Case study: Permian basin, North America

INTeX service accurately evaluated lightweight cement in inconel-coated casing

A major oil and gas operator in North America required a more detailed evaluation of its lightweight zonal isolation job after the initial cement bond log (CBL) data yielded inconclusive results. The operator had used a low-density resin material in its Permian Basin well to help minimize lost circulation and achieve the specified top of cement, but the resin additive—which increased the shear bond strength between the casing and the annular material—also reduced the slurry weight to only 9.4 ppg. The low-density cement made evaluation difficult using conventional acoustic-based technologies, and the 7-in. casing had an Inconel coating on the inside of the pipe which also compromised the measurements.

To accurately detect the presence of cement and/or microannnuli in the low-density slurry, Baker Hughes recommended its breakthrough **Integrity eXplorer™ cement evaluation service**. Although traditional cement evaluation technologies can provide some valuable information in certain applications, they only respond to compressive strength. The Integrity eXplorer service can measure shear strength—the only true indicator of cement integrity across all applications.

Because the Integrity eXplorer service's electromagnetic-acoustic transducer (EMAT) technology responds to the shear properties of the annular material as opposed to its compressive strength, the accuracy of the measurements was not affected by the lightweight resin. While the Integrity eXplorer service showed a horizontal shear attenuation readings increase of ~50 db/ft from the free pipe to the fully-bonded pipe section in the lightweight cement section of the well, the conventional CBL readings showed a compressional attenuation readings increase of only 2 db/ft.

With more than 25 times the sensitivity of conventional pulse-echo-based cement evaluation technology, the Integrity eXplorer service's shear measurements showed the presence of cement while the conventional technology failed to see any contrast between the resin and free pipe. The shear data obtained using the Integrity eXplorer service agreed with the CBL data for the upper section of the well, which used conventional class G cement.

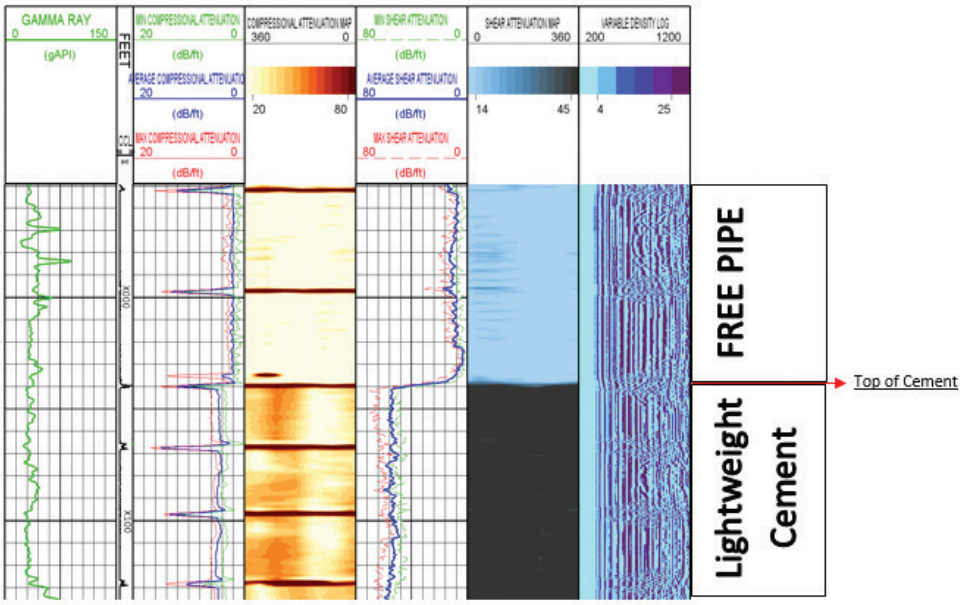
Because the Integrity eXplorer cement evaluation service was able to collect the shear measurements needed to accurately detect the lightweight cement, the operator was able to avoid unnecessary remedial operations and increase overall confidence in its well integrity. The operator plans to use the service on future jobs to improve the efficiency and reliability of its cementing operations.

Challenges

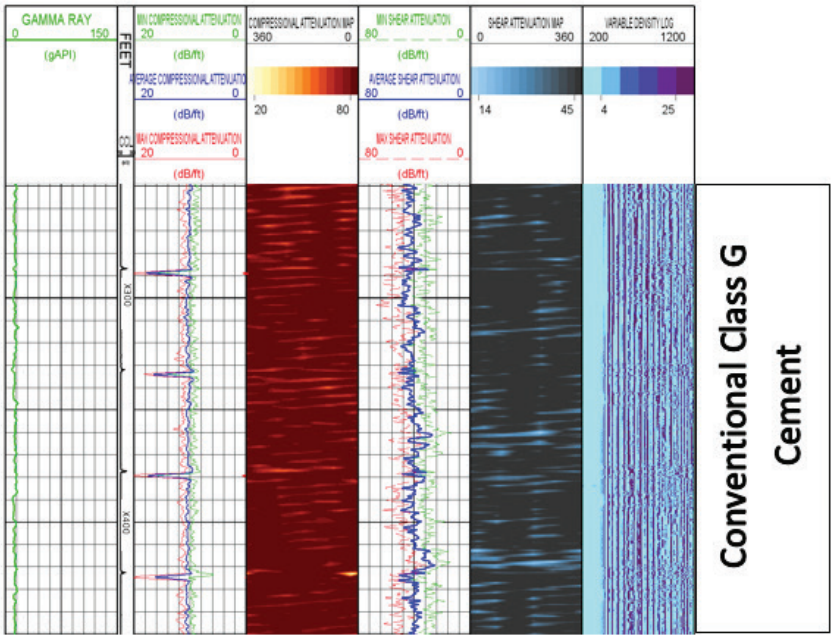
- Customer needed to evaluate lightweight resin slurry of 9.4 ppg that had drastically different acoustic properties than conventional cement
- Casing with internal Inconel coating could interfere with measurements

Results

- Accurately detected the presence of lightweight resin when conventional cement evaluation data was inconclusive
- Eliminated unnecessary cement squeeze operations



The Integrity eXplorer service showed a shear attenuation difference of ~50db/ft, confirming the presence and strength of the lightweight cement, while the CBL showed a compressive attenuation of only ~2 db/ft.



The CBL data agreed with the Integrity eXplorer service data in the upper section of the well containing conventional class G cement.

Baker Hughes