EVALUATION OF THE LARGEST RUSSIAN OIL FIELD DEVELOPMENT PERFORMANCE USING THE COMBINATION OF HYDRODYNAMIC MODELING AND HORIZONTAL WELL PRODUCTION LOGGING METHODS USING MARKERS

CHALLENGE

One of the largest subsurface users has a field that is marked by a complex structure of productive horizons with three layers of a particular interest; two of them being medium and low productive, the one with productivity lower than normal. Field development is impossible without an active impact on its productive strata. Hydraulic fracturing is one of the most effective methods for intensifying oil production from low-permeable formations and increasing the oil reserve recovery.

SOLUTION

GeoSplit offered the subsurface user an innovative and cost-effective solution based on the use of a unique marked proppant with quantum dots creating separate signatures for each stage of multi-stage hydraulic fracturing. Marked proppant was injected during multi-stage hydraulic fracturing operation. GeoSplit employees provided the subsurface user with the history of inflow profile, then several options for hydrodynamic models were calculated.

APPLICATION

The hydrodynamic model included the calculation of four options with different fractions of hydraulic fractures operating at the site: 100%, 80%, 66% and 33%. Hydraulic fractures in the model were randomly disconnected with the relevant probability. Less than 70 operating hydraulic fractures remained out of more than 200 hydraulic fractures in the model with 100% successful hydraulic fracturing results, the worst model, with a 30% success rate.
Timely detection of broken hydraulic fractures will enable effective decision-making for maintaining or increasing the coverage area of the developed facilty.
Instead of one-time downhole operations, the well is equipped with high-tech material (quantum markers), which is released into the formation fluid. The fluid is further analyzed on the surface using special equipment and AI-based software. The data are automatically processed and continuously transmitted to the customers' electronic systems.
Then, the developed hydrodynamic models are updated based on marker diagnostics data. The customer can thus obtain reliable information on the actually operating well ranges and the flow rate of the incoming fluid, identify ranges of water or gas breakthrough, evaluate the effectiveness of reservoir stimulation and, as a result, select the optimal well production conditions.

CONCLUSION

The combined application of production logging with the option of fractures modeling and high-tech methods for marking each port with unique codes for oil, water and gas in injection and production wells provides with unique opportunities for solving applied problems related to localizing residual reserves and maintaining the field site development efficiency. This also contributes to the development of methods for involving the maximal number of MFrac stages in the operation.