Case study: Indonesia

SealBond system sealed lost circulation zone, increased production 10%

An operator in the Sukowati field in East Java experienced severe lost-circulation problems in a high-permeability limestone formation. The fracture gradient of the formation was equivalent to 7 to 8 ppg. The 8½ in openhole section was drilled by the operator blindly, so the depth of the loss zone could not be determined. Previous attempts at cementing the section resulted in very poor bonding as indicated by a free-pipe signal on the cement bond log/variable density log (CBL/VDL).

Due to poor zonal isolation in the entire section of the production section, which contained a water zone, the well was producing a lot of unwanted water and minimal oil. A competitor had performed a remedial job using lightweight cement slurry at 8.5 ppg. Two more cement jobs were performed through a cement retainer to squeeze off poorly bonded cement, but the results were unsuccessful. The upper zone was perforated and produced, but water cut had increased to 94% in December 2014.

Baker Hughes was contacted to provide a solution. The main concerns were three-fold: stop losses, reduce water cut, and repair poor cement bond in the entire section and provide zonal isolation. Another condition was that all squeeze materials used in the wellbore had to be nondamaging to the formation (acid soluble) because the production zone had a historic record of strong oil production.

Baker Hughes solution

Baker Hughes recommended using the **SealBond™ cement spacer system**. The SealBond system is designed to form a protective barrier at the wellbore wall to strengthen the wellbore, mitigate lost circulation, minimize filtration invasion, and promote enhanced hole cleaning to ensure good cement bonding.

The idea was to pump through existing perforations in the middle of the 7 in liner and squeeze the spacer and cement slurry to the lower zone near the casing shoe.

The design recommended pumping 10 bbls of the SealBond cement spacer system and soaking it for 30 minutes to allow the lost-circulation zone to heal before determining the injection/losses for the cement squeeze. The cement slurry was designed at 15.8 ppg with 15% calcium carbonate-acid-soluble cement additive.

Using a balanced plug technique, 5 bbl of SealBond along with 20 bbls of 15.8 ppg cement slurry was spotted. The cement slurry volume of only 7.3 bbl was squeezed into the formation using the Bradenhead squeeze method.

Challenges

- High-permeability limestone formation
- Low formation fracture density of 7 to 8 ppg
- Unknown depth of loss zone due to blind-drilled 8½ in openhole
- Wellbore integrity issues
- Entire section required cement bond repair and production zone isolation
- Squeeze the spacer and slurry to the lower zone near the casing shoe through existing perforations in the middle of 7 in liner casing

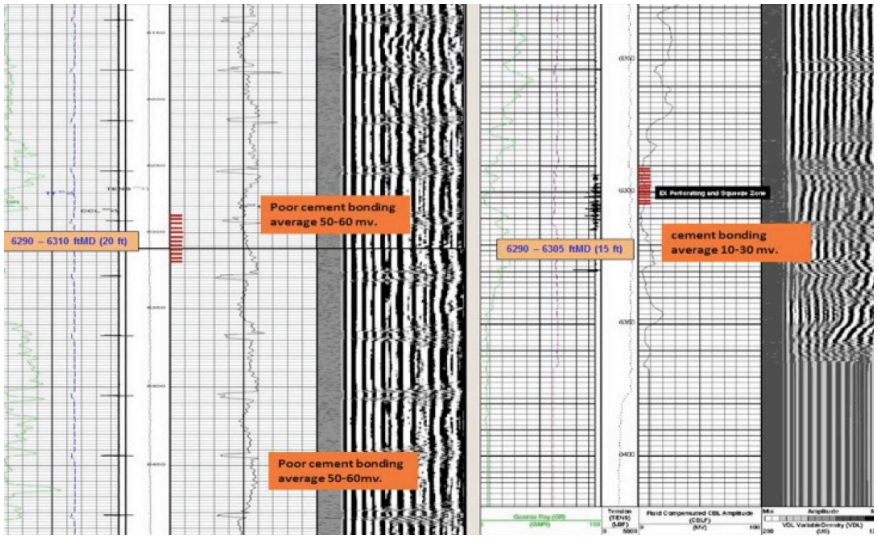
Results

- Sealed lost-circulation zone
- Isolated production zones from 94% water cut to 70%
- Increased oil production rate by 10%
- Saved costly remedial cementing job
- Improved cement bonding from free pipe to isolation

Results

The 30-minute soaking of the designed spacer system improved the formation integrity and the injection test indicated that the losses were reduced from 94% to 80%. The cement job was a success as the CBL/VDL evaluation tool showed very good cement bonding through the entire production section. Upon successful completion of the operation, water cut was reduced to 70%, while oil production improved by 10%.

Optimized engineering design and improved spacer and slurry performance, along with flawless execution, ensured that the challenges were met and exceeded the operator's expectations. This further resulted in a contract for six additional remedial cement jobs for this operator to improve formation integrity and improve zonal isolation.



Left—CBL/VDL indicates poor cement bond/free pipe prior the squeeze cement job. Right—CBL/VDL indicates zonal isolation after the squeeze cement job using the SealBond cement spacer system.