CASE STUDY

HALLIBURTON

Middle East

Successful cement operation in region's first CCUS well

WellLock® resin system delivers excellent zonal isolation in first CO_2 injection well in UAE

CHALLENGE

- Cement the first global fully sequestered CO_2 injection well in a carbonate saline aquifer
- Provide CO_2 corrosion-resistant barrier for life of the well
- Achieve required TOC, despite expected losses

SOLUTION

- Deploy 100% non-Portland WellLock® resin system
- Run Obex GasLock® packer to provide V0-rated secondary mechanical barrier support with the ES II™ HD cementer
- Deploy reduced Portland CorrosaCem™ cement
- Deploy Tuned® Defense™ cement spacer to address lost circulation

RESULT

- Successful execution of 100% WellLock® system for a primary job application
- Successfully set Obex® packer
- Received cement to surface

Overview

The capture and injection of CO_2 into geological formations in a process known as carbon capture, utilization, and storage (CCUS) is an effective way to reduce global emissions. Cement barriers in these operations face unique challenges attributed to the corrosive environment, harsh injection cycles, and storage requirement length. A sustainable barrier must be ensured throughout a well's life for proper isolation and to meet injection targets.

Challenge

As part of a journey to accelerate decarbonization of operations and supply low-carbon products, ADNOC planned the first CO_2 injection well in the UAE. Losses were expected during displacement, which could potentially impact the planned top of cement (TOC). It was essential to design and place a system that could maintain an equivalent circulating density (ECD) below the formation's fracture gradient to avoid lost circulation and achieve the planned TOC.

Solution

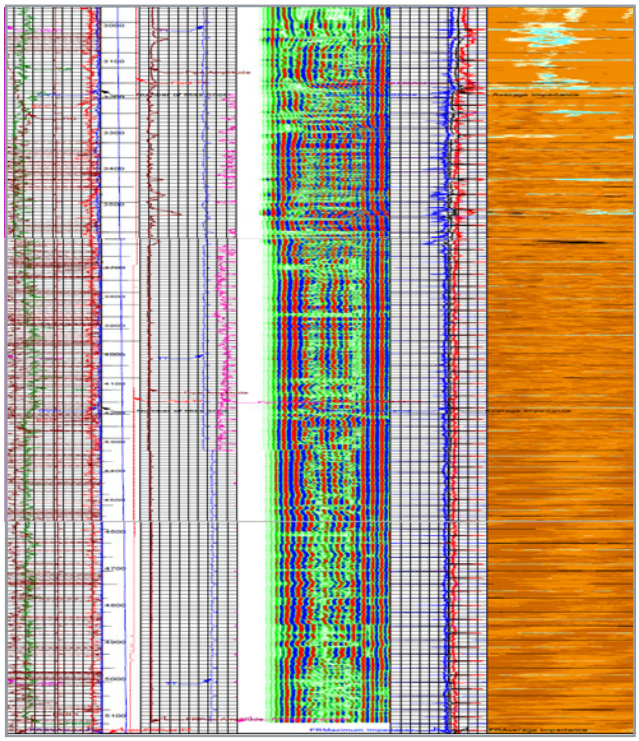
To meet the injection plan, Halliburton proposed a non-Portland system to provide ultimate corrosion resistance and proper isolation over the lifetime of the well. WellLock® resin, a non-Portland system that does not chemically react with CO_2 and has ultralow permeability, was deployed to cement 9 5/8-in. and 7-in. casing. WellLock resin also acts as a highly elastic barrier, which helps the system withstand stresses induced by the cyclic loads of the injection operations. Because of the relatively high mud weight, the WellLock resin system was weighted up to 14.5 lbm/gal to cement the 9 5/8-in. casing during the first stage and the full column of 7-in. casing.

CorrosaCem™ cement, a reduced-Portland system, was used during the second stage of the 9 5/8-in. casing cement operation. The CorrosaCem system is designed to minimize components that readily react with CO_2. The system's improved mechanical properties also minimize the impact of cyclic injection.

To mitigate the risk of losses during displacement and achieve cement to surface, Tuned® Defense™ cement spacer, a specialized cement spacer with lost circulation prevention features, was supplemented with BridgeMaker™ II lost circulation material (LCM) and pumped ahead of the WellLock resin. An Obex GasLock® packer, which provides V0-rated secondary mechanical barrier support, was run with an ES II™ HD stage tool to support multiple-stage cement operations, prevent cement system contamination, and help achieve cement to surface.

Result

Halliburton successfully executed a flawless cement operation for the first CO_2 injection well in the UAE. No losses were observed during the first stage with 9 5/8-in. casing. The Obex packer and stage tool successfully operated and set. A cement bond log (CBL) confirmed excellent cement coverage with WellLock resin across all sections of interest in both the 9 5/8-in. and 7-in. applications.



Excellent zonal isolation.

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