CASE STUDY

HALLIBURTON

North America

Corrosion-Resistant System Helps Operator Meet Class VI Injection Well Requirements

ThermaLock™ II cement system successfully placed during multiple-stage cement operation for carbon sequestration

CHALLENGES

- Design and deploy corrosion-resistant slurry system for corrosive gas injection.
- Potential lost circulation.

SOLUTION

- Perform multiple-stage cement operation to help minimize or prevent fluid loss.
- Pump two-stage design comprised of ThermaLock™ II cement during the first stage followed by NeoCem™ system and IsoBond™ cement system during the second stage.

RESULTS

- Successfully placed cement system with full circulation maintained throughout the operation.

Overview

With the industry focus on a low-carbon future, carbon capture, utilization, and storage (CCUS) is a rapidly growing market. Regulatory bodies, such as the Environmental Protection Agency (EPA), require operators to fulfill specific and rigorous requirements to obtain Class VI status for CCUS wells.

Challenge

An operator required Class VI injection well status to sequester carbon dioxide. Lost circulation was anticipated across the openhole section. To minimize equivalent circulating density (ECD) and achieve full cement coverage of the annulus, a lightweight CO_2-resistant sealant system was recommended.

A visual comparison of Portland cement (left) and ThermaLock™ cement (right) shows how CO_2 deteriorates Portland cement over time, while leaving ThermaLock cement virtually unaffected.

Solution

To address challenges associated with corrosive injection and slim ECD margins, corrosion-resistant cement was placed as part of a multiple-stage cement operation. The non-Portland 13-lbm/gal ThermaLock™ II cement system was pumped during the first stage to help significantly minimize the effects of carbonation attributed to CO_2 exposure. A lightweight 11.5-lbm/gal NeoCem™ system lead was pumped during the second stage followed by a 13.5-lbm/gal IsoBond™ cement system tail slurry.

The NeoCem system is a reduced Portland slurry with enhanced mechanical properties to help minimize the effects of cyclic loading induced by the injection process on the mechanical integrity of the cement barrier.

The IsoBond™ cement system provides enhanced shear bonding that helps minimize the potential for debonding and creation of pathways for CO_2 to flow to the surface. It additionally provides a low-permeability barrier to help improve corrosion resistance and provide ultralow fluid loss. This is to shorten the slurry transition time to help compact fluid flow through unset cement and ultimately reduce the potential for sustained casing pressure (SCP).

The operation was executed in two stages to help ensure the ThermaLock II cement slurry was isolated from other fluids to help prevent contamination of the planned barrier in the injection zone. In addition to standard laboratory testing of all fluids, contaminated thickening time tests were performed to help ensure no adverse interaction between the ThermaLock II cement and the NeoCem slurry systems during the second stage of the operation.

Multiple-stage cement design using ThermaLock™ cement during the first stage provided corrosion-resistance and delivered isolation requirements.

Results

All operator objectives were met after placement of the corrosion-resistant barrier in the injection zone and circulation of the cement to the surface. Identification of the cement at the surface during each stage indicated a full column of cement from the surface to the injection zone. This confirmed one of the key objectives to obtain Class VI well status.

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