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Remedial Cementing Advancements In Annular Placement Methods Using Non-Explosive Techniques

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Abstract

Reliable annular isolation remains one of the most challenging objectives in well intervention, remediation, and plug and abandonment operations. Conventional remedial cementing techniques typically rely on explosive perforating methods to establish communication with the target annulus. While widely used, these approaches are often affected by perforation variability, debris generation, tool eccentricity, inconsistent entry-hole geometries, and uncertainty in the actual total flow area created. These factors can adversely impact fluid placement efficiency, injection performance, circumferential coverage, and ultimately the success of zonal isolation. As operators continue to seek safer, more predictable, and more efficient remediation solutions, alternative methods are emerging that challenge long-standing industry practices.

This presentation introduces a non-explosive annular access technology that utilizes hydraulically activated mechanical cutters to create engineered apertures with a known and repeatable total flow area. By replacing explosive perforations with precision mechanical cuts, the technology delivers predictable radial flow distribution, improved annular coverage, reduced operational uncertainty, and elimination of explosive-related health, safety, and environmental concerns. The system can be deployed in multiple configurations to address a broad range of remedial cementing, well integrity restoration, annular leak repair, and plug and abandonment applications, including complex multi-annulus barrier installations.

A key component of this work is an extensive Computational Fluid Dynamics (CFD) study conducted to evaluate flow behavior and cement placement performance through the engineered cuts. The modeling demonstrated highly uniform radial discharge, favorable helical flow regimes, and improved circumferential fluid distribution within the annulus. A multi-fluid simulation further quantified displacement efficiency between drilling fluids, spacers, and cement slurries, revealing limited fluid intermixing, reduced channeling, and plug-flow characteristics that support efficient cement placement. These findings provide valuable insight into the hydraulic mechanisms that contribute to successful annular isolation and increased placement confidence.

The presentation also highlights deepwater field applications where the technology was successfully deployed to establish non-invasive lateral barriers, restore annular integrity, and remediate sustained casing pressure. These case histories demonstrate how integrated cutting and cement placement strategies can reduce intervention complexity, eliminate operational trips, improve placement assurance, and deliver verified barrier performance under challenging well conditions.

Attendees will gain a unique perspective on how engineered annular access is reshaping remedial cementing design philosophy. Through a combination of CFD validation, operational lessons learned, and field-proven results, this presentation demonstrates how non-explosive annular access technology is helping operators achieve more reliable zonal isolation, improve well integrity outcomes, and unlock new efficiencies in intervention as well as abandonment operations today.
