Customized Lost Circulation Treatments Help Resolve Severe Losses in Highly Fractured Geothermal Wells

ENGINEERED LCM PILLS ELIMINATE NEED FOR COSTLY CEMENT PLUGS

NORTHERN CALIFORNIA

CHALLENGE

Reduce rig time and costs by eliminating the need for cement plugs in geothermal wells located in highly fractured volcanic reservoirs.

SOLUTION

» Pump engineered LCM pills as each loss zone is encountered
» Use WellSet® modeling to identify optimal LCM blend

RESULTS

» Eliminated need for cement plugs
» Reduced rig time, NPT, and treatment costs
» Saved USD 1.5 million overall

SEVERE LOSSES IN HIGHLY FRACTURED VOLCANIC ROCK THREATEN DRILLING OPERATIONS

In 2010, geothermal wells in Northern California were drilled in highly fractured volcanic reservoirs, where massive fluid losses could potentially bring operations to a halt.

One operator considered discontinuing a drilling program because 44 cement plugs had to be used to fight losses in a single section of a previous well.

ENGINEERED LCM PILLS HELP CURE SERIES OF LOSSES THROUGHOUT WELLBORE

While drilling the second well on the same pad in the same zones, 300 barrels per hour of losses were encountered at 3,288 feet (1,002 meters). The initial effort to stop losses with a combination of lost circulation material (LCM) was not successful. The next attempt included 50 lb/bbl of HYDRO-PLUG® hydrating lost circulation squeeze, as well as 25 lb/bbl of STEELSEAL® 1000™ resilient graphitic carbon and 25 bbl per hour of BARACARB® 600 ground calcium carbonate. This formulation and the subsequent treatments were engineered through WellSET® analysis, which models particle size distribution and determines the optimal mix for specific formations.

The pill was spotted on bottom, and the drillstring was pulled up to 1,400 feet (427 meters). After four hours, the rig pumped 150 bbl of mud and regained circulation. At 3,401 feet (1,037 meters), losses occurred at a rate of 100+ bph. A pill containing 47 lb/bbl of DUO-SQUEEZE® H™ LCM and 64 lb/bbl of HYDRO-PLUG LCM was placed on bottom and drill string was pulled up eight stands. After a one-hour wait, the operator resumed drilling to 3,555 feet (1,084 meters), where 100 bbl per hour losses were encountered. Another pill was set containing multiple types of LCM, including DUO-SQUEEZE H, STEELSEAL 400™, and HYDRO-PLUG materials.

After this pill was spotted on bottom, the operator was able to resume drilling. The continued application of a series of combined pills including squeeze type materials and bridging agents allowed the operator to reach total depth at 4,395 feet (1,340 meters).
without resorting to cement plugs.

**LCM TREATMENT ELIMINATES NEED FOR CEMENT PLUGS, SAVING USD 1.5 MILLION**

Eliminating the need to set multiple cement plugs saved the operator time and expense, and also reduced nonproductive time (NPT). Comparing the cost of the LCM treatments to the cementing operations required on the previous well, the operator was able to save approximately USD 1.5 million.