Halliburton Advanced Cement Evaluation service saved operator $1.2 million and 16 days of rig time

Unique log analysis service can distinguish between lightweight cement and fluids, eliminating need for cement squeezes caused by uncertainty.

**OVERVIEW**

Impedance values of fluids and lightweight cements are so close that conventional logging and analysis techniques often confuse them. This can cause companies to try to squeeze cement into perceived “voids,” which may not actually exist – wasting time and money.

A large US operator in southern Louisiana used light cement in three wells. The operator had to be sure that cement coverage extended throughout the entire Travis Peak formation, which lies below freshwater aquifers.

Halliburton Advanced Cement Evaluation (ACE™) service reliably distinguished between fluids and the lightweight cement in the annular space. Analysis clearly showed two of the three wells had adequate coverage. It also showed that the third needed a cement squeeze to ensure complete coverage of the Travis Peak formation. Based on squeeze costs for the third well, the operator estimates it avoided spending $1.2 million and 16 days of rig time on the first two wells.

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<th>CHALLENGE</th>
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| Lack of experience with new type of light cement | Unique combination of tools and log processing
The operator had no experience with a new light cement it was using in these three wells. Because the cement slurries were tailored from well to well, their impedance also varied. In this case, the impedance for all three wells fell within the range of other wellbore and reservoir fluids. | Halliburton recommended using its CAST-F™ and CBL tools to measure the cement sheath, and ACE™ software to analyze logs. ACE analysis can accurately differentiate between lightweight cements and fluids by measuring vertical changes in impedance (the “activity” rate). |
| Thin cement sheath | CAST-F tool and measuring changes in activity rates
Tools that measure impedance need at least 3/4” of cement to get good readings. In horizontal or deviated wells, cement sheaths tend to be uneven. They are thinner on the low side of horizontal wells and on the inside of turns. This can lower the average readings that a CBL tool would see. | Despite these complications, Halliburton can verify sheath integrity by measuring log activity. Low variation indicates presence of fluids; high indicates a solid cement sheath. Instead of relying on average readings as CBL tools do, the CAST-F tool shows whether cement is behind the casing. |
| Confirming cement presence in critical well intervals | Cement squeeze in third well
Regulations call for complete isolation of the Travis Peak formation before drilling further. ACE analysis showed that the top of cement rose above the top of the formation in two of the wells. It also showed that cement in the third well did not rise above the formation. | Performing a $600,000, 8-day cement squeeze in the third well was costly, but necessary. It helped assure complete isolation and will help prevent well-integrity and environmental issues that might result in future liability. It will also help avoid future loss of production. |

Solving challenges™
UNCERTAINTY ABOUT COVERAGE

A large US operator used lightweight cement in three wells in southern Louisiana. The company needed to verify that the entire Travis Peak formation was isolated by cement before the wells could start producing. However, impedance values for lightweight cement can fall within the range of drilling fluids. This makes it difficult to verify the integrity of cement jobs with normal analysis. Uncertainty can lead companies to try to perform expensive squeeze jobs that ultimately prove to be impossible and unnecessary. Conversely, uncertainty can also lead them not to attempt squeeze jobs, which are necessary. The latter could lead to fluid channelling and jeopardize the well’s integrity.

HIGH ACTIVITY = SOLID CEMENT SHEATH

LOW ACTIVITY = PRESENCE OF FLUIDS

Formation entirely isolated in two out of three wells

Halliburton Advanced Cement Evaluation (ACE™) service examines the variance of impedance values. Low variation or “activity” indicates the presence of fluids behind pipe. High activity indicates a solid cement sheath. (See more detailed explanation on page 3).

Due to the certainty that ACE analysis provided, the operator credits Halliburton with helping them avoid the expenditure of $1.2 million and 16 days of rig time for squeeze jobs on the first two wells. Without that certainty, regulators would have forced the operator to perform two unnecessary cement squeezes to ensure adequate cement coverage of the Travis Peak formation.

Solving challenges™

HALLIBURTON
Unique Halliburton ACE™ service distinguishes between lightweight cement and fluids, saving operator $1.2 million plus 16 days by eliminating uncertainty.

Taking the guesswork out of squeeze decisions
Traditional cement evaluation services have difficulty properly characterizing lightweight or foamed cements. Because these cements have impedance values close to those of annular fluids, such as mud or water, conventional interpretation can lead analysts to believe that the cement bond is inadequate, causing them to order expensive – and completely unnecessary – remedial cementing.

However, Halliburton’s Advanced Cement Evaluation (ACE) service tells operators at a glance whether a well needs remedial cementing. It helps give clients quick, accurate information on cement placement and bonds when using lightweight or foamed cement.

Works with any CBL data or acoustic tool used for cement evaluation
Halliburton ACE service can analyze any standard cement bond log data acquired with any acoustic tool used for cement evaluation – even data generated from competitors’ sonic and ultrasonic tools.

Halliburton can run ACE service with data acquired from CBLs, RCBLs, ultrasonic scanners, openhole sonic, or LWD sonic tools.

Three wells using lightweight cement prove difficult to evaluate
In southern Louisiana, a large, independent US operator drilled three wells into a sandstone reservoir through the Travis Peak formation. State regulations require this interval to be fully cemented for aquifer protection before drilling continues. The state regulatory agency requires evidence of complete zonal isolation resulting from the cement job. A third-party service company logged the wells with a standard CBL, but the results were inconclusive due to the low-density of the cement that was used – just 11 pounds per gallon.

Ultrasonic evaluation and ACE post-processing eliminate ambiguity
To provide conclusive evidence of proper cement coverage and integrity through the Travis Peak formation, Halliburton recommended the post-processing of both CBL and CAST-F ultrasonic data using ACE service.

ACE analysis looks not just at the impedance of media surrounding the casing; it looks at the variance in the impedance. The resulting derivative image distinguishes cements from fluids.
Unique Halliburton ACE™ service distinguishes between lightweight cement and fluids, saving operator $1.2 million plus 16 days by eliminating uncertainty.

The science behind ACE analysis
Liquids, such as water or drilling muds, have low activity due to their homogeneity; while solids such as cement, are particularly heterogeneous and display high activity. The variations in activity levels distinguish cement from annular fluids, regardless of cement weight.

Bonding and coverage found adequate in two of three wells
Results obtained from ACE processing revealed that two of the three logged wells had complete cement coverage through the Travis Peak formation. In the third well (where ACE results displayed mud-filled channels in the annulus), the operator decided to perform a squeeze job. This remedial operation cost $600,000 and eight days of rig time to complete.

Saving time and money through data disambiguation
Information provided by Halliburton ACE service satisfied regulators. Clearly, the first two wells did not need any additional work to cover the Travis Peak formation and protect the environment. Based on the costs of remediation for the third well, the operator estimates it saved a total of $1.2 million and 16 days of rig time on the first two wells. Without ACE service, regulators might have forced the company to spend this time and money to perform unnecessary cement squeezes because of ambiguous cement evaluation results.

Saving more by preventing future problems
The operator also credits Halliburton ACE service with helping it prevent future environmental problems and potential liabilities. Ambiguous data might have led some companies to argue that a cement squeeze was not necessary when, in fact, it might have been. Problems could then develop that might disrupt future production and cost the company even more money for remediation.

Field proven around the world
Halliburton ACE service has been available since 1998 and has proven its worth in dozens of countries and thousands of wells. Several large clients have Halliburton perform ACE analysis on every well they drill.

Ideal for varying situations with ambiguous readings
ACE service is unique in the industry and seen as the standard of cement analysis in difficult situations. For example, it is ideal any time that:
• Operators use foamed or lightweight cement
• Cement becomes contaminated with hydrocarbons
• Clients suspect a micro-annulus might be developing
• Cement evaluation logs show ambiguity.