

# AvantGuard Advanced Flowback Services Help Lonestar Determine Optimal Coiled Tubing Operating Conditions

Real-time monitoring with Vx Spectra surface multiphase flowmeter enables better preservation of fracture integrity, Eagle Ford Shale

## CHALLENGE

Avoid proppant mobilization from fractures by optimizing plug millout and wellbore cleanup strategies in a horizontal well.

## SOLUTION

Integrate coiled tubing (CT) operations with Vx Spectra\* surface multiphase flowmeter to monitor flow rates at surface in real time to identify hydrocarbons, excessive proppant production, or both.

## RESULTS

Identified stable operating conditions during CT millout that were used with AvantGuard services to recommend an effective cleanout strategy without mobilization of proppant from the fractures.



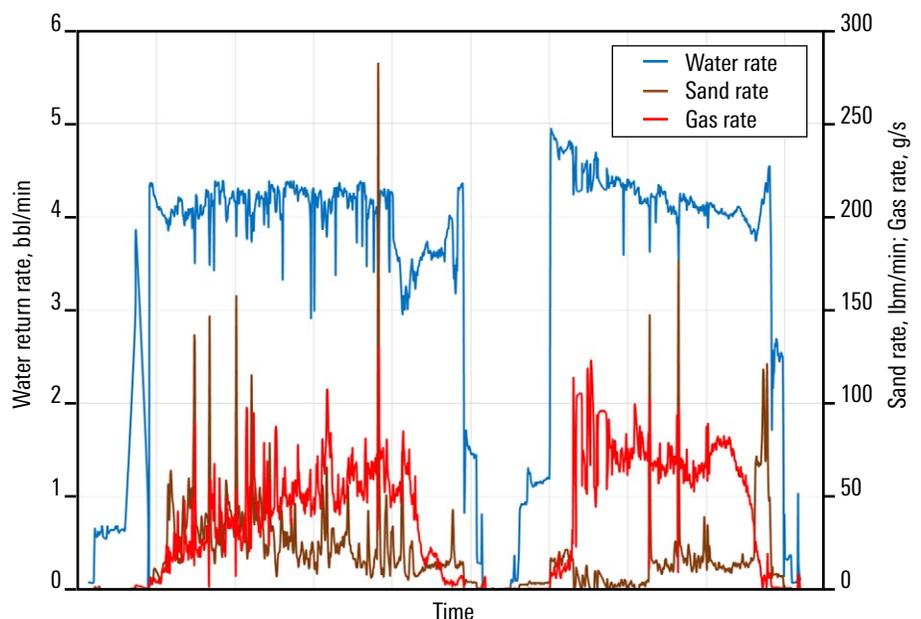
## Overcome CT operational challenges in unconventional reservoir

Coiled tubing operations are a necessary part of the poststimulation process in many wells, both for plug removal and general wellbore cleanup. However, these operations often occur when proppant pack stability is most vulnerable—at low effective stress on the proppant. Suboptimal CT operations at these conditions can generate a large underbalance that can lead to mobilization of proppant from the near-wellbore area and decreased well performance.

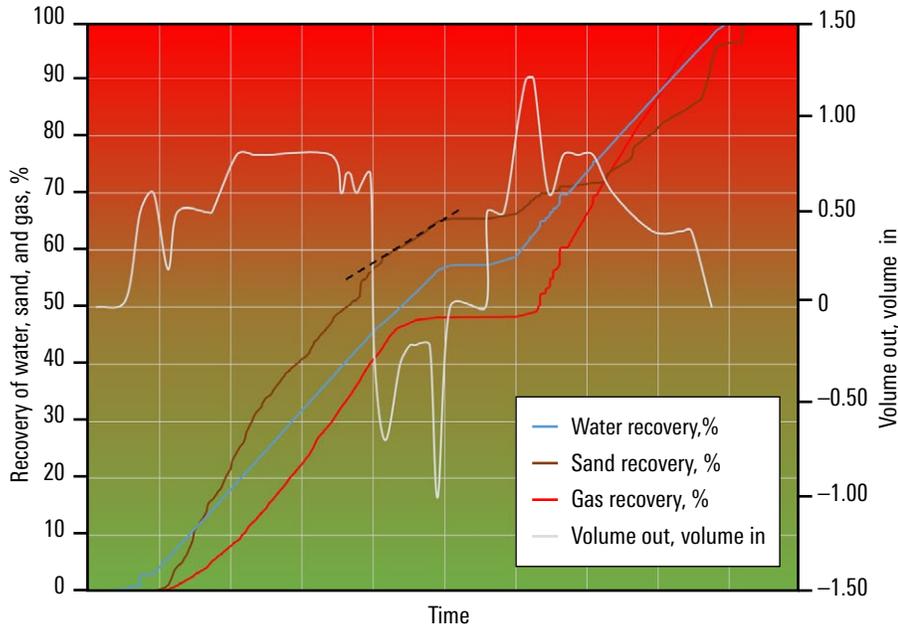
## Deploy Vx Spectra flowmeter to monitor water, sand, and gas return rates

To help Lonestar Resources, Ltd., optimize its CT operations in the Eagle Ford Shale, Schlumberger recommended integrating the Vx Spectra surface multiphase flowmeter into the CT campaign. The flowmeter uses advanced full-gamma spectroscopy and measures at a single point in the venturi throat to accurately capture multiphase flow dynamics while enabling real-time data monitoring and analysis.

Schlumberger installed a Vx Spectra surface multiphase flowmeter downstream of a choke manifold to monitor return rates during the millout period. The flowmeter measured water, sand, and gas return rates at surface. Injection rates averaged 4.3 bbl/min [680 L/min] and return rates averaged 4.7 bbl/min [747 L/min]. Downhole conditions during the entirety of the operations ranged from slightly overbalanced at 0.4 bbl/min [65 L/min] to underbalanced within the range of 0.5–1.2 bbl/min [80–190 L/min].



*The Vx Spectra flowmeter measured water, sand, and gas return rates in real time at surface during the millout period of CT operations. On average, the injection rates were lower compared with return rates, leading to an underbalanced condition that resulted in sand mobilization.*



As reflected in the cumulative water, sand, and gas returns, underbalanced conditions during the majority of the job led to gas production and excessive proppant production. As a result, it was recommended that Lonestar perform future millout operations in slightly overbalanced conditions to discourage sand mobilization.

As a result of these underbalanced conditions, gas was observed at surface and quantified by the Vx Spectra flowmeter throughout most of the CT operations. Sand mobilization was simultaneously measured at surface, with 23,000 lbm [10,500 kg] recovered during this period. By volume, this translates to approximately 40 bbl [6.36 m<sup>3</sup>]. Although some proppant and plug parts are to be expected in the return fluid at surface, the combination of high proppant mass and simultaneous hydrocarbon production suggested potential sand mobilization from the fracture network.

### Identify optimal CT strategy for enhanced long-term recovery

Coiled tubing operations for the study well were run moderately underbalanced for the majority of the millout. However, midway through the operation, the well was run in 0.5-bbl/min [80-L/min] overbalance for 3 hours immediately before a shutdown. This overbalance corresponded to a drop in gas recovery but still resulted in sand mobilization. The rate of sand recovery during this period of time was 23% lower compared with the preceding underbalanced operations, further suggesting that a portion of the sand recovered at surface was likely mobilized from the fracture network.

As a result of these findings, Lonestar and Schlumberger determined that some proppant was mobilizing from the near wellbore. For future CT operations, AvantGuard advanced flowback services were used to develop a flowback strategy that recommended performing millout at slightly overbalanced conditions (4.5-bbl/min [715-L/min] injection and 4-bbl/min [635 L/min] return) to clean out the lateral without mobilizing sand from the fractures. These operating procedures would help Lonestar minimize disposal costs and achieve better long-term production by preserving the near-wellbore fracture integrity.