SANDTINEL CASE STUDY: WOLFCAMP SPHERE COMPARISON

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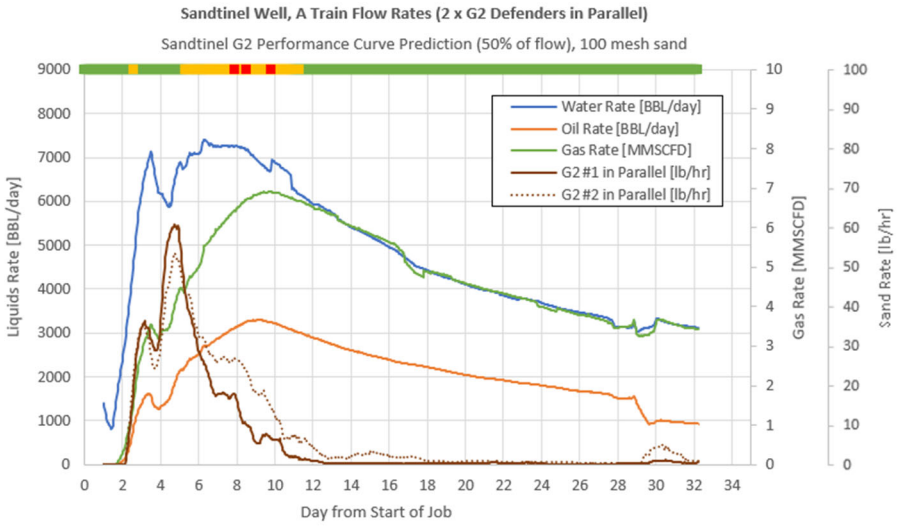
In this case study, two Sandtinel trains were deployed on a well in the Wolfcamp Shale in the Delaware basin in New Mexico. The first train had two G2 Sandtinel units in parallel (A Train). The second train had one G4-S Sandtinel followed by a G2 unit in series (B Train). A second well had competitors' spherical units in a similar setup (two in parallel, two in series). Details below:

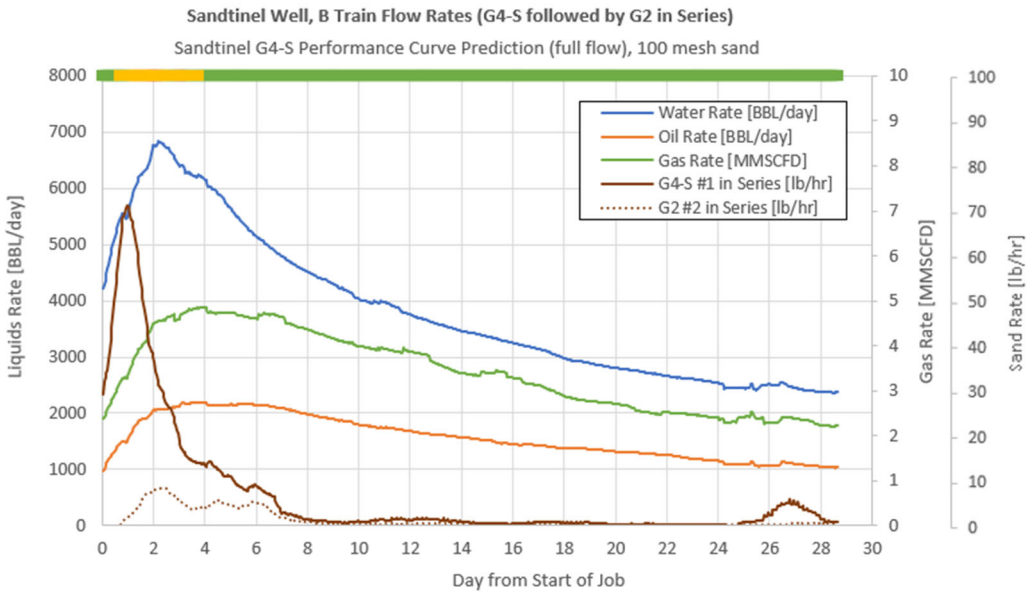
PARAMETER	VALUE
Basin	Delaware
Location	Wolfcamp Shale
Peak gas	7 MMSCFD (198 e3Sm3/d)
Peak liquids	10800 BBL/day (1717 m3/d)
Water cut	~75%
Pressure	800 - 2400 psi (5.5 – 17 MPa)
Sand capture	11600 lb (A), 5900 (B)
Test duration	30 days

DATA TYPE	AVAILABLE
Pre-install	No
Trend chart	Yes (A and B)
Performance curve	Yes (G2 and G4-S)
CFD pre-evaluation	No
CFD replication	Yes (x5)
CFD report	Yes
Sand analysis (laser diffraction)	Yes (A and B)

On this extended test, there were four total trains, on two wells (one Sandtinel and one with competitor spheres). Each well had two trains with two units in parallel and two units in series. The four trains were compared against each other to determine the relative efficiency of the units and the optimal layout. The trends are shown below for the G2 A Train and the G4-S B Train:



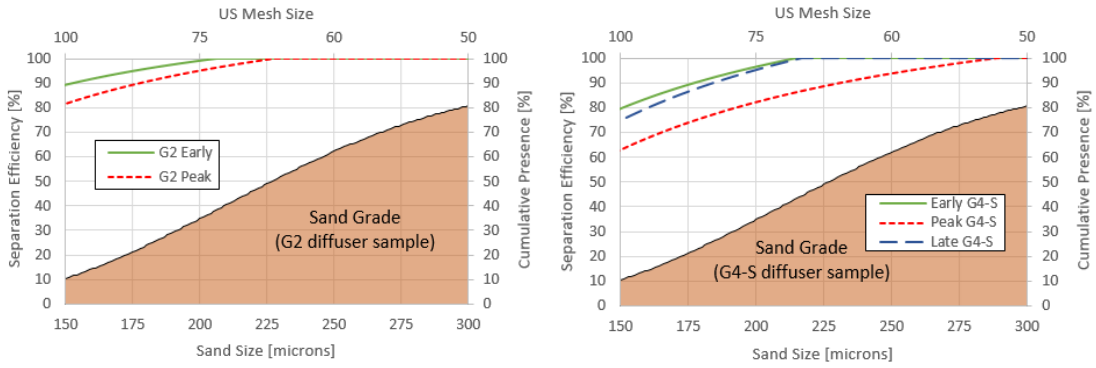
This trend clearly shows approximately even split of flow between the two G2 Defender Sandtinel units, with a high volume of sand captured on each one (11,600 lb total between the two of them). The yellow and red regions along the top show periods of high flow rate where the conditions were outside of Sandtinel's operating envelope. During these periods, lower than 95% efficiency would have been expected.



This trend shows the superior sand separation of the G4-S Maverick which handled nearly twice as much flow as either G2 Defender on the A Train. The G4-S captured almost all of the sand on the B Train, which saw 5,900 lb total. The downstream G2 Defender captured the remainder, and no sand was seen in the downstream 4-phase separator tank.

The majority (90%) of the sand on this scenario was between 40 mesh and 100 mesh in size. Both Sandtinel trains were very effective at capturing sand, with 95%+ removal over the test. The results indicated that parallel layout was superior to remove sand compared to series. The results from the field conformed to Sandtinel's performance predictions (shown along the top axis in the trend figures). The G4-S was able to handle much higher volumes of liquid than the G2 unit.

Five full CFD (Computational Fluid Dynamics) simulations were performed for these conditions to replicate the Sandtinel performance at different point in the flowback. The carryover estimates from the CFD simulations are shown below. A detailed CFD analysis report is available for this case trial upon request. The efficiency of each Sandtinel train against sand size is shown below; efficiency quickly approached 100% for larger sand sizes:

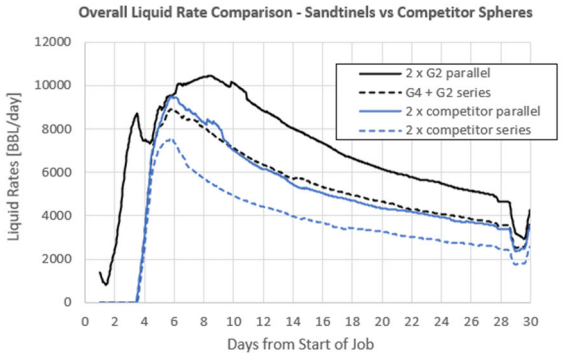


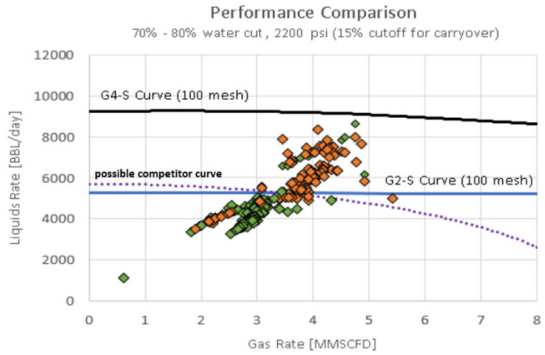
The efficiency as estimated in CFD simulations is shown below for the five selected operating conditions. G2 conditions are from the A Train and G4-S conditions are from the B Train.

PARAMETER	G2 "Early"	G2 "Peak"	G4-S "Early"	G4-S "Peak"	G4-S "Late"
Sand volume retention	99.5%	98.7%	98.8%	95.2%	98.5%

The CFD results from this replication accurately match the carryover seen during the trial.

The second well in this trial had four of a competitor's spheres. The results showcased both the inefficiency of spherical separators without a Vapor Lock system as well as a high pressure drop across competitor's spheres which reduced overall production and oil recover. The difference in overall production was approximately 2000 BBL/day compared to each Sandtinel train. The difference in casing pressure between the two wells was approximately 250 psi. The difference was not due to choking operations; the well using the competitor's spheres was opened up faster.





Overall, the competitor units on this trial captured less sand, less efficiently, while seeing lower overall liquid volumes. This reduction in flow rate may be due to higher back pressure across the competitor (non-Vapor Lock) spheres.

For more information on how Sandtinel can improve your flowback operations, contact our team:

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