

Successful deployment of first NANOSHIELD application in Qatar

CHALLENGES

- Water based mud system
- Significant risk of wellbore instability and fracture propagation
- Conventional pressure shielding products use high concentration materials
- High dilution rates due to mud weight control require large mud volumes
- Limitation on the usage of solids control equipment
- High torque and drag
- Mud and/or filtrate invasion
- Minimize formation damage in multizone intelligent (LEL) completion

KEY PERFORMANCE INDICATORS

PROPERTIES	TARGET RANGE	UNITS	FC-02	FC-06
Product concentration	<3.0	ppb	2.0-2.2	2.0-2.2
Density	8.9-9.2	ppg	8.9-9.2	8.9-9.2
Plastic viscosity	ALAP	cP	9-13	9-19
Yield point	25-30	lbs/100ft ²	25-28	25-28
LSYP	4-6	lbs/100ft ²	4-7	3-7
pH	10.0-10.5	-	10.2-10.4	10.2-10.5
Gels (10s/10m)	-	lbs/100ft ²	7-9/9-12	7-10/9-12
API filtrate	<5.0	cc	2.8-4.6	4.0-4.9
PPA total fluid loss	<12.0	cc	10.4-6.8	10.4-6.4
PPA spurt loss	250-500	in/32"	2.2-0.8	2.8-0.8
Disc size	10	microns	10	10
Cake thickness	1	in/32"	1	1

CONCLUSION

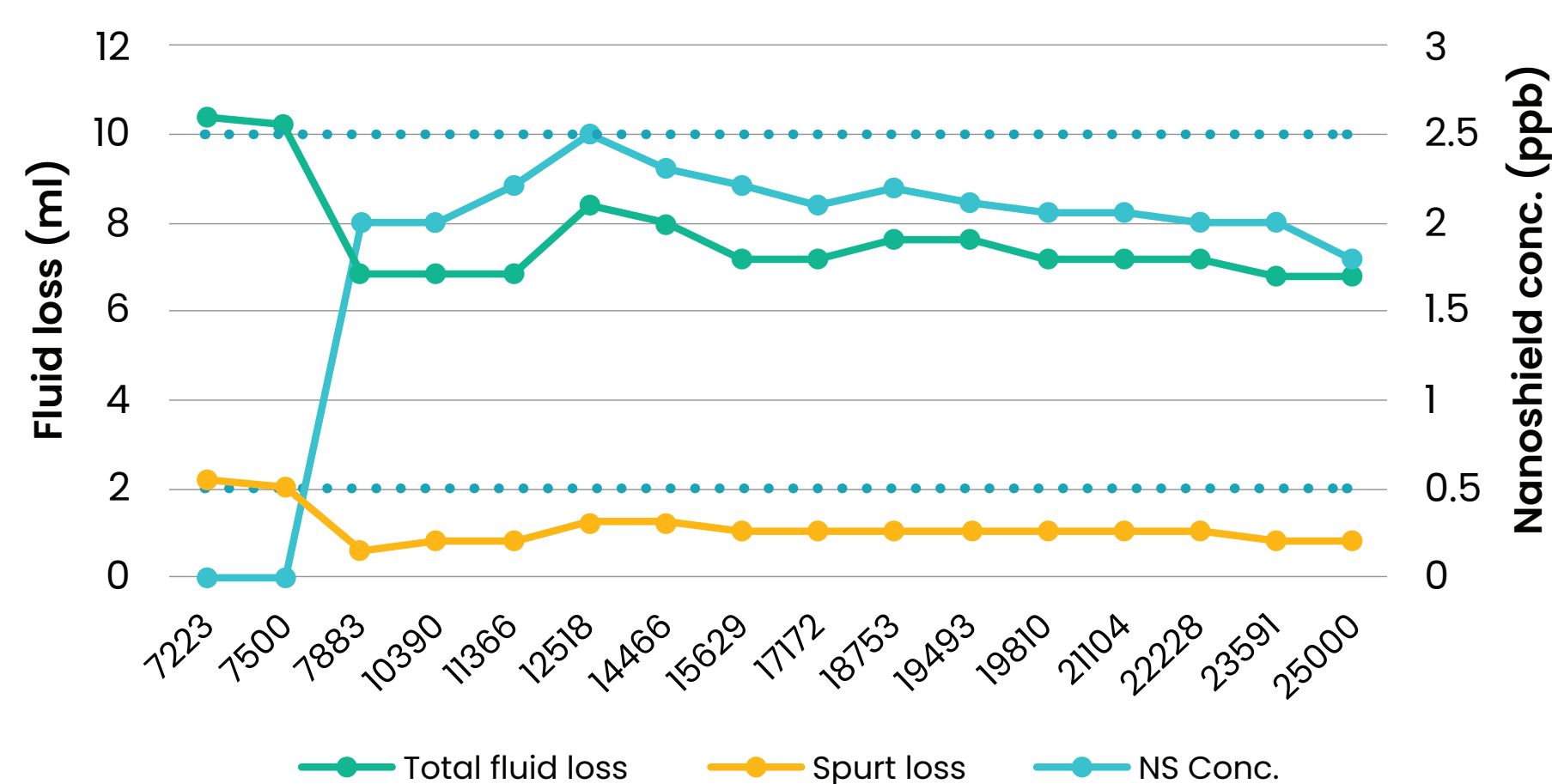
- Adding NANOSHIELD™ wellbore sealing polymer for strengthening and pore pressure transmission to an openhole completion did not cause any formation damage based on the return permeability data as shown by the well production and injection rates, respectively
- Lower coefficient of friction and torque values while drilling
- Zero HSE incidents and fluids related NPT
- Multi-zone completion liners were run successfully in the first run on long laterals of approximately 18,000 ft.
- Record drilling of 7,501 ft. in 24 hours in the 8.5-in. section of FC-06 well, which broke the previous record of 7,335 ft. in this field
- Considerable cost savings were achieved by replacing the existing technology with NANOSHIELD due to less dilution rates
- Saved 3.3 days of rig time vs. plan to reduce approximately 101,734 eq kg CO₂ eq GHG emissions (both wells combined)

WELL DETAILS

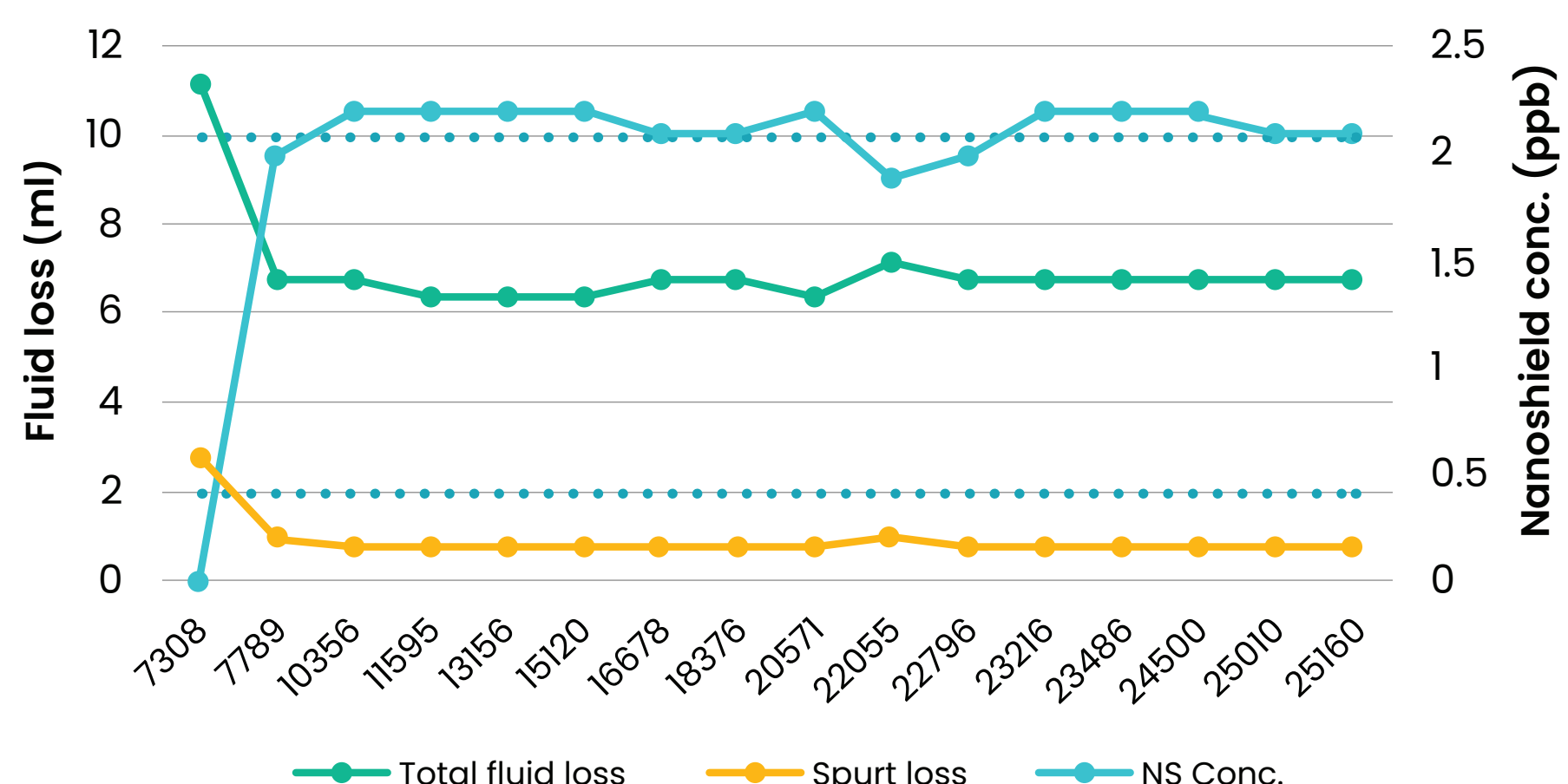
WELL TYPE	OIL PRODUCER	INJECTOR
Drilling fluids system	Low solids non-dispersed	Low solids non-dispersed
Fluid density (ppg)	8.9-9.2	8.9-9.2
Feet drilled (ft)	18,063	17,967
Formation type	Limestone	Limestone
Highest over balance (psi)	580	720
Max inclination (deg)	90.73	91
Hole size/Liner size (in)	8.5 / 7	8.5 / 7
Max BHCT (°F)	161	165
Number of hours	93	89
ROP range achieved (fph)	250-500	250-560

RESULTS

FC-02 PPA fluid loss



FC-06 PPA fluid loss



Dilution factor

