

## **Applications of Source-Less NMR Technology in Integrated Formation Evaluation for Tarmat Identification, Geosteering, and Smart Completions Design – A Case Study from Middle East Jurassic Reservoir**

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### **ABSTRACT**

This paper presents the successful integration of advanced NMR (magnetic resonance) source-less technology with core data and other technologies to resolve the challenges of reservoir characterization (including identification of tar mat) and placing the wells in best reservoir zones. This enabled subsequent ICD completion design for optimal production in these complex carbonate Jurassic reservoirs. A comprehensive suite of advanced, conventional logs and core data were used. Wireline suite covered both conventional (Resistivity-Density-Neutron-Gamma Ray-Acoustic) and advanced (NMR-Elemental Spectroscopy-Image) technologies in one of the pilot wells. In another calibration well, a combined data gathering was designed including wireline (Resistivity-Density-Neutron-Gamma Ray) and LWD NMR (magnetic resonance) to log the same reservoirs. Integration was done using these conventional, advanced logs and core data to establish the correlations to derive permeability in this complex carbonate Jurassic reservoirs. From these study wells, a correlation was established between the NMR porosity, density/neutron porosity and core porosity to enhance confidence on NMR measured porosity. The NMR permeability index was calibrated using parameters that were developed by integrating NMR results with the core data. This permeability relationship (core and NMR) was applied in all the lateral wells with LWD NMR results that targeted the same reservoirs in the field. For delineating the tar mat interval, a combination of NMR, Density and resistivity measurements was used. The LWD NMR results provided real-time reservoir characterization with rock quality (porosity distribution, permeability) which helped in ICD completion design and enhanced well placement. This approach and technology also enabled substantial rig time savings and reduced HSE risks. This approach demonstrates strong benefits of data integration and proven LWD NMR source-less and lithology independent technology in addition to the resistivity and gamma ray as the preferred solution for advanced reservoir characterization, ICD completion design and enhanced well placement in complex carbonate reservoirs. Solution for reservoir characterization which enabled confident decisions on ICD completion design and enhanced well placement by implementation of source-less technology by eliminating the risks of using radioactive source based technology.