Introduction to cement bond logs

The use of acoustic tools in the evaluation of cement placement is an established practice. The measurement concept relies on an acoustic wave being transmitted along the casing and received back at the tool. The magnitude of energy loss is used to establish an acoustic coupling between casing and cement and, based on the degree of energy loss, infer the presence of cement and hydraulic isolation.

Cement bond log tools (CBLs) have evolved over the years as technology and telecommunications have advanced. From the 1950s basic single transmitter and dual receiver design with analog communication and zero reprocessing capability, industry has moved to broadband transmitters and arrays of receivers that digitize and record full waveforms at each firing depth. Ultrasonic tools were introduced in the 1980s that are capable of azimuthal and vertical resolution and have continued to improve in reliability and signal to noise capability. Interpretation products have moved from consulting a nomograph to colourful displays that provide clearer representations of anticipated cement placement in the annulus.

However, despite the technical advances, the perceived accuracy of the CBL as a diagnostic tool has remained quite poor due to inherent challenges associated with interpreting tool data. A common issue is that the impedance of cement is often close in impedance to the drilling fluid, which limits the contrast and ability to identify features such as micro-annuli. With the perception of measurement limitations, development budgets for CBL technology have been largely dedicated to hardware improvement that have resulted in a variety of CBL tools available in the market.

Two important developments are occurring that will enable tools to provide improved cement barrier analysis. Firstly, telemetry and downhole memory capability are improving and enabling more tools to capture and record full arrays of waveforms at high sampling rates. Secondly, access to low cost computing power is more widespread. Previously, signal processing was largely performed downhole and algorithms were necessarily computationally efficient. As processing moved to surface systems, there was a lack in any step change advancements made in the signal processing routines. There is an effort now underway to advance the data processing and answer products. These new advancements will enable industry to use the full potential of the measurements and therefore increase cement bond log reliability and accuracy.

An industry work group of cementing evaluation experts is developing a technical report describing the most recent advancements in the tools, methods and analytical processing tools. Industry is encouraged to participate in this activity. Details can be found here http://mycommittees.api.org/standards/ecs/sc10/default.aspx. The API Technical Report 2 is scheduled to be issued in 2017 to industry. The current edition, *Cement Sheath Evaluation API 10TR*, is available through API.

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