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Reducing the Uncertainties Associated with Well Placement-Integrated Approach Case Study of a Carbonate Field Onshore Abu Dhabi-UAE

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ABSTRACT

Generating a pre-well model before drilling, is an established industry procedure for any well that is planned to be geosteered. This model, which can be up-dated in real-time, allows for prediction of properties along the trajectory, which serves as a guide for accurate placement. An alternative approach that involves collaboration within a multidisciplinary team, can create strong understanding of the subsurface geology that can greatly enhance reservoir exposure without the so called pre-well model.

Placement criteria were defined to characterize the target of interest. This characterization involves using log measurement to define boundaries and cut off values for a particular rock and fluid property. In XH field, the top of the reservoir boundary was defined by the contrast between the GR values of the two layers within gross reservoir interval.
The lower limits of the wells were defined by the lowest resistivity values beyond which we risked being in the area of high bound water as a result of increasing micro porosities. The resistivity ranges were based on 2D petrophysical resistivity map which enabled us to divide the field into sections. Other rock properties, such as porosity and density values, also have ranges defined to keep the well in most productive layer. The cut offs were handed over to the LWD and well placement engineers before the horizontal section. Prior to this stage, a thorough review of subsurface geology and its associated log responses with the nearby wells were systematically inferred. The greatest uncertainty was the dip of the bedding planes. In order to avoid unplanned exit from the reservoir, real-time dip picks from the density image was utilized. During operations, the wells were intentionally landed in excess of 10ft TVD to penetrate different layers to target high resistivity units.

Analysis and comparison of the placement accuracy of the newly drilled wells with the previous wells using saturation and other petrophysical parameters obtained from computer processed interpretation shows that the wells drilled with the integrated approach were better placed. Even though we had lateral variations in the horizontal section, we were able to steer the wells in the desired unit. Also, the actual resistivity values of the new wells correlated well with the predicted resistivity from 2D map thereby increasing our confidence to drill future wells with the same approach.