Going beyond the log – from cement bond logging to barrier verification – consistency in zonal isolation assessments

By: Sigrid Kramer

Safe well operation requires eliminating any unwanted flow to surface, cross flow between subsurface zones and out-of-zone injection. Zonal isolation is achieved through impermeable seals between porous and permeable formations and a continuous formation-to-completion seal at the wellbore.

To be effective as a barrier, annular fill in the borehole must have sufficient sealing capability – at least equal to the caprock - to withstand potential pore pressure and fracture gradient contrasts and variations.

Despite the potential impact of inadequate zonal isolation during the full well life cycle, regulatory standards concerning verification of annular seal quality are vague and usually driven by industry best practise, in-house guidelines developed by operators or service companies. In addition, variations in regulatory requirements and inconsistencies in the approach to verification across the North Sea complicate matters further.

This paper proposes guidelines for a consistent and quantified assessment of zonal isolation at the wellbore suitable for the full well life cycle, with special considerations made for effective well abandonment. The guidelines address verification of bond quality for a variety of annular fill materials (cement, formation, remediation material etc.), and circumferential coverage to provide a consistent assessment of annular zonal isolation as well as considerations on addressing conflicting evidence during well abandonment planning.