

# Losseal Family of Reinforced Composite Mat Pills Enables Lifting Cement in the Permian Basin

Apache Corporation met stringent local regulations on cement tops during primary cementing, saved USD 40,000 per well

## CHALLENGE

Mitigate massive losses with an alternative, cost-effective method; protect top of cement from corrosive water elsewhere requiring remedial work; and meet local regulation requirements for top of cement.

## SOLUTION

Deploy Losseal\* family of reinforced composite mat pills, which are specifically shaped and sized materials to the cement slurry to lift cement in the wells to the designed target levels.

## RESULTS

- Achieved cement tops in wells with up to 67 bbl/h lost circulation rate prior to the cementing operation with an average fracture width of 0.1 in [0.39 mm] and maximum fracture width of 0.5 in [1.35 mm] as per FMI\* fullbore formation microimager log data.
- Saved more than USD 25,000 in squeeze cementing operations per well with no further remedial work required.
- Cemented in a single stage and eliminated the need for multistage tool, which saved an average USD 40,000 per well.
- Met all requirements set by the local regulatory agency pertaining to the required top of cement.



## Alternative method to lift cement in Permian basin

Highly depleted wells and naturally fractured formations have contributed to challenging cementing operations in the Permian basin. Apache Corporation needed to lift cement in the upper Spraberry Formation of the basin to the designed target levels. In the Permian basin, it is common to drill and cement wells without mud returns because the upper and lower Spraberry Formations are two of the main thief zones in the Permian basin. Conventional lost circulation control materials (LCM) are added to the drilling fluid with marginal or no improvements. When cementing across depleted and corrosive formations in the Permian, specifically designed pills loaded with LCM are pumped ahead of cement slurries, which exhibit high viscosities. As a result, displacing the pills to the thief zone without channeling through the formation is a challenge.

Additionally, low-density fluids typically have a low solid content, which is detrimental to the performance of LCM. Certain types of LCM in cement affect the cement mechanical properties. Costly alternatives to cure losses in the Permian basin did not perform as expected, thus prompting the operator to seek an alternative, cost-effective method.

## Reinforced composite mat pills and placement technique

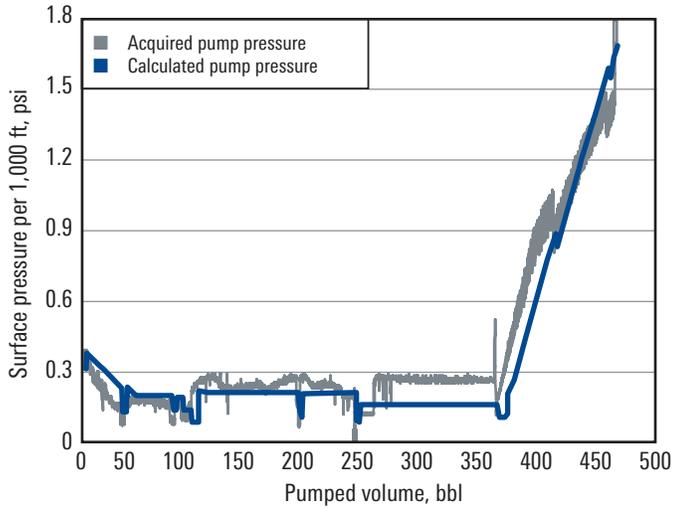
To address these concerns, Apache Corporation consulted with Schlumberger, which recommended an engineered combination of a placement technique and Losseal composite mat pills to lift cement in the basin to the designed targets when the technique and pills are used in a specific sequence. Based on the observed lost circulation zones, 67 bbl of the lead cement was treated with the solids package. The first part of the lead was treated with 30 bbl followed by 30 bbl of the lead cement as a buffer, and then 37 bbl of cement treated with LCM before switching to tail cement.

## Success rate of 90% in loss mitigation during cementing operations

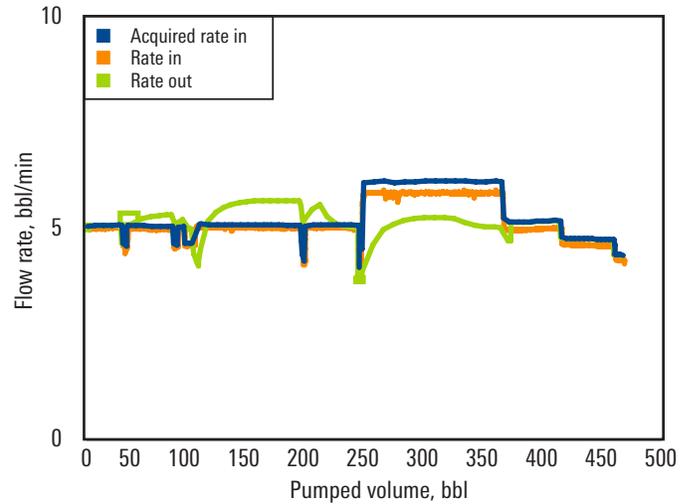
The unprecedented results obtained with the Losseal composite mat pills enabled lifting cement to the depths specified by regulatory entities (e.g., Texas Railroad Commission). The Losseal pills also provided long-term zonal isolation and casing protection across the corrosive formations in the Permian basin. These operational optimizations prevented the further need for costly remedial cement operations.

The Losseal composite mat pills have been implemented in more than 170 wells with more than 90% success rate in mitigating losses while cementing, and more than 70% of wells achieved the required TOC. This technology has also been adapted by 10 other operating companies in the Permian basin.

## CASE STUDY: Losseal composite mat pills save more than USD 25,000 in squeeze cementing operations



Pressure match between calculated and acquired pressures.



Lifting pressure chart as circulation was maintained throughout the job with fluids injection rate at surface.

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