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Establishing Petrophysical Benchmark for the Burgan Field in Kuwait. A Case Study

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ABSTRACT

A field-wide petrophysical re-evaluation project was carried out for the Greater Burgan field of Kuwait. The evaluation covered Early Cretaceous Burgan Sands and the platform carbonates of Mauddud as well as Late Cretaceous Wara and Ahmadi sequences. The aim of the project was four fold. First, a comprehensive open hole well log database was constructed to serve as the foundation for the subsequent work. Second, standardized and auditable log processing and normalization procedures were prepared to facilitate the petrophysical interpretation. Third, a core calibrated petrophysical model was generated for each reservoir in the analyzed interval. Finally, a consistent process was implemented to evaluate new wells in the field. The 1000 wells processed in the study were divided based on old and modern vintages. The old vintage of wells (nearly 400 wells) in the Burgan field were processed to derive shale volume, porosity and water saturation estimates. A consistent Neutron counts to porosity index conversion algorithm was implemented for the old vintage Neutron tools. The petrophysical properties distribution in the old vintage wells were validated against modern well data in offset wells. A Potassium Chloride correction workflow was introduced in the processing of the modern wells that included quantitatively estimating and then removing the borehole effect. For consistency, complete set of environmental corrections were performed on Gamma Ray, Neutron Porosity and Bulk Density logs. The key well study was performed on 46 wells in the field, incorporating all core and advanced log data. Thorough examination of XRD and integration with thin-section data revealed formation complexity and heterogeneity which was studied in detail. Other core data including core grain density, porosity, permeability and critical saturation from SCAL data in addition to advanced logs including capture spectroscopy and magnetic resonance log data was used for model validation. The validation process was implemented at each step of the workflow to reduce the results uncertainties. The modern wells that were processed using defined workflows from the study showed consistent results when integrated with new core and dynamic data such as production logs. The results of the new and improved petrophysical analysis would fulfill the first ever reservoir rock typing and the next generation full field static model requirements for the Greater Burgan field.