

# **Unlock Potential and Applied First Microseismic Monitoring of Hydraulic Stimulation in Tight Carbonate, North Kuwait**

**Nour Alaboud<sup>1</sup>, Sabry A. Eissa<sup>1</sup>**

<sup>1</sup>KOC

## **Abstract**

**Objectives:** Nowadays tight oil reservoirs in the Middle East are require non-conventional development approach due to the complexity and challenges faced. This work was performed on the tight carbonate formation with relatively low permeability and medium-to-high oil viscosity ranging from 8 to 20 cP. In order to efficiently develop the target formations, multistage acid fracking techniques have been identified as one of the most viable strategy. The main parameters of the well design that affect cost of the well and overall economics of the project is the laterals length and number of acid fracking stages. To determine optimal well design, the first micro-seismic monitoring operation of hydraulically stimulated wells was ran in Bahrah and Sabriyah oilfields, northeastern Kuwait to evaluate the capacity of the micro-seismic in optimizing the fracturing process and consequently improving the production of these reservoirs.

**Procedures:** The major phases are to select the treatment well drilled in minimum stress direction, observation well, sensors network design, deployment, acquisition, data processing, results delivery and interpretation Then, The geophones was deployed in observation well nearby treatment well to record the seismic waves emitted by the microearthquakes induced by the rock fracturing process. This seismicity was located and characterized to image the fracture networks growth under the effect of pumping. From this, fracture geometry parameters were assessed, characterized stress and hazard, monitored and analyzed unexpected behaviors.

**Results and conclusions:** By providing information in real-time during rock stimulation operations, allowed to reliably estimate fracture geometry and to finely track fluid propagation induced seismicity as well as capturing unexpected behaviors due to acid frac leak-offs. This provided a valuable insight into formation response to stimulation and helped to calibrate injection models during pressure pumping operations to optimize the production of these semi unconventional reservoirs. Finally, it helped to assess hydraulic stimulation effectiveness and to characterize stress and hazard.

The results from this study can serve as a point of comparison for future well planning and for successful field development. It can help to optimize well design and placement, stage spacing, evaluate the potential risk of frac hits or stress shadowing and the associated interferences to maximize production safely and at lower cost.

The abstract reports on the development approach in tight carbonate and first usage of microseismic monitoring in Kuwait. Monitoring met the initial objectives and both the approach as well as results are now a baseline for the effective development of hydraulic stimulation in these reservoirs and others with similar characteristics.