Centrifuge Optimization

Unlocking Efficiency & Cost Savings

"The Future of Drilling Fluids Management:
Real-Time Sensors, Digital Driven Optimization"

AADE Conference

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Function of the Centrifuge

Why it Matters

Operator Problem → Centrifuge Solutions:

- “High rheology spikes, torque & drag” → LGS removal stabilizes mud.
- “Escalating barite costs” → HGS recovery returns barite.
- “Dilution costs rising” → Base oil recovery reduces dilution demand.
- “Excess disposal volumes” → Waste minimization cuts trucking & disposal.
- “Tool wear from quartz” → Quartz removal reduces NPT.
- “High Diesel Consumption in Generators” → Solids removal reduces energy needs

Current Industry Focus

Digital Solutions

- Industry Focus: reduce head count using tools already available from the centrifuge (torque, amps, g-force, bowl speed, back drive differential)
  - Create If/then feedback loops that targets pack-off prevention.
  - If torque exceeds set limits, pump rpm automatically reduces.
  - While this type of automatic feedback loop helps address one side of the equation, it misses the bigger opportunity
- Real value: quantifying centrifuge performance across full mud system, quantify exactly how many tons of drilled solids was removed. How many bbls of base oil was recovered, how many tons of barite was returned to the system.
- The industry is “playing small” while the real prize is quantifiable KPIs

“Preventing pack-offs ≠ Optimizing performance.”

Conventional Methods vs Digital Solutions

Centrifuge Optimization

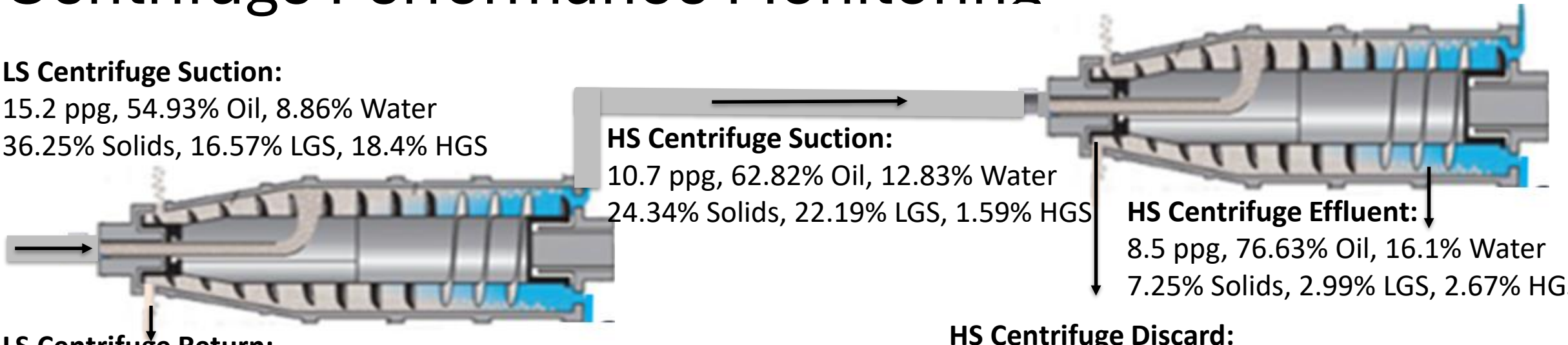
- Retort Analysis:
  - Establish a baseline run – multiple retorts from suction, effluent, discard
  - Every change in centrifuge parameters requires additional retorts
  - The time it takes to establish optimum settings is huge

- Real Time / Near Real Time Analysis:
  - Flow Rate & Density at the suction and effluent in real time
  - % Oil, Water, HGS & LGS in near real time
  - Instantaneous cause & effect analysis
  - Augment the real time data with a 60 second retort – XRF Technology

"Digital Retort in the palm of your hand"

Centrifuge Performance Monitoring

LS Centrifuge Suction:
15.2 ppg, 54.93% Oil, 8.86% Water
36.25% Solids, 16.57% LGS, 18.4% HGS



HS Centrifuge Suction:
10.7 ppg, 62.82% Oil, 12.83% Water
24.34% Solids, 22.19% LGS, 1.59% HGS

HS Centrifuge Effluent:
8.5 ppg, 76.63% Oil, 16.1% Water
7.25% Solids, 2.99% LGS, 2.67% HGS

LS Centrifuge Return:
19.2 ppg, 49.9% Oil, 9.2% Water
41.29% Solids, 4.7% LGS, 33.9% HGS

HS Centrifuge Discard:
19.4 ppg, 35.74% Oil, 5.9% Water
56.9% Solids, 24.7% LGS, 36.8% HGS

Barite Recovery Low Speed	Drilled Solids Removal High Speed	Base Oil Recovery
Feed: 36.3% solids → 16.6% LGS / 18.4% HGS LS discard (returned): 41.3% solids → 4.7% LGS / 33.9% HGS Interpretation: Good barite recovery	Suction: 24.3% solids → 22.2% LGS / 1.6% HGS Effluent (returned): 7.3% solids → 3.0% LGS / 2.7% HGS Discard (waste): 56.9% solids → 24.7% LGS / 36.8% HGS Interpretation: HS cuts ~70% total solids, ~87% LGS	HS suction → effluent oil: 62.8% → 76.6% (+13.8 pts), density drops 10.7 → 8.5 ppg. Interpretation: Oil-rich effluent returns to active, solids-rich discard to waste → less dilution required.

XRF Example Report

Anyone can run the XRF technology.

- Collect the sample from the centrifuge suction
- Pour 20 ml into sample cup
- Place sample on sensor face
- Press analyze on the XRF desktop application
- Wait 60 seconds and the report will generate

Anyone on the rig can run a quick mud check anytime, no mess, no mud engineering skills required.

Database access for internal analytics







Company: Typical Mud Company
Well Name: Optimizaed Well 101
Operator: Big Oil Operator
Sample Source: Active

SHOT # 1

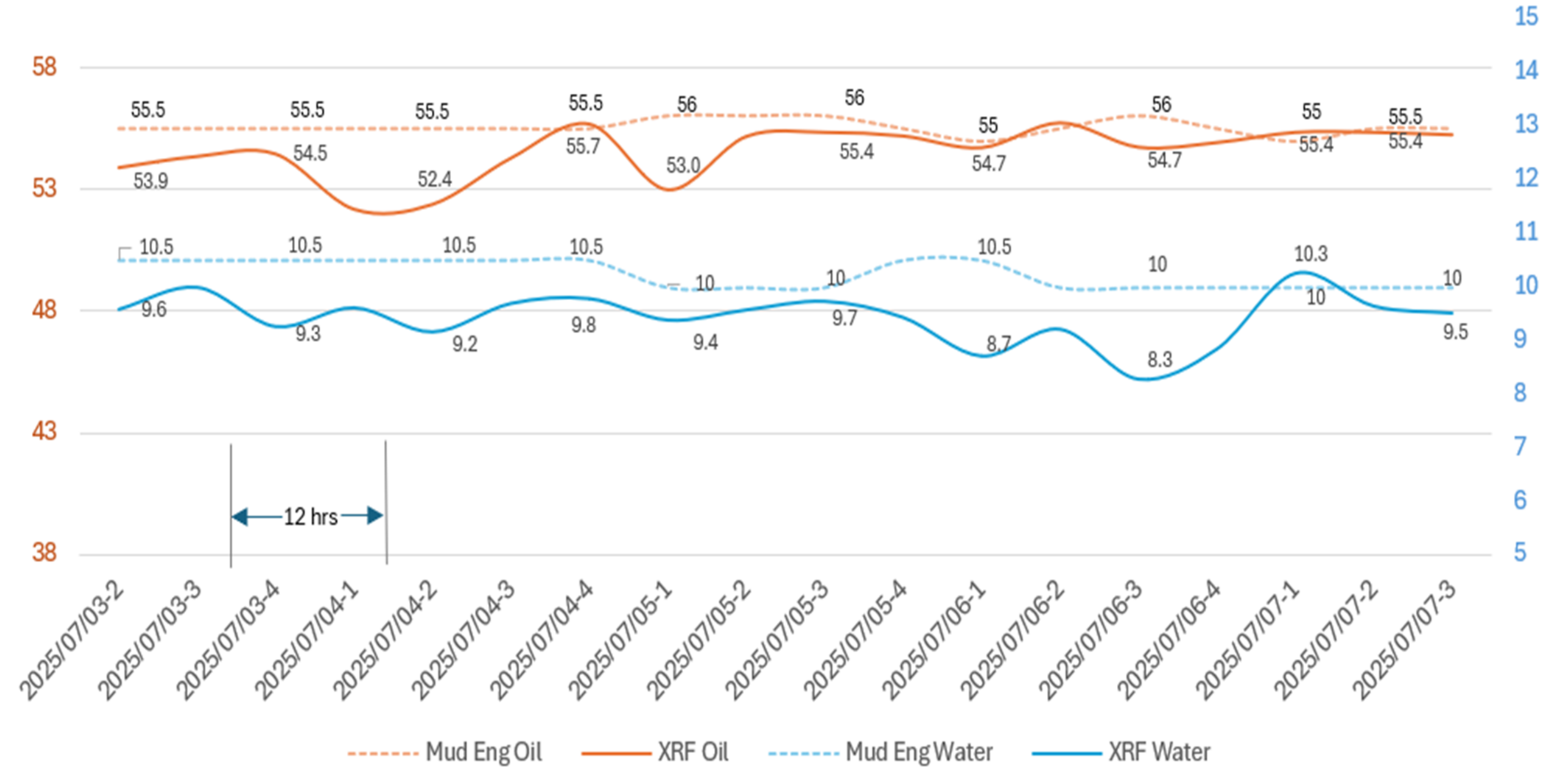
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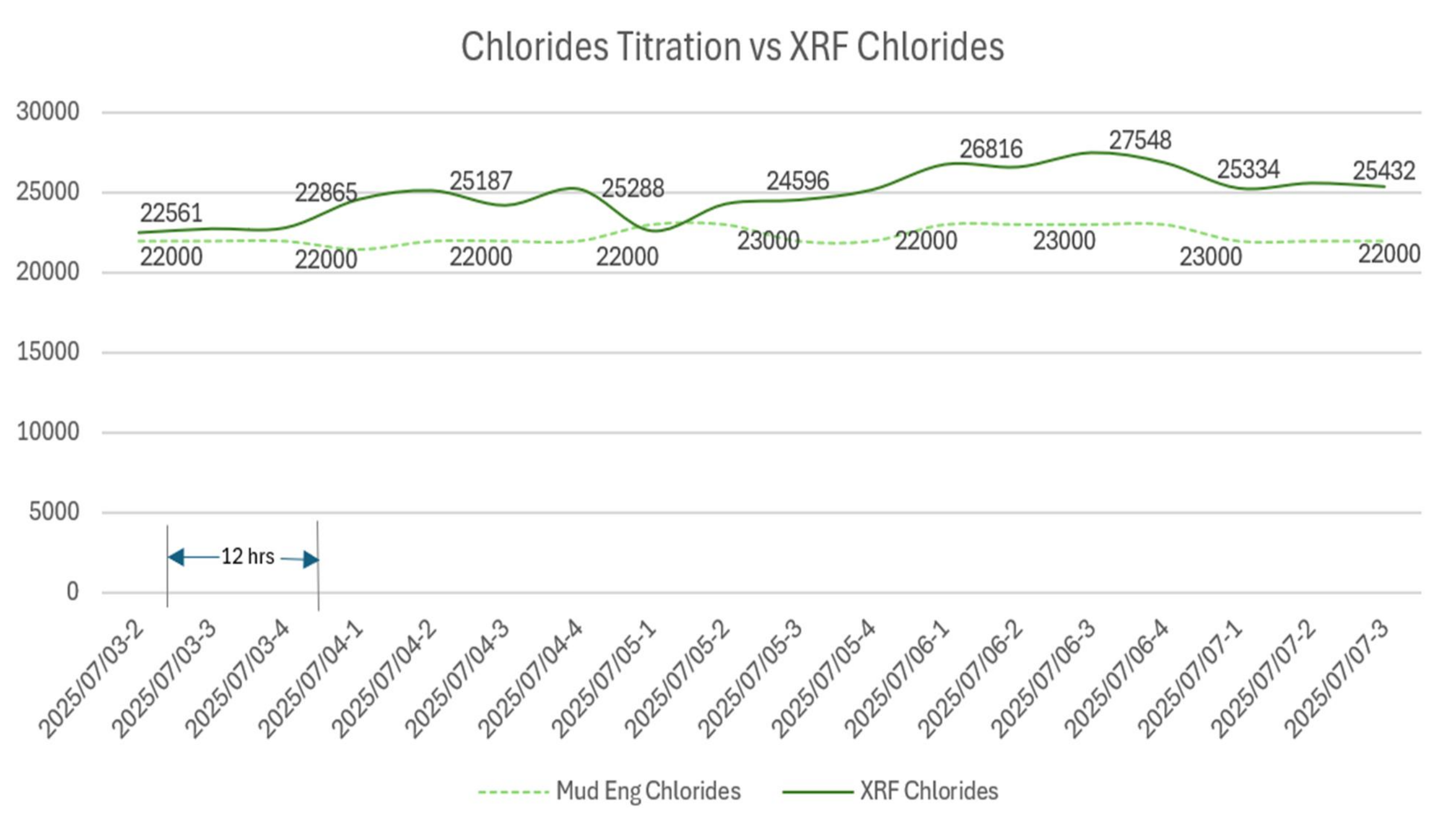
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XRF/XRD Analysis (% by mass)		
Mud Weight (lb/gal)	15.70	lb/gal
Liquid Phase %	28.63	mass%
Solids Phase %	71.38	mass%
Silicate %	3.39	mass%
Calcium %	1.61	mass%
Chloride %	1.38	mass%
Barium %	60.36	mass%
Iron %	0.52	mass%
Aluminum %	1.17	mass%
Chromium %	0.06	mass%
Strontium %	0.13	mass%
Magnetic Particles %	1.88	mass%
Quartz Content %	18.64	mass%
Base Oil %	22.11	mass%
Water %	5.74	mass%
Barite HGS %	54.58	mass%
Drilled Solids LGS %	16.88	mass%
CaCl2 %	10.77	mass%
Brine Density - SG	1.09	SG
SG of Solids / LGS	3.83 /	2.36

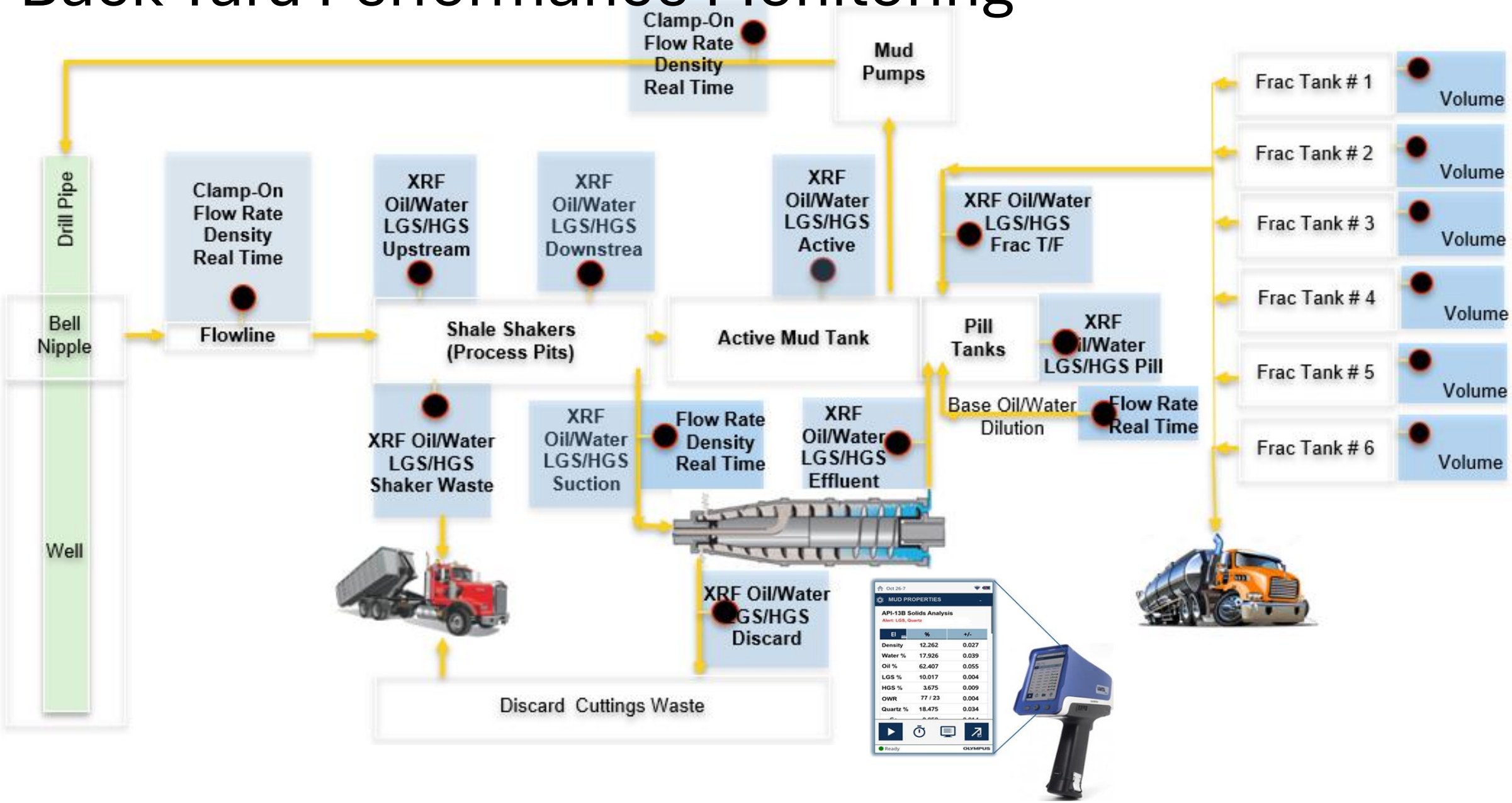
Oil & Water Content (% by volume)		
Oil Content (Vol %)	53.89	Vol%
Water Content(Vol %)	10.77	Vol%
Oil/Water Ratio		
Oil Ratio	83.34	
Water Ratio	16.66	
Solids Analysis (% / Volume)		
Low Gravity Solids (Vol %)	12.18	Vol%
Low Gravity Solids (lb/bbl)	110.95	lb/bbl
High Gravity Solids (Vol %)	22.86	Vol%
High Gravity Solids (lb/bb)	208.11	lb/bbl
Corrected Solids (Vol %)	35.04	Vol%
Dissolved Solids (Vol %)	0.32	Vol%
Total Retort Solids (Vol %)	35.34	Vol%
SG of Whole Mud	1.88	SG
Salinity		
Chlorides, Whole Mud (mg/l)	28046	mg/l
Water Phase Salinity (ppm)	107700	ppm
$CaCl_2$ (mg/l)	44032	mg/l
$CaCl_2$ (lb/bbl)	15.46	lb/bbl
Brine Content (vol%)	11.09	Vol%

Retort vs XRF % Oil & % Water




Chlorides Titration vs XRF Chlorides
30000
25000
20000
15000
10000
5000
0
22561
22865
25187
25288
24596
26816
27548
25334
25432
22000
22000
22000
22000
23000
22000
23000
23000
22000
12 hrs
2025/07/03-2
2025/07/03-3
2025/07/03-4
2025/07/04-1
2025/07/04-2
2025/07/04-3
2025/07/04-4
2025/07/05-1
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2025/07/06-3
2025/07/06-4
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2025/07/07-3
Mud Eng Chlorides
XRF Chlorides

Back Yard Performance Monitoring



Data-Driven Centrifuge KPIs

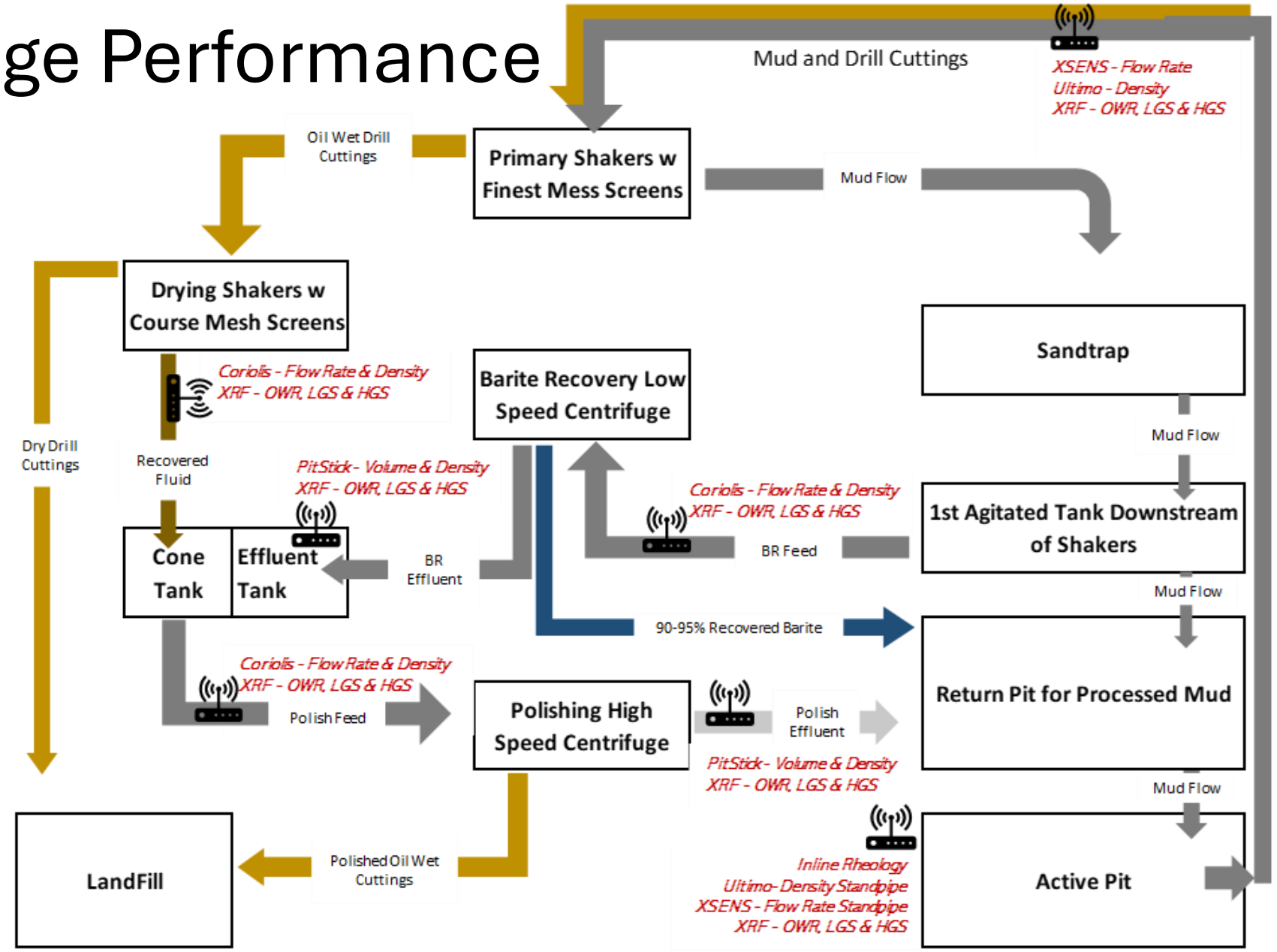
Typical metrics from field reports:

- Density reduction: what maximum cut point can be achieved
- Solids removal efficiency: What are the technical limits
- % Barite recovered vs discarded: Totalized in tons with costs
- % LGS recovered vs removed: Totalized in bbls and tons
- % Oil recovered vs removed: Totalized in bbls with costs

Solids Removal System Performance Hierarchy

- Optimize the primary shaker cut point with the finest mess screens for maximum solids removal first pass
- Dress the drying shakers with a course mesh screen to handle the wet discard from the primaries, recover more oil
- Process the drying shaker effluent through the high speed
- Run barite recovery on the low speed centrifuge
- Feed the high speed the low speed effluent for maximum solids removal, maximum oil recovery

Centrifuge Performance



ls Control Company:

Well Name/Sample:

Operator:

Drilling Contractor:

X-Ray Floresence / Particle Size Distribution

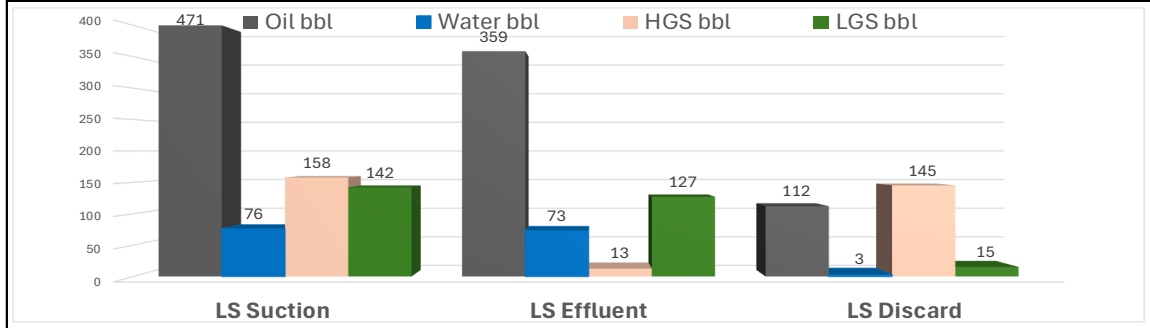
CENTRIFUGE PERFORMANCE REPORT

www.NPTLabs.ai
24hr@NPTLabs.ai
24h Call 844-683-5231

OPERATION: BARITE RECOVERY / POLISHING MODE

Active Mud - Low Speed Centrifuge Suction

Low Speed Centrifuge Effluent - Overflow



Low Speed Centrifuge Performance KPI's

Density Cut ppg	4.5	40 hr	Run Time Utilization
LS Feed Rate gpm	15.0	10 gpm	LS Effluent Flow Rate
% Oil Returned v/v	23.8	112 bbl	Base Oil Return Volume
% Barite Returned v/v	92.0	145 bbl	Barite Return Volume
% Drilled Solids Return	10.7	15 bbl	Drill Solids Return Vol
Solids Removal Efficiency	35.2	114 ton	Barite Return Tonage
Return Flow Rate gpm	5.0	275 bbl	Total Returned Volume
G-Force	800	1000	Torque

Fluid Analysis Suction Feed

Mud Density	15.2	ppg
% Base Oil	54.93	%
% Water	8.86	%
% HGS	18.40	%
% LGS	16.57	%

Fluid Analysis Effluent

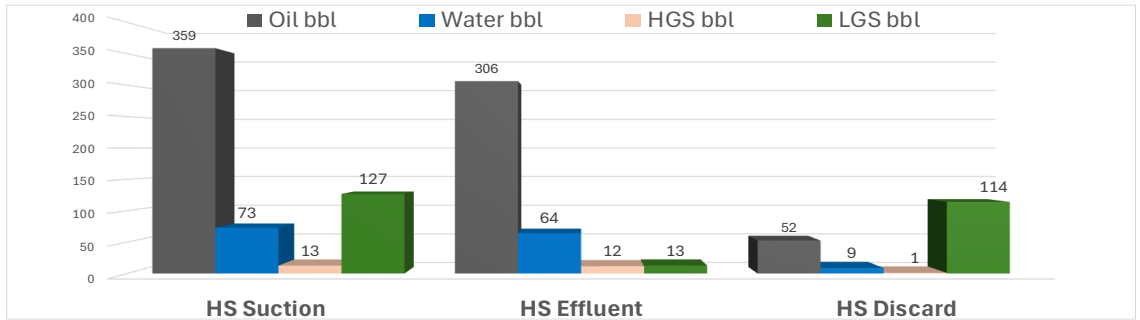
Mud Density	10.7	ppg
% Base Oil	62.80	%
% Water	12.79	%
% HGS	2.20	%
% LGS	22.19	%

Fluid Analysis Return Fluid

Mud Density	23.7	ppg
% Base Oil	40.7	%
% Water	1.04	%
% HGS	52.74	%
% LGS	5.53	%

High Speed Polishing Centrifuge Suction

High Speed Polishing Centrifuge Effluent



High Speed Polishing Centrifuge Performance KPI's

Density Cut ppg	2.2	40 hr	Run Time Utilization
HS Feed Rate gpm	10	7 gpm	HS Effluent Flow Rate
% Oil Removed v/v	14.6	52 bbl	Base Oil Discard Volume
% Barite Removed v/v	7.7	1 bbl	HGS (Barite) Discard Vol
% Drilled Solids Remove	89.9	114 bbl	LGS (Drill Solids) Discard
Solids Removal Efficiency	77.6	1 ton	Barite Discard Tonage
Discard Flow Rate gpm	3.0	177 bbl	Total Discard Volume
G-Force	3200	2000	Torque

Fluid Analysis Suction

Mud Density	10.7	ppg
% Base Oil	62.8	%
% Water	12.8	%
% HGS	2.2	%
% LGS	22.2	%

Fluid Analysis Effluent

Mud Density	8.5	ppg
% Base Oil	77.5	%
% Water	16.3	%
% HGS	2.9	%
% LGS	3.2	%

Fluid Analysis Discard Fluid

Mud Density	16.2	ppg
% Base Oil	42.4	%
% Water	7.0	%
% HGS	0.8	%
% LGS	64.7	%

The Vision

- Move from centrifuge uptime → centrifuge performance optimization
- Deliver a true mass balance across solids control system
- Tie KPIs directly to cost savings & ESG footprint
- Enable remote monitoring & RTOC decision making
- Apply process control algorithms that adjust centrifuge parameters as the mud properties change.

Conclusion

- Centrifuge = cost control lever
- Optimization yields:
  - Lower mud costs
  - Extended tool life
  - Reduced NPT
  - Smaller environmental footprint
- Centrifuge optimization = drilling optimization

Barite Quality Report

This ***Example*** report presents a compositional analysis of a barite sample using XRF technology to determine compliance with the **API Specification 13A** for drilling-grade barite.

Using handheld XRF, this analysis precisely quantifies the elemental composition, enabling:

- Verification of barite purity
- Detection of contaminants (e.g., quartz, iron)
- Assurance of specific gravity based on actual mineral content

This digital report supports QA/QC procedures for incoming barite loads, helping operators avoid performance issues linked to sub-spec material, including inaccurate mud weight, increased equipment wear, and elevated solids loading.

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PYCNOMETER SPECIFIC GRAVITY REPORT

OPERATOR	:	**Operator**	**DATE** :	**20-Jun-25**
SAMPLE FROM	:	**Barite Silo**		
WELL NAME	:	**Well # 1**	**RIG** :	**Contractor**

Solids Type	:	**Barite**	
Mass of Empty Glassware (grams)	:	41.13	
Mass of Solids Added + Glassware (grams)	:	62.82	
Mass of Glassware + Solids + Water (grams)	:	82.37	
Mass Glassware + Water (grams)	:	66.14	
Mass of Solids (grams)	:	21.69	
Mass of Water + Solids (grams)	:	19.55	
Mass of Water (grams)	:	25.01	
Volume Displaced by Solids (ml)	:	5.47	
Barite % by weight	:	88.6%	Fail < 90%
Barite Specific Gravity	:	**3.967**	**Fail < 4.1**
Barite Density ppg	:	33.19	
Barite Pure ppg	:	37.48	4.48 SG
Low Gravity Solids Present ppg	:	4.3	
Non-Barite Low Gravity Solids %	:	12.92%	
XRF Data Stochimetry			
Barium %	:	68.74	4.48 SG
Silicates %	:	2.71	2.65 SG
Light Elements %	:	20.84	2.55 SG
Calcium %	:	0.34	2.75 SG
Trace Elements %	:	2.33	3.55 SG
Specific Gravity$_{mix}$	:	3.95	
% Error	:	0.45	Acceptable
% Quartz Content	:	**5.79**	**Fail > 3%**
Quartz ppg	:	1.92	
Soluble Alkaline Earth Metals (Ca, Mg & Sr) %	:	0.66	Fail < .025 wt%
Heavy Metal Mercury %	:	<LOD	Pass
Heavy Metal Cadmium %	:	<LOD	Pass
Radioactive Elements Uranium %	:	<LOD	Pass
Radioactive Elements Thorium %	:	<LOD	Pass

Thank You

Questions, Comments, Cheap Shots?





