components of the HOT-DRILL system have an extended temperature stabilization with POLYTS-P.



To reduce filtration loss HOTTROL NP were used in addition to GEOBEN NT, REOPAC-LV and REOPAC-HV. The system has been shown to control API fluid loss for even deeper and hotter sections of the interval.

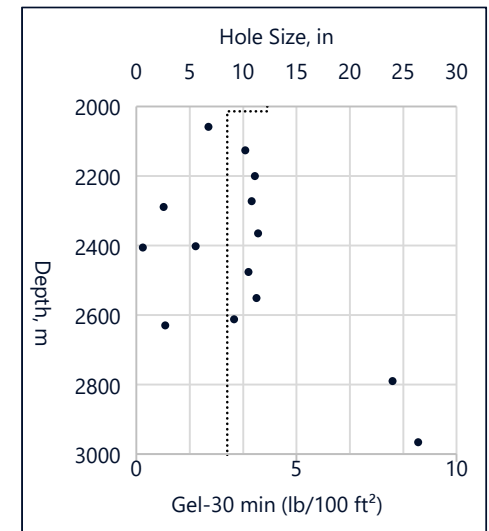
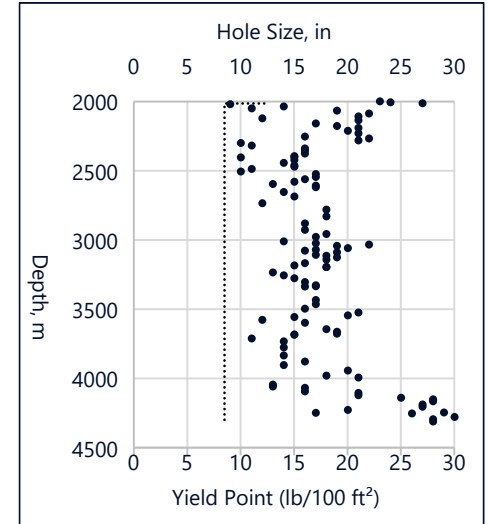
- HOTTROL NP sodium polyacrylate copolymer is a medium-molecular-weight, anionic additive used to reduce fluid loss in freshwater and seawater muds.

To regulate rheology GEOTHIN HT was used instead of GEOTHIN, which is a Chrome Free Lignosulfonate. Although some bicarbonate and carbonate contamination, there was no 30 min gel value measured higher than 45 lb/100sq-ft. The systems has shown a manageable rheology control for long time.

- GEOTHIN HT is a liquid anionic acrylic copolymer used as high temperature deflocculant

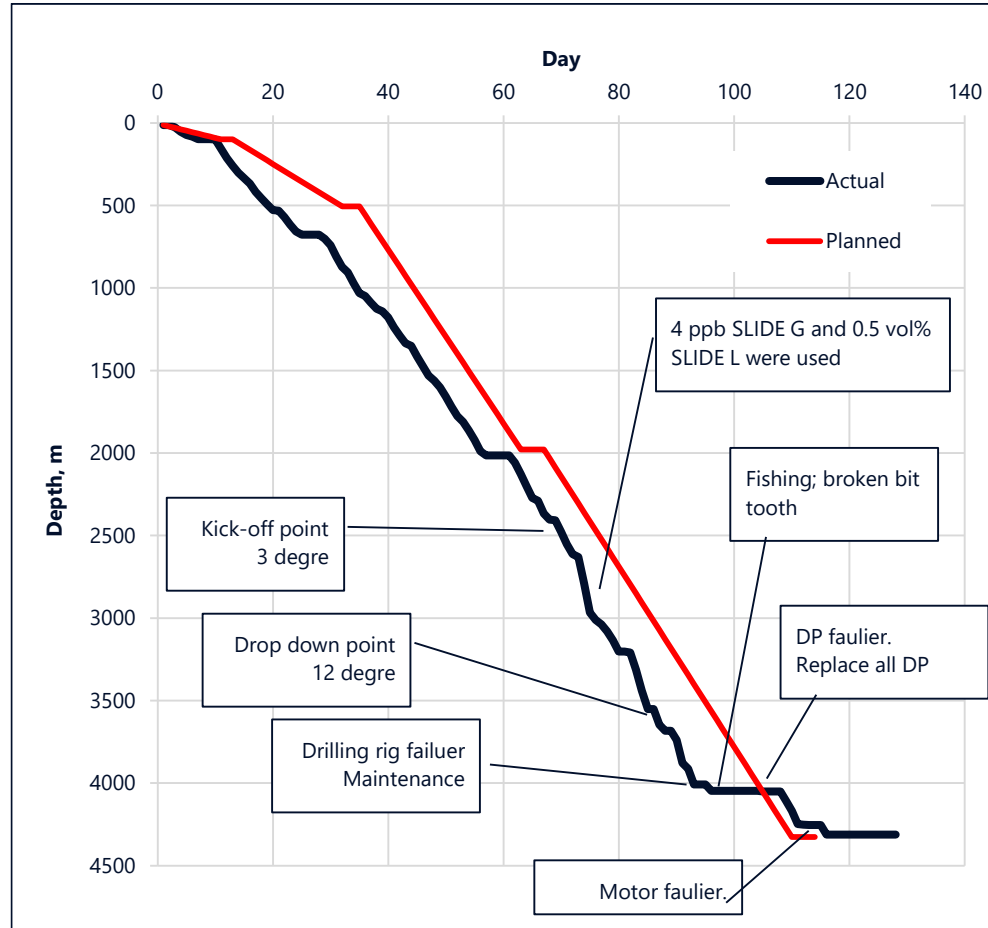
Due to long open hole section and deviated hole, high torque readings were recorded. After 2,600 meters, 4 ppb SLIDE G and 0.5 vol% SLIDE L were used in the active system and a drastically decrease in torque values and increase in penetration rate were observed.

- SLIDE G is high performance graphite, specially sized and formulated lubricant for drilling fluids.
- SLIDE L is a high quality, highly active, environmental friendly, modified vegetable oil based Lubricant. Recommended to use as a lubricant and surfactants.



Results:

The well was drilled safely to total depth with the drilling fluid proving to be very stable for high temperature. The fluid loss and rheology were controlled easily. Moreover, lubricants resulted to increase penetration rates and extended the open hole length by reducing torque readings.



About HOT DRILL:

- Water based drilling fluid system for high temperature reservoirs
- Temperature stabilized up to 250 °C
- Active API Fluid Loss control at high temperatures
- High cutting carrying capacity
- Enhanced lubricicity

General formulization of HOT DRILL was used in the application is shown below.

Additive Name	Function	Concentration (ppb)
GEOBEN NT	Viscosifier & Fluid Loss Control	10-15
REOPAC LV	Fluid Loss Control	0.5-1.5
REOPAC HV	Fluid Loss Control & Rheology Control	0.25-1.0
HOTTROL NP	HT Fluid Loss & Rheology Control	0.5-1.5
CAUSTIC SODA	Alkalinity Control	0.5-0.75
POLYTS P	Temperature stabilizer	0.5-1.5
REOZAN D	Viscosifier	0.25-0.75
GEOHIN HT	High Temperature Deflocculant	0.5-1.5
SLIDE G	Lubricant & Hole Stability	2.0-6.0 *
SLIDE L	Lubricant	1-3 vol% *

* If needed