

CASE STUDIES ON MULTI-STRING ISOLATION EVALUATION IN P&A OPERATIONS

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Abstract:

Cement sheath quality assessment is a critical initial step in plug and abandonment (P&A) operations during oil and gas well decommissioning. However, the technologies commonly used require unimpeded access to the casing annuli thus enforcing the need for production tubing pulling or inner casing milling. Cement integrity or isolation evaluation through multilayered well casing strings will provide the opportunity to significantly reduce operational time and costs and to greatly simplify the traditional P&A process. As desired by the industry for years, recent advancements in isolation evaluation have proven the feasibility to assess cement sheath quality without the removal of production tubing or inner casing.

The new development, consisting of a sophisticated logging apparatus with a novel processing methodology, led to a groundbreaking technology evaluating zonal isolation through multiple casing strings in wells. The logging tool is deployed in the borehole using E-line, Slickline, or Coiled Tubing; then the acoustic energy that is emitted and received by the tool travels through the tubing and surrounding annulus to reach the isolation barrier behind the casing. A proprietary frequencydomain processing algorithm successfully identifies the desired signal by discriminating it from overwhelming undesired signals such as tubing arrivals. The latest development stage further enables the segmentation of the measurements, providing an improved sensitivity to detect the azimuthal variations in the cement sheath quality.

Case histories of applying omnidirectional and segmented multi-string isolation evaluation technology in field trials in the North Sea are presented in the paper. The measurement accuracy has been verified through side-by-side comparisons with industry-standard Cement Bond Log (CBL) and ultrasonic logs recorded after the tubing was removed. Additionally, the technology has been proven applicable to various casing or tubing weight & size combinations with tubing eccentric inside the casing. Thus, it is practicable in actual well configurations and suitable for the deviated well sections as well. In conclusion, this innovative technology that exhibits quantitative assessments of bonding or isolation conditions of wells in multi-string configurations provides a cost-effective solution during P&A and further demonstrates a great potential to accelerate along the path to a rigless P&A operation.

Bio:



Jun Zhang, Chief Scientist at Probe, supervises company-wide R&D and leads various engineering developments focused on next-generation well integrity evaluation and well intervention, etc. Jun received his Ph. D in Applied Physics from Rice University in 2008 and then started his career at Schlumberger as a physicist building expertise on acoustic and electromagnetic logging technologies. He has been a team lead for years on developing several cutting-edge LWD & MWD technologies, prior to Probe. With years' experience in the well logging business, Jun held numerous US and international patents on acoustic & electromagnetic logging technologies, and signal processing techniques. He is also an active member in various oil field societies & consortiums and contributing as the technical reviewer as well.