

Challenge:

Drilling through zones with total losses can lead to poor cement quality or in severe cases a total absence of cement behind the casing. This could lead to crossflow of corrosive fluids and ultimately corrosion in the casing and potential leaks.

Acoustic Logging Result:

One example when acoustic logging was conducted was to identify the root cause of the B annulus leak-off test (LOT) failure, this is shown below:

The well is an S-shape gas lift oil producer drilled in 1992.

Drilling for 13 3/8" surface casing was to 525 m with total losses from a depth of 30 m. The 13 3/8" casing was run in hole with the shoe at 524 m. The casing was cemented in one stage with 45 m³ of slurry. Due to the total losses the top of cement was expected to be approximately 250-300 m.

Drilling continued to 1340 m where the 9 5/8" intermediate casing was installed (shoe@1165.00 m) and the 7" production liner was set at 1103-1316 m.

In December 2017, during a Hoist intervention a scab liner was run with the tapered tieback string (7"x5.5"x4.5") at 854.82-1179.86 m. The existing 2.875" tubing was replaced with a new tapered 3.5"x 2.875" gas lift completion string (WEG@1181.17 m).

In September 2022 an integrity test (SIT) was conducted, the B annulus leak-off test (LOT) failed (unable to build up pressure) and the A annulus inflow test failed.

Interpretation Summary:

An acoustic logging pass was conducted while pumping water into the A annulus. SNL data showed fluid movement from surface-200 m. VVL data indicated the presence of vertical downward flow movement at an interval from surface-200 m. It was observed that the formation was taking fluid flow horizontally from 56-200 m with a more intense flow at 56-74 m. The temperature curve supported the acoustic log findings as the temperature curve confirmed crossflow at 60-200 m. The gamma ray curve showed significantly greater counts at a depth of 23 m compared to the original open hole log. This could be attributed to scale accumulation (possible depth of leak on the 9 5/8" casing and 13 3/8" casing). Additionally, the gamma ray curve had greater counts from 183-200 m which confirmed the end of the crossflow zone.

Considering the drilling history (losses across the upper section) and the acoustic log results, the main conclusion of this survey is that:

The 9 5/8" casing has a through-wall defect at a very shallow section at 23 m. The water pumped into the A annulus passed through the leak in the 9 5/8" casing and into the B annulus. The fluid then entered the formation and travelled to a depth 200 m. The flow across the formation was not even with a different intensity across the interval 56-200 m.

Conclusion:

In the event of a failed LOT test, an acoustic log can be run which to identify the depth of a leak and determine any fluid movement behind the pipe. Combining corrosion and acoustic logging gives a more complete picture of the overall well integrity status.

