



CleanDrill™ Reservoir Drill-in Fluid System, with engineered LCM package, successfully applied across a fractured carbonate reservoir section, onshore Albania

An engineered solution was employed to establish a means of mitigating losses occurring at the well site and inhibit H₂S contamination, all while reducing or minimizing formation damage.

CHALLENGE	SOLUTION	RESULT
<ul style="list-style-type: none"> • Prevent thermal degradation of polymers • Inhibit H₂S contamination • Customize a plan to minimize losses 	<ul style="list-style-type: none"> • A low-solids CleanDrill™ RDF weighted up with Calcium Carbonate to 13.8 ppg (1.65 sg) 	<ul style="list-style-type: none"> • Safely and successfully drilled a deep reservoir section, characterized by a fractured carbonate formation and overpressure, from 16,165' to 18,517' (4,927 m to 5,644 m) • Minimized losses significantly

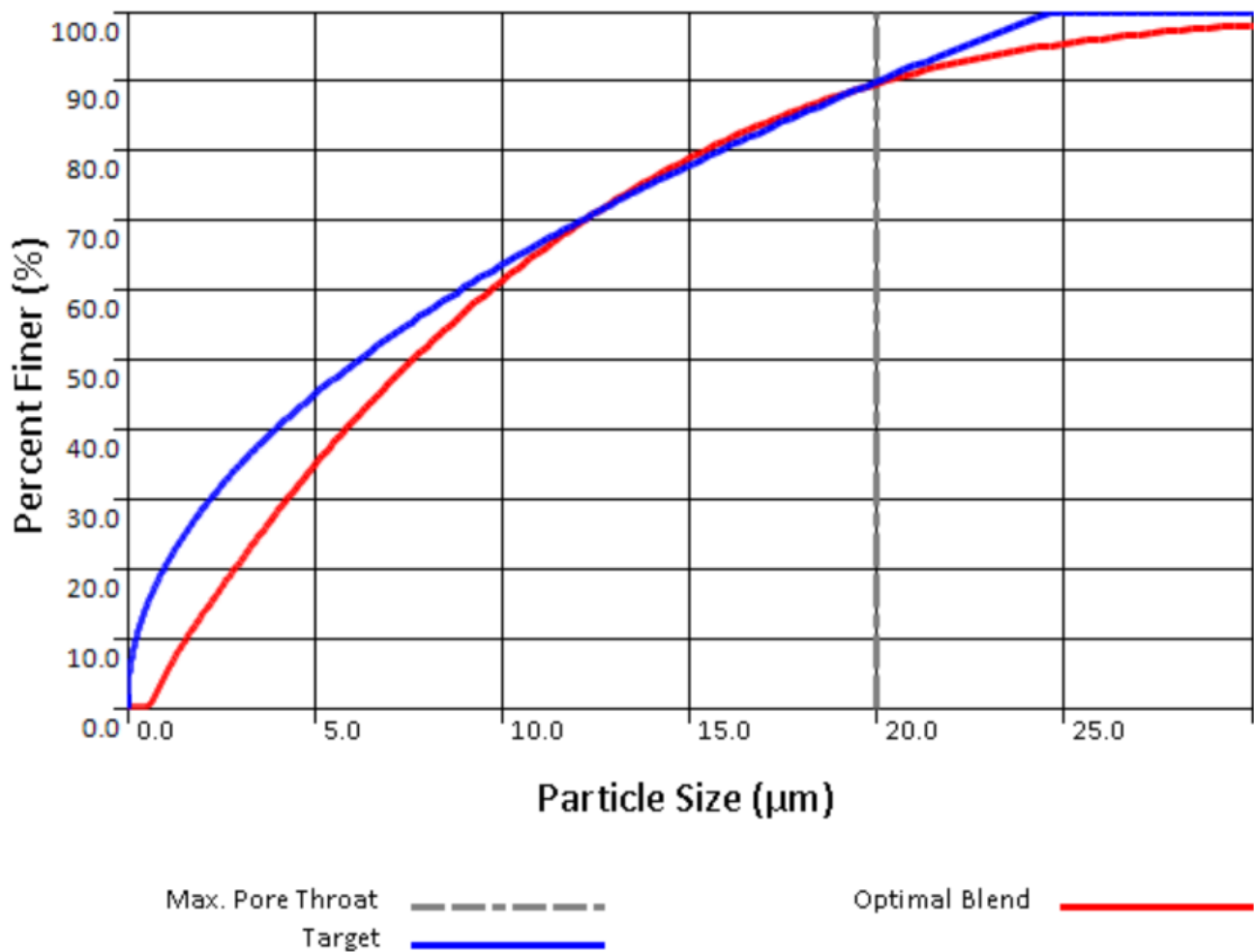
OVERVIEW

An operator required the use of a 13.8 ppg CleanDrill™ Reservoir Drill-In Fluid (RDF) system to drill across a fractured carbonate reservoir section of a deep and complex Albanian well characterized by high BHST. In addition, there was also the presence of H₂S, and the potential for serious losses.

CHALLENGE

After evaluating the expected reservoir drilling challenges, the project engineers established the benchmarks listed below for the design of an applicable technical and cost-effective fluid solution:

- Minimize formation damage
- Formulate a fluid with low solids content at 13.8 ppg (1.65 sg)
- Provide H₂S inhibition
- Formulate an engineered LCM strategy and solution to mitigate losses
- Design a dedicated bridging package, using Newpark proprietary software ClearBridge™, for a specific Particle Size Distribution to cure microfractures, with results validated in the laboratory

Max Pore Throat [D90] (μm)**SOLUTION**

Newpark's extensive lab testing indicated that the best technical option for drilling the fractured carbonate reservoir formation was the CleanDrill RDF system. The testing data confirmed the selection of the following components and chemicals in the CleanDrill formulation:

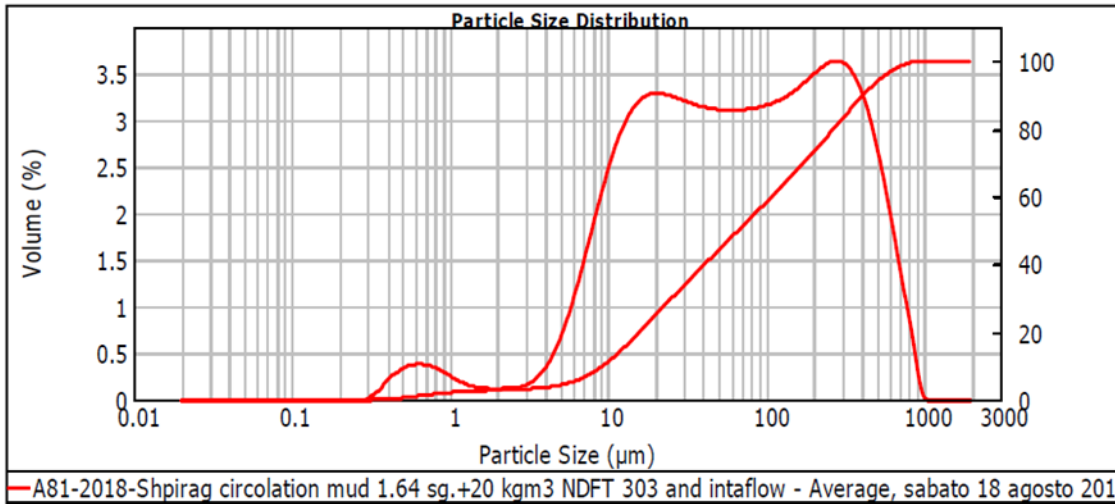
- Potassium formate was chosen as the monovalent brine phase to limit solid content and for its ability to stabilize polymers under high temperature conditions.
- Utilize NewZan D and a modified starch for rheology control and filtrate loss.
- Use a zinc-free liquid additive H_2S Scavenger.
- A dedicated LCM plan was validated.
- Use a selected package of sized carbonate bridging agents (see graph below).



d(0.1): 9.156 um

d(0.5): 66.427 um

d(0.9): 412.547 um



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.00	0.105	0.00	1.096	0.17	11.482	2.63	120.226	2.92	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.13	13.183	2.81	138.038	2.98	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.11	15.136	2.91	158.489	3.05	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	0.11	17.378	2.96	181.970	3.13	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	0.11	19.953	2.96	208.930	3.21	2187.762	0.00
0.020	0.00	0.209	0.00	2.188	0.11	22.909	2.94	239.883	3.26	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	0.12	26.303	2.91	275.423	3.27	2884.032	0.00
0.026	0.00	0.275	0.01	2.884	0.15	30.200	2.87	316.228	3.20	3311.311	0.00
0.030	0.00	0.316	0.07	3.311	0.22	34.674	2.84	363.078	3.03	3801.894	0.00
0.035	0.00	0.363	0.26	3.802	0.33	39.811	2.82	416.869	2.76	4365.158	0.00
0.040	0.00	0.417	0.26	4.365	0.51	45.709	2.81	478.630	2.38	5011.872	0.00
0.046	0.00	0.479	0.31	5.012	0.74	52.481	2.80	549.541	1.93	5754.399	0.00
0.052	0.00	0.550	0.34	5.754	1.04	60.256	2.80	630.957	1.42	6606.934	0.00
0.060	0.00	0.631	0.34	6.607	1.38	69.183	2.81	724.436	0.91	7585.776	0.00
0.069	0.00	0.724	0.32	7.586	1.74	79.433	2.82	831.764	0.37	8708.636	0.00
0.079	0.00	0.832	0.27	8.710	2.08	91.201	2.84	954.993	0.01	10000.000	0.00
0.091	0.00	0.955	0.22	10.000	2.39	104.713	2.87	1096.478	0.00		
0.105	0.00	1.096	0.22	11.482	2.39	120.226	2.87	1258.925	0.00		

RESULTS

The 8 ½” reservoir section was successfully drilled from 16,165’ (4,927 m) to TD at 18,517’ (5,644 m) using a the selected CleanDrill RDF fluid at 13.8 ppg with an average ROP of 16.1 ft/hr (4.9 m/hr).

During drilling, H₂S contamination was properly treated out with additions of a zinc-free liquid H₂S scavenger.

The expected formation losses, with the highest loss rate of 160 bbl/hr at 18,405’ (5,610 m), were properly controlled by spotting several non-damaging LCM pills and following an LCM sweeping program to TD.