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BG Group Successfully Evaluates Foamed Cement Bond in Heavy Oil-Base Mud Environment, North Sea

Foamed cement placement quality and casing centralization quantified using third-interface echoes acquired by PowerFlex annular barrier evaluation service

CHALLENGE

Evaluate placement and bond quality of foamed cement behind 9⅝-in casing with heavy oil-base mud (OBM) to fulfill requirements of the NORSOK D-010 standard for well integrity in drilling and well operations.

SOLUTION

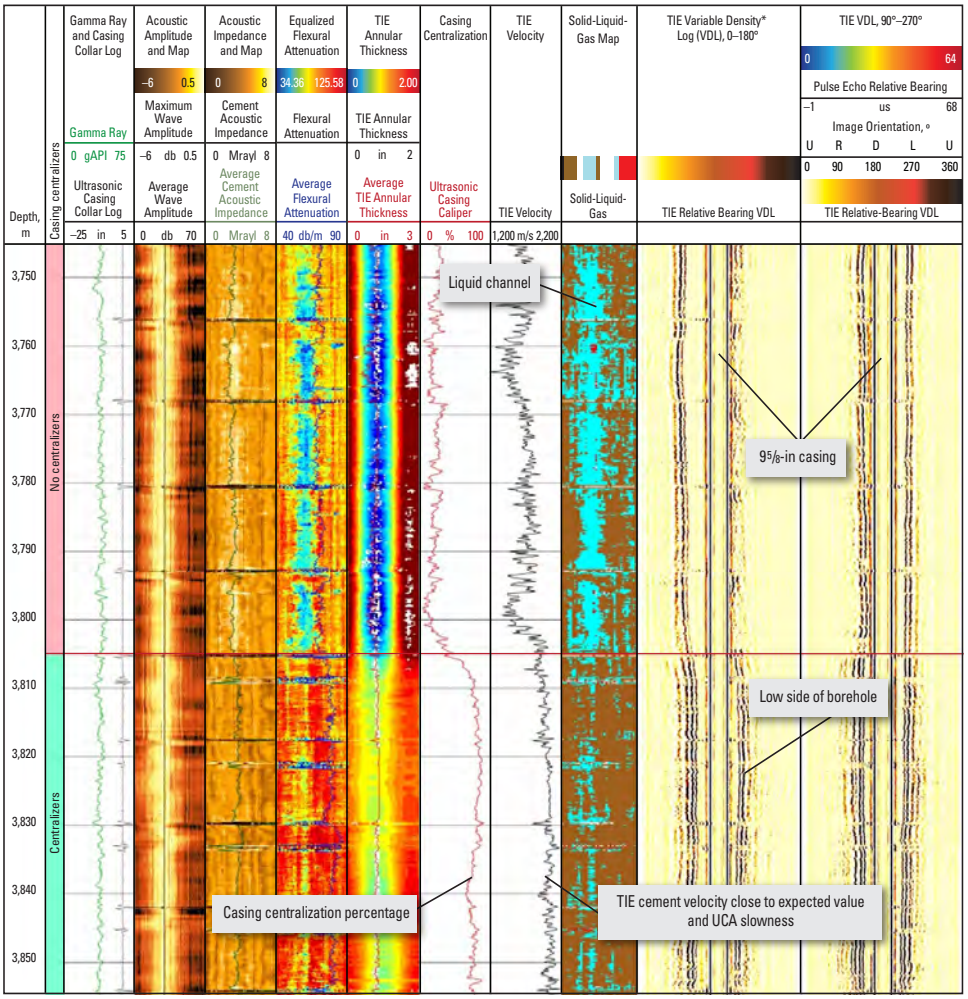
Run new PowerFlex* annular barrier evaluation service, which uses a powerful transducer that expands the working envelope for ultrasonic measurements to obtain both pulse echo and flexural measurements in highly attenuative, high-weight muds and large-diameter, thick-walled casings.

RESULTS

Visualized differences in casing centralization that resulted from centralizer placement and confirmed cement bond quality with a good match to laboratory ultrasonic cement analyzer (UCA) values for demonstrating that NORSOK requirements were met.

Regulatory requirements for foamed cement bond

BG Group needed to evaluate the quality of the foamed cement bond behind 9⅝-in 53.5-lbm/ft casing in a North Sea well to fulfill the NORSOK D-010 standard for well integrity in drilling and well operations. However, the heavy OBM in the well posed major challenges for conducting the required acoustic logging with traditional pulse-echo ultrasonic technology. The 1.71-g/cm^3 density of the mud was very close to that of the 1.73-g/cm^3 cement, which would make it difficult for conventional tools to differentiate between mud and cement in the annulus. Heavy mud also has a highly attenuating effect on the signal emitted from the transducers, dampening it to the extent that the return signal cannot be read. Swapping out the heavy OBM for a low-attenuation fluid to make it possible to conduct a conventional cement evaluation would be expensive.



PowerFlex service provided BG Group with a comprehensive evaluation of casing centralization and cement quality with no biases introduced by the heavy OBM in the well.

Expanded boundaries for evaluating the annular barrier

Unlike conventional ultrasonic tools, PowerFlex annular barrier evaluation service is able to resolve casing and cement information for almost any cement type and well fluid, including very heavy muds. Innovative power transducer technology and the tool's advanced mechanical design efficiently provide full azimuthal coverage to definitely characterize the annulus in casing diameters up to 22 in and casing thicknesses to 1 in. The superior-quality pulse echo and flexural attenuation data, including third-interface echoes (TIEs), is available faster than from conventional ultrasonic logging through the optimized downhole and surface telemetry systems. Enhanced wellsite processing drives an efficient 2-hour turnaround time from acquisition to answers. Operators can use their in-house workflows or the Techlog* wellbore software platform for any subsequent postprocessing.

Quantification of centralization and cement bond quality

The integrated postprocessing workflow in the Techlog platform for the pulse echo, flexural attenuation, and TIEs acquired by PowerFlex service enabled quantifiying the casing centralization without any difficulty posed by the highly attenuative well environment. Centralization was confirmed in zones that had casing centralizers, as opposed to those that did not in the well, which had a maximum deviation of 43°. Calculation of the transit time for the solids in the annulus closely matched values reported on laboratory UCA charts to quantify the cement quality for BG Group in successfully meeting NORSOK requirements.

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