CASE STUDY

HALLIBURTON

Iraq

Cement system secures zonal isolation in depleted reservoir

IsoBond™ cement system provides enhanced dependability and long-term isolation to mitigate fugitive emissions

CHALLENGE

- Stringent zonal-isolation standard
- Highly permeable formation
- Depleted reservoirs

SOLUTION

- Deliver required barrier and meet operator's zonal isolation requirements using IsoBond™ cement system

RESULT

- Excellent fluid loss control
- Reduced transition time
- Improved shear bonding between casing and formation

Overview

An oil field in southern Iraq presents distinct challenges to achieve the minimum standard of zonal isolation. Highly permeable formations and depleted reservoirs make appropriate well barrier selection crucial to isolate potential flow zones and maintain well integrity throughout the entire life cycle.

Challenge

An operator established stringent criteria to meet the field's zonal isolation requirements, which included:

- A minimum of 30 m of cement above the shallowest distinct permeable zone (DPZ)
- A minimum of 10 m of cement between DPZs in the same section
- The cement must cover 100% of the annulus in the interest area to qualify well barrier element (WBE) as well

However, because of the permeable rock characteristics and depleted reservoirs, seepage losses and higher differential pressure led to increased fluid loss from the cement slurry and compromised zonal isolation.

Solution

Halliburton proposed deployment of the IsoBond™ cement system to deliver the required barrier and meet the operator's zonal isolation requirements. The IsoBond cement system proactively mitigates potential flow mechanisms, which include annular flow through unset cement, mud channels, and cement permeability. The IsoBond system tightly controls fluid loss to help ensure successful cement placement in challenging formations, while filtrate loss to the nearby formation is minimized. Laboratory results performed with various densities executed in different temperatures show that the IsoBond system provides excellent fluid-loss control in 30 minutes.

IsoBond™ cement system fluid-loss performance

SECTION	BHCT	DENSITY (LBM/GAL)	API FLUID LOSS (CC/30MIN)
Production liner	170	16.2	10
Production casing	153	14.0	25
Intermediate casing	113	15.8	40
Intermediate casing	163	12.5	35

In addition, its rapid static gel strength helps mitigate the risk of flow through the cement and channeling, which can lead to sustained casing pressure.

The IsoBond™ cement system is easily dry-blended, which eliminates the need for additional equipment and helps reduce operational costs.

Mechanical gel strength analyzer testing

15.8-LBM/GAL CLASS G CEMENT, 1% ISOBOND™ CEMENT SYSTEM	
Temperature (°F)	171
SGS (100 to 500 lb/ft^2)	31 minutes

Result

A sonic or ultrasonic log was run for verification to evaluate zonal isolation. In the intermediate section, it is common to experience a rapid fluid-level decrease attributed to losses, which results in the loss of the barrier between Dammam and the surface. Effective equivalent circulating density (ECD) management with optimized IsoBond cement system rheology during field execution helped achieve the required top of cement (TOC) and zonal isolation requirements in the intermediate sections.

In the production section, with consideration to the complexity of the reservoir zones and the production objectives of the operator, the Mishrif and Zubair formations were 100% covered with cement to help ensure hydraulic isolation and implement the well completion strategy.

Use of the IsoBond cement system prevented unwanted fluid flow from the permeable zones, which could have resulted in sustained casing pressure (SCP) or crossflow between the DPZs.