

THE APPLICATION OF VARIOUS NANOMATERIAL TRACER-BASED SOLUTIONS IN MULTILATERAL WELLS TO EVALUATE PRODUCTION PERFORMANCE OF LATERALS

OBJECTIVE

In order to enlarge well drainage areas of the stock of old wells and to develop complex reservoirs, one of the common solution is multilateral drilling or sidetracking of the wells that have been in operation for a long time. In the course of the pilot studies performed jointly with an oil and gas production company, a task was set to evaluate the efficiency of sidetracking and production performance of two boreholes of one well.

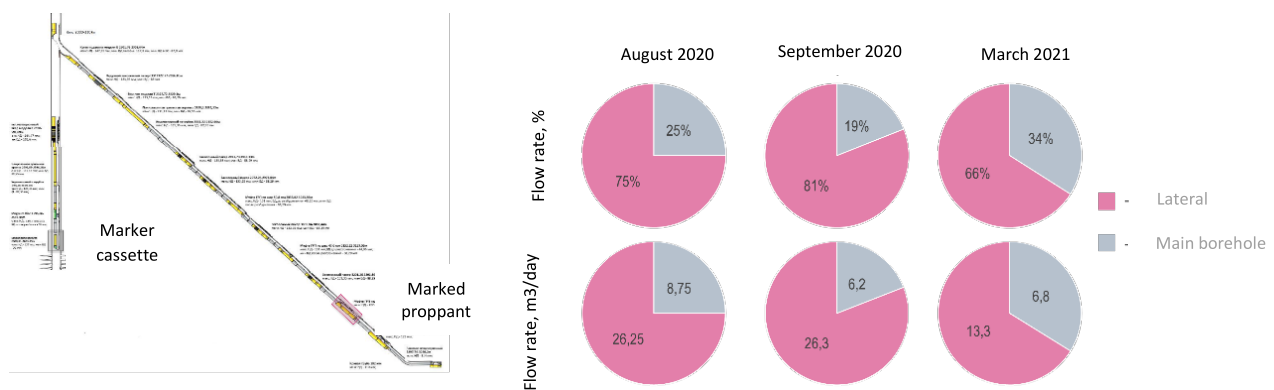
SOLUTION

It was the first time on the well that two different types of marker solutions were applied for the main borehole and for the lateral. A downhole cassette with the marked material was run into the existing mother borehole, while the horizontal sidetrack was fracked using the marked proppant.

APPLICATION

To ensure joint application of two types of solutions, a set of experiments to test the fluid flow through the marked material at different flow rates was conducted in the research lab; they provided marker release rates as a function of the volumetric flow rate for the proppant and cassette solutions. The resultant functions served as a basis for plotting calibration curves which were used to interpret the initial analysis data of the samples taken from the well in question.

The dynamic marker monitoring lasted 7 months. Reservoir fluid samples were collected in August and September 2020 and March 2021.



The marker diagnostics results demonstrate that it is the drilled lateral that contributes most (66–81%) to the well operation throughout the study. However, when converting flow rates to absolute values, its productivity is declining over time (from 26.3 to 13.3 cub. m/day). Meanwhile, there was a minor variation in the main borehole contribution in absolute terms throughout the test period (within a range varying from 6.2 to 8.75 cub. m/day), which demonstrates its stable operation. The resultant performance of the main borehole and of the lateral correlates to the design targets predetermined before sidetracking. The total well rate is declining because of the decreasing post-WI contribution of the lateral, though the main borehole liquid rate is stable.

SUMMARY

To evaluate the efficiency of the work done to enhance recovery by sidetracking a vertical well in the vintage well stock, two types of solutions were used for the first time: running a marked cassette into the producing mother borehole and performing hydraulic fracturing using the marked proppant in the lateral. Hence, a 7-month dynamic performance monitoring of the boreholes, which demonstrated the higher recovery from the drilled lateral that used the marked proppant versus the mother borehole, was successfully conducted on the well in question.

Therefore, the proposed technology can be scaled up and adjusted to evaluate borehole operation efficiency in various wells both in the vintage and novel well stock with any type of completion.