CASE STUDY

HALLIBURTON

North America

Corrosion-resistant multistage cementing solution mitigates lost circulation

CorrosaCem™ cement system successfully placed in three-stage production casing using Fidelis™ stage cementers

CHALLENGE

- Design and deploy a sealant system for cement sheath integrity in a corrosive environment.
- Achieve full coverage of the cement barrier in multiple zones with anticipated lost circulation.

SOLUTION

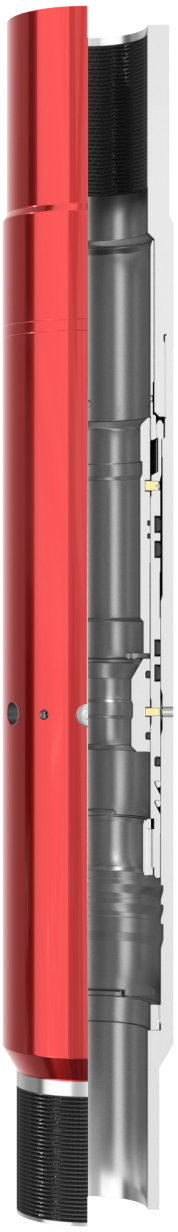
- Perform three-stage cement operation using Fidelis™ stage cementers designed with CO_2-resistant seals.
- Apply Tuned® Defense™ cement spacer with BridgeMaker™ II LCM spacer fluid to help mitigate lost circulation.
- Deploy CorrosaCem™ cement system during the first and second stages followed by EconoCem™ cement during the third stage.

RESULT

- CorrosaCem cement and EconoCem cement successfully placed while maintaining circulation throughout the operation.
- CBL confirmed full coverage of the casing string with cement in all three stages.

Overview

Cementing casing strings in weak formations requires careful design and execution. Multiple weak formations were anticipated while cementing 7-in. production casing, which required a multistage cementing operation. The potential presence of carbonic acid created additional challenges because certain wellbore sections required cementing with an acid-corrosion-resistant slurry design.



Challenge

The operator's goal was to achieve full cement coverage of the 7-in. casing while addressing multiple zones with potential lost circulation. Fluid returns (spacer and/or cement) were desired for all stages. Additionally, sections of the wellbore required corrosion-resistant slurries to address the presence of carbonic acid.

Solution

Because lost circulation was expected in different sections of the wellbore, a three-stage cement solution was designed using two Halliburton Fidelis™ stage cementers that featured two sets of CO_2-resistant, high-pressure seals on either side of the cementer circulation ports within the internal closing sleeve.

CorrosaCem cement system, a corrosion-resistant, low-Portland-cement solution, was placed across the sections with potentially corrosive environments.

All slurries were designed at relatively low density with a low rheological profile to help minimize equivalent circulating density (ECD). Tuned® Defense™ cement spacer, a system that helps mitigate seepage loss, was tailored with BridgeMaker™ II LCM to help mitigate losses and achieve a full column of cement to surface.

iCem® service was used to perform sensitivity analysis, ensure cement placement, and help maintain an ECD below the fracture gradient. This service was also used to provide fluid volume recommendations to achieve +80% displacement efficiency at each critical depth of interest by leveraging the 3D modeling capabilities of the software.

A total of 120 bbl of Tuned Defense cement spacer with LCM and 396.8 bbl of a 13-lbm/gal CorrosaCem cement slurry were pumped during the first stage of the operation. A total of 205 bbl of 13.5-lbm/gal CorrosaCem™ cement slurry was placed during the second stage. Approximately 107 bbl of 12.2-lbm/gal EconoCem™ cement slurry, a lightweight low-rheology system, was pumped during the third stage. Permanent fiber optics installed in the annulus allowed real-time distributed temperature sensing (DTS) data monitoring for heat of hydration during each stage to indicate when the next stage could begin.

Result

Circulation to the surface was achieved during all three stages. Both stage tools operated as designed; the wiper plugs landed, and the casing was pressure tested with no flowback observed during any stage. The technology and execution of the CorrosaCem cement system and EconoCem cement, engineered Tuned Defense cement spacer, and Fidelis stage cementers met all operator objectives. A CBL confirmed excellent coverage throughout the entire casing string.

Three-stage cement operation achieved full cement coverage of the 7-in. casing with a corrosion-resistant slurry design.

(left - Portland cement; right - CorrosaCem™ cement) Phenolphthalein, a pH stain, shows improved corrosion resistance of CorrosaCem cement compared to Portland cement after one month of static supercritical CO_2 exposure at 100°F. Purple represents unaltered cement.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com