APPLICATION OF THE CRM MODEL AND MACHINE LEARNING ALGORITHMS FOR MANAGING FIELD DEVELOPMENT BASED ON DYNAMIC MARKER MONITORING DATA

OBJECTIVE

A sharp production rate declines due to formation energy depletion as we recover from a reservoir is a common and rather pressing problem which occurs during field development. In order to overcome it, secondary recovery techniques, namely formation pressure maintenance (FPM) systems, are employed at numerous fields.

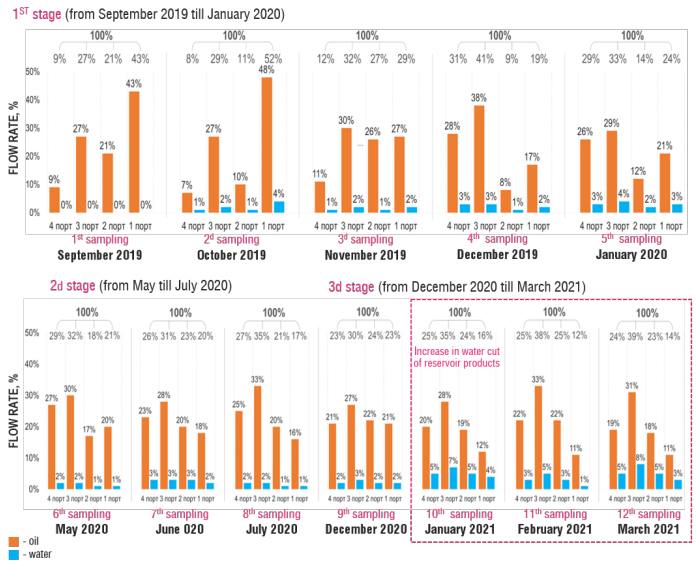
It can be difficult to control pressure maintenance systems when several injection wells located close to each other are operated simultaneously because the injected fluid path may be hard to define. It is especially hard to predict flow direction in unconventional reservoirs, which are more and more common these days, and this uncertainty leads to uncontrolled risks of premature water breakthrough.

SOLUTION

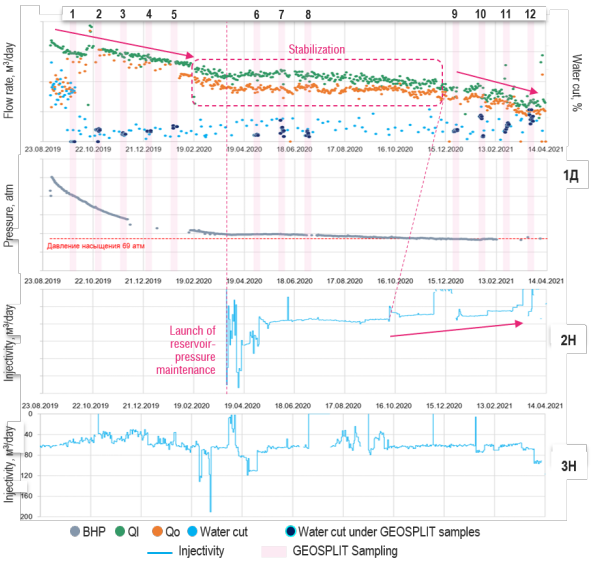
In order to decrease the uncertainty in supporting the flow paths of the pressure maintenance system, the dynamic marker monitoring technology was used for horizontal injection wells in one of the areas.

The marker monitoring showed an increase in the reservoir fluid watercut taking place over the recent months. The connectivity established between the well being monitored and Injection Wells No. 2N and 3N enabled to identify the source of water; however, it is difficult to say which of the injection wells has a more significant effect because it is impossible to trace a distinct response in the bottomhole pressure.

DYNAMICS OF WELL INTERVALS PERFORMANCE BY OIL AND WATER



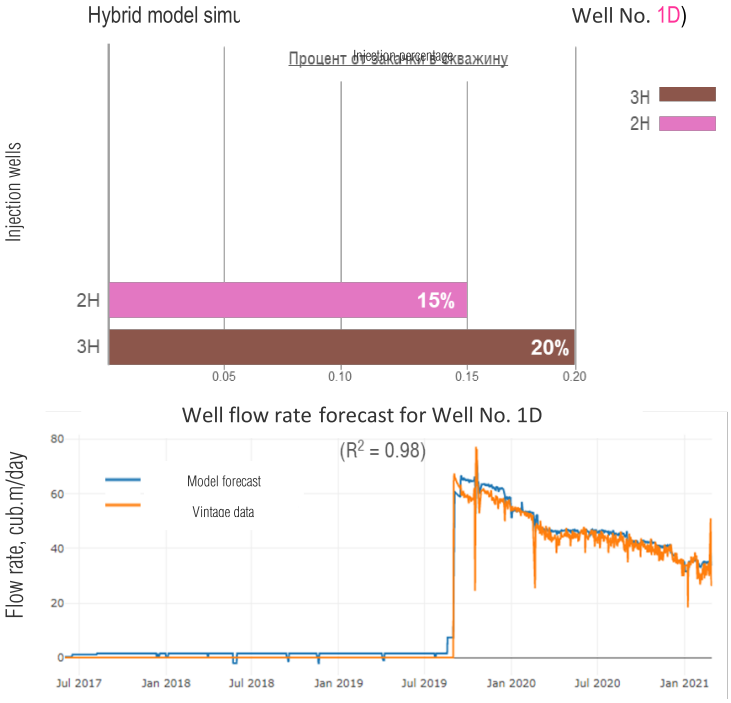
WELL OPERATION HISTORY

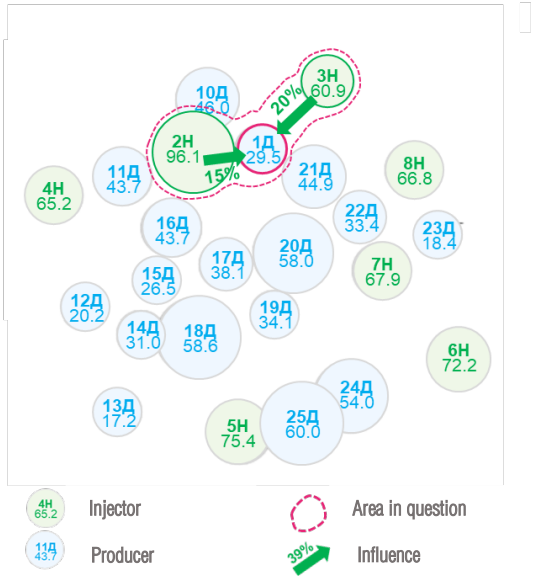


GeoSplit has developed a hybrid simulation model that can define the degree of the effect injectors have on producers, i.e., it shows the proportion of water which reaches the producer from each injector. The hybrid simulation model uses a standard CRM simulator (a material balance equation-based model), which also includes machine learning algorithms. The tool is applicable both to existing formation pressure maintenance systems and to the fields at the primary development phase. It should be mentioned that the tool can be used to define well interference during conventional field development, when no formation pressure maintenance system is employed.

GeoSplit LLC • +7 (495) 280-1-006 • www.geosplit.org • info@geosplit.org
121205, Moscow, Innovation Center «Skolkovo», Bolshoy boulevard street 42, building 1

WELL INTERFERENCE





Processing data with the hybrid simulator revealed well interference rates which gave an idea as to what proportion of injected water from a certain injector reaches the producers in the immediate vicinity. The study revealed that 15 and 20 percent of the injected water reaches the producer in question from Injection Wells No. 2N and 3N, respectively. Thus, in order to decrease watercut of the producer under analysis, it is recommended to consider rearranging injection volumes.

The key advantages of the simulation model lie in the fact that it is easy to use and it enables quick calculations and prompt decision-making related to the development system management.

SUMMARY

Implementing the hybrid simulation model into field development process is positively promising. The piece of work described above demonstrates that it is possible to use machine learning techniques and CRM simulation to study interference between injectors and producers using vintage operation data and well spacing maps.

The resultant well interference assessment can be easily implemented and it demonstrates high reliability which is based on the actual versus forecast data, and also on comparison to the reservoir simulation model. The approach we use can be applied to other development targets.