Sanjel ENERGY SERVICES

Case History

Thermal Intermediate Slurry Utilizes Novel Fibers for Improved Placement and Enhanced Long-Term Well Integrity

Overview

Producers in designated thermal areas of Alberta and Saskatchewan require specialized slurries to cement intermediate casing strings used for producing heavy oil. These wells use steam recovery techniques that create significant stresses from cyclic temperature and pressure changes over production spans often greater than 15 years.

Case Description

Thermal intermediate casing strings are challenging to cement due to the large hole and casing sizes producing an annulus. These require high pump rates to reach effective annular velocity to successfully place the cement. High pump rates combined with slurry viscosity create significant pressure on the well's formations, increasing the risk of losing cement returns to surface or fall back after the slurry is placed. The wells can be on newly drilled pads or as infill wells into an existing steamed area, further complicating the cementing process due to variable temperatures and unconsolidated formations. Once the wells are ready, steam is introduced stimulating well production and beginning a series of stress cycles on the cement sheath.

Solution

The new fiber was laboratory tested for improvements to mechanical properties in the thermal systems at simulated steam conditions. Next, it was tested against traditional systems using a newly developed direct strain mapping technique to measure failure thresholds and severity.

The fiber was integrated with a thixotropic thermal slurry at ratios shown to reduce lost circulation as well as improve mechanical durability. The slurry viscosity was optimized to lower friction effects on the formation during high rate displacements.

The slurry was placed in over 40 wells, with more than 20 being infill wells in existing steam chambers. Overall, the trend showed improved results with cement returns in 100% of the wells and minimal slurry fallback, all while using a thick high density blend displaced at high rates over 1.5 m^3/minute.

The infill wells were heated to production temperatures very quickly while the new pads were put on production slower. Although very early in their production life, the wells are performing as expected with no failures attributed to cement issues.

Features and Benefits

- In slurry form, the fiber improves cement returns and reduces slurry fallback
- Fiber enhances tensile strength and cement durability to provide improved well integrity
- The fiber chemically reacts within the cement matrix to improve mechanical strength
- University testing shows fibers failure at higher pressures and limits crack length and width
- Fiber can be bulk blended for operational efficiency, or mixed on the fly.
- Fiber slurries mix easily at high rate with accurate density control

For more information, see papers SPE-174483 and SPE-188151