CASE STUDY

HALLIBURTON

Japan

# Corrosion-resistant cement solution helps operator apply for CCUS well application

CorrosaCem™ cement system provides corrosion resistance and achieves zonal isolation

## CHALLENGE

- Corrosion-resistant cement solution for injection zones and full isolation of casing string for future CCUS wells
- Low fracture gradient requires low-density cement to achieve planned TOC

## SOLUTION

- Place CorrosaCem™ cement system in the injection zone
- Tailor with IsoGuard® fluid additive to reduce barrier permeability, enhance corrosion resistance, and improve shear bonding to help combat debonding

## RESULT

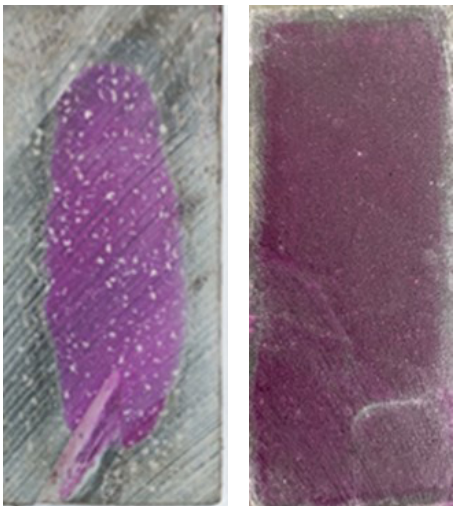
- Successfully cemented 9 5/8-in. intermediate string and 7-in. production string
- CBL confirmed full cement coverage of wellbore
- Operator able to apply for CCUS well application

## Overview

Carbon capture, utilization, and storage (CCUS) has become a primary means used to help prevent carbon dioxide emission into the atmosphere. Wells used for $CO_2$ storage require a rigorous design process to meet local regulation and long-term integrity requirements. One of the key requirements for long-term integrity is full annular isolation of the production casing with $CO_2$ corrosion-resistant cement.

## Challenge

An operator in Japan planned to drill a CCUS well into a depleted reservoir and inject $CO_2$ emitted from hydrogen and ammonia production nearby. The corrosive environment required corrosion-resistant cement across the zone of interest to maintain well integrity, as conventional Portland cement can degrade over time when exposed to $CO_2$. Cyclic injection in CCUS wells further increases the risk of mechanical failures, such as cement debonding. In addition, these wells are in a low-fracture-gradient area, which makes it difficult to lift high-density cement to the planned top of cement (TOC) without exceeding equivalent circulating density (ECD) limits. Regulations mandate a cement bond log (CBL) in the injection section to confirm proper cement isolation.



(left - Portland cement; right CorrosaCem™ cement system) Phenolphthalein, a pH stain, provides visual cues of carbonation. Purple represents unaltered cement. The results of CorrosaCem cement system after one month of static supercritical $CO_2$ exposure at 100°F show improved resistance to $CO_2$ chemical alteration compared to conventional Portland cement.

## Solution

The CorrosaCem™ cement system, a corrosion-resistant, reduced-Portland-cement solution, was deployed in the injection zones. CorrosaCem cement system replaces a portion of Portland cement with supplementary cementitious materials (SCM) that do not react with $CO_2$. This helps improve $CO_2$ corrosion resistance. The solution was tailored with IsoGuard® fluid additive to reduce permeability, which further enhances corrosion resistance and improves shear bond to mitigate the risk of debonding caused by cyclic loading. The cement system was designed at relatively low density, 1.25-SG lead and 1.50-SG tail cement, to help minimize ECD.

## Result

A total of 27 bbl of 1.25-SG CorrosaCem system lead cement and 27 bbl of 1.50-SG CorrosaCem system tail cement were mixed and placed in the 9 5/8-in. intermediate string and 7-in. string. A CBL confirmed cement coverage throughout the wellbore, which helped the operator to apply for their CCUS well application.

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