SHURE-Shear RTAI - A Case Study

The Challenge

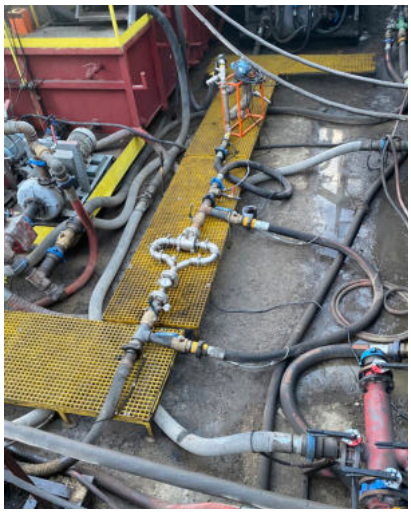
A major multi-national exploration and production company requested Black Diamond to provide an improvement to the drilling circulation system. A large proportion of the solids in the mud were too fine for traditional centrifuges to remove. The resultant solids control issues had a damaging impact on surface connections and downhole tools. Furthermore, by addressing the low gravity solids the rig would be able to reduce the need for mud “dump and dilution”, making considerable savings and limiting environmental impact.

The Solution

Black Diamond deployed the SHURE-Shear RTAI system to the rig in Greely, Colorado, U.S.A., which was drilling production wells in the Niabara Shale Formation. The device was installed seamlessly in the circulation system and was meticulously validated through a centrifuge application, assessing its performance across varying feed rates. The test program employed a comprehensive analysis of suction, effluent, and discard samples at each stage. A total of 56 samples were subjected to Solids Analysis, Particle Size Distribution, and X-Ray Diffraction. A Coriolis meter was also installed to capture realtime flow rate and density data.

The Results

The centrifuge performance data proved that SHURE increases the solids removal efficiency, reduces the volume of base oil discarded and reduces the percentage of oil on cuttings.



Results conclusively demonstrate that with each incremental increase in feed rate, there is a proportional enhancement in drilled solids removal, base oil, and barite recovery, and also that SHURE adds value even at lower flow rates. Optimal results were achieved at the higher 60 gpm feed rate. It is also clear that electro-static forces generated within the cavitation chamber aid in removing ultra-fine particles.

Passage through SHURE decreases viscosity and increases Emulsion Stability, reducing Emulsifier and Wetting Agents requirements. Installation downstream of the hopper enhances blending and homogeneity in mixing systems and aids the reduction in emulsifier concentration. Installing SHURE along all gun lines and reserve tanks helps energize the fluid before being introduced to the wellbore environment.

X-Ray Fluorescence (XRF) data showed an incremental increase in Quartz content in the centrifuge discard. This is highly advantageous due to Quartz’s high angularity, relative hardness and abrasiveness. Improved Quartz removal reduces downhole tool failures and mud pump consumable usage.

Value Added by SHURE

1. **Increased Solids Removal Efficiency:**
   - Reduced waste volumes
   - Reduced dilution volume requirements
   - Improved rheological profile
   - Reduced ECD & SPP
   - Improved hydraulics for hole cleaning
2. **Cleaner Mud System:**
   - Fewer downhole tool failures
   - Less wear & erosion
   - Fewer mud pump consumables
3. **Reduced Oil Wastage:**
   - Reduced percentage oil on cuttings
   - Reduced volume of base oil discarded
4. **Lower Standpipe Pressure:**
   - Lower energy consumption
   - Less diesel consumption in the generators
5. **Fewer Trucks Hauling Waste:**
   - Reduced greenhouse gas emissions
   - Good environmental stewardship

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Centrifuge Performance[1]					
Centrifuge Discharge per 24 hour			Solids Analysis of Discard		
	No SHURE	SHURE		No SHURE	SHURE
Discard Rate (gpm)	4.0	4.0	Discard Density (ppg)	18.80	19.80
Feed Density (ppg)	10.80	10.80	Volume Oil (%)	35.9	30.8
Effluent Density (ppg)	9.40	9.40	Volume Solids (%)	53.9	60.4
Discard Density (ppg)	18.80	19.80	Volume Water (%)	10.2	8.8
Hours Run	24	24	ASG of Corr. Solids (SG)	3.47	3.39
Oil Volume (%)	35.9	30.8	High Gravity Solids (%)	27.1	27.3
Solids Volume (%)	53.9	60.4	Low Gravity Solids (%)	25.5	32.1
Water Volume (%)	10.2	8.8	High Gravity Solids (ppb)	403.6	405.9
Oil Discard (bbl)	49.2	42.2	Low Gravity Solids (ppb)	236.9	297.3
Whole Mud Discard (bbl)	87.9	94.9	Oil on Cuttings Discard (%)	14.97	11.75
Drilled Solids Discard (bbl)	35.0	44.0	Separation Efficiency[2] (%)	42.5	45.5
Barite Discard (ton)	26.3	26.5			

[1] Average of all runs
[2] Separation Efficiency = (Discard-Feed) / Discard

Retort Analysis							
40 gpm Stage		Density (ppg)	% Oil	% Water	% HGS[3]	% LGS[4]	Comments
Suction	No SHURE	10.91	61.73	16.80	6.36	13.87	Suction samples show little variance, as expected.
	With SHURE	10.82	62.70	16.10	6.04	13.93	
Effluent	No SHURE	9.52	67.80	16.83	2.42	11.72	Effluent indicates there is an increase in drilled solids after passing through SHURE.
	With SHURE	9.46	67.37	16.13	1.37	**12.97**	
Discard	No SHURE	19.12	34.23	11.00	34.09	19.37	Discard indicates there was more drilled solids & less barite after passing through SHURE.
	With SHURE	18.54	35.27	10.57	**30.20**	**21.63**	
60 gpm Stage		**Density (ppg)**	**% Oil**	**% Water**	**% HGS**	**% LGS**	**Comments**
Suction	No SHURE	10.89	62.43	16.10	6.35	13.88	Suction samples show little variance, as expected.
	With SHURE	10.87	62.13	16.00	5.71	14.92	
Effluent	No SHURE	9.54	67.60	16.93	2.40	11.84	At 60 gpm, Effluent indicates a higher concentration of both drilled solids & barite.
	With SHURE	9.66	66.93	16.77	**2.45**	**13.81**	
Discard	No SHURE	18.36	37.03	10.23	31.36	20.93	Discard indicates there was more drilled solids & less barite after passing through SHURE.
	With SHURE	18.65	35.50	10.57	**30.39**	**23.79**	

[3] High Gravity Solids
[4] Low Gravity Solids

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