

A Multi-Disciplinary Integrated Approach to Understand the Potential of the Najmah-Sargelu Reservoirs of the Dharif and Abduliyah Fields (West Kuwait)

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ABSTRACT

The Najmah and Sargelu, two Jurassic, tight carbonate reservoirs, are oil bearing in the West Kuwait fields Dharif and Abduliyah. Due to their structural complexity, presence of numerous natural fractures and low matrix porosity and permeability, these reservoirs have been underdeveloped in both fields. A multi-disciplinary integrated study has been performed to investigate their potential thoroughly and design an appropriate future development plans.

3D seismic volume interpretation is carried out to identify major fault and fractures along with respective top and bases of target reservoirs (Najmah, Sarjalu and Dharuma). Seismic fracture index maps showing the presence of detailed fracture corridors are generated and exported to 3D grid for further modelling. Fractures are lithology dependent. Therefore, a matrix characterization study is also carried out tying seismic facies attributes along with well log and sedimentological data. Average shale proportion maps are used as a guide to populate fractures dependent porosity and permeabilities during subsequent property modeling.

From the available well data, mainly core description and well logs, a detailed sequence stratigraphic interpretation and petrophysical models are created performed. Well constrained facies model is then propagated to 3D space for both the fields.

Finally analysis of the natural fracture network is made using multiple sources of data like core description for fractures, image logs, seismic maps, transient well tests; production data etc. A Discreet Fracture Network (DFN) model is created and then dynamically calibrated. The equivalent fracture properties (porosity, permeability and fracture spacing) are all incorporated in to a dual porosity – single permeability simulation model.

Using the limited production and pressure data in both Dharif and Abduliayh fields, the dynamic models were adjusted to fit the production history. Minor modifications are done in the model takin the advantage of uncertain oil-water contacts and fractures properties around the wells. The calibrated dynamic models are then used to test several development scenarios. Dharif potential, due to the presence of a thin oil column, is shown to be limited. Abduliyah potential, on the other hand, is likely to be greater if the fracture network is proved to be as permeable as in Dharif. If this is confirmed, horizontal producers located at the crest of the structure will be the most suitable option for development.