

## Post-operative Analysis of Cementing Job - Field Validation

### CHALLENGE

Cementing evaluation and remediation is costly. A post-operative analysis is a critical process used to find issues and identify the variables to adjust to achieve the success of cementing. This process requires experience, skills, time, and dedication in understanding the indications from the field data and simulations.

### SOLUTION

Implement CEMPRO<sup>+</sup> in post-operative analysis for early indication of success without the need for records. To eliminate the need for remediation, reduce the well construction time and costs, and optimize the costs for cement evaluation.

### RESULTS

The results provide a validation of the pressure calculation and fluid displacement simulation by CEMPRO<sup>+</sup> in comparison to the cementing records and logs. The analysis provided useful indications of the cementing job for the well. It guided the design and savings for future cementing in both the operating time and throughout the productive life of the well.

Due to events that are unpredictable in their magnitude, such as the degree of fluid contamination, potential mud channeling, lost circulation, fluid influx, hole size variation, and other causes, actual cementing jobs are expected to deviate from the planned design to some degree. After job execution, it is important to identify the actual top of cement, evaluate mud channels, poor bond, and contaminated cement. In this process, field data, cementing logs, and computer simulations are used to provide useful information.

PVI's cementing software CEMPRO<sup>+</sup> enables complete job simulations of hydraulics, temperature, displacement efficiency all together with post-job evaluation capability. Re-running the job on the computer after job execution using field-measured data such as pump pressure, flow rate, fluid densities, and volumes provides valuable information in the post-operative analysis.

One of PVI's Mexico based clients uses CEMPRO<sup>+</sup> in support with PEMEX and other local companies, such as Sniper Oilfield, in their ability to understand and improve well-cementing processes. In one of the successful applications of CEMPRO<sup>+</sup> modeling and analysis, the user was able to have a virtual computer reproduction of the job for a well of 2390m in TD. The calculated pressure profile together with the field data helped to eliminate the concern of losses (figure 1) and to predict the severity of channeling. With the planned top of tail (TOT) at 1284m, the simulated cement concentration results indicated TOT at 1300m (50% tail) and 2000m (100% tail), which are consistently predicted by ultrasonic logs ( max/min/average acoustic impedance and AI image) as shown in figure 2.

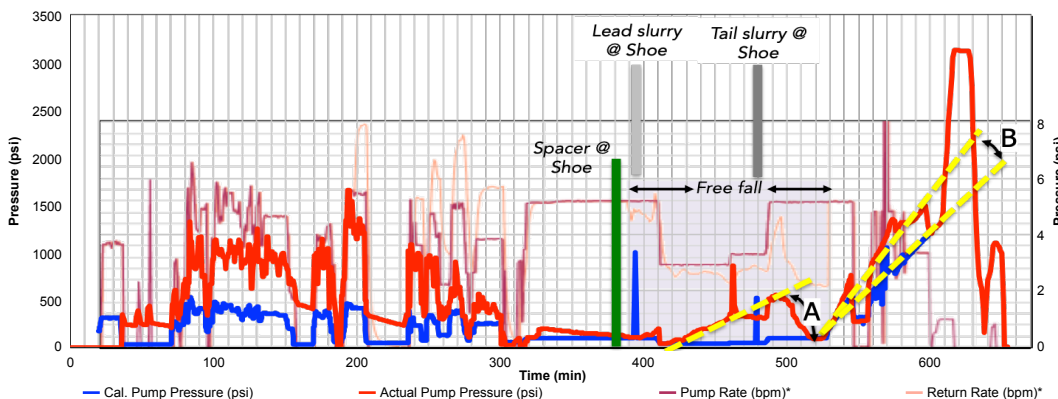


Figure 1: A job evaluation in CEMPRO<sup>+</sup> with calculated pressure and actual data. The differences indicated by A and B result from the channeling of lead and tail slurries. (\* Return rate is from simulation)

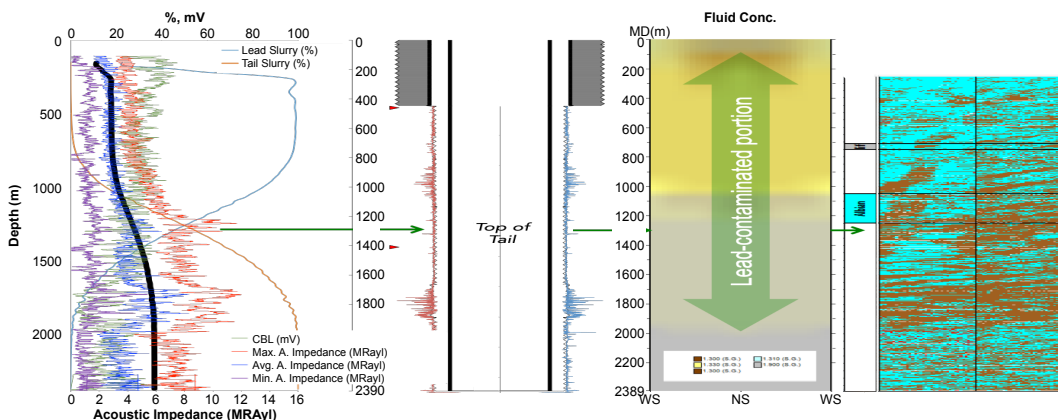


Figure 2: Simulated cement concentrations matched acoustic logs in a post-operative analysis.