Impact of Geological Uncertainties on Advance Wells Design and Optimization

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Application of advance wells technology to improve well productivity by maximizing contact with the reservoir quality rock is becoming more and more common in the oil and gas companies for developing different reservoir types. These wells are also known as Maximum Reservoir Contact (MRC) wells. By definition, these are multilateral horizontal wells with more than five km of total contact with the reservoir rock. Such long, reservoir contact wells bring not only advantages; but also present new challenges in terms of drilling due to the increasing length and complexity of the well's exposure to the reservoir. In addition, the local reservoir dynamics governed by geological properties definition influence the performance of these wells. An optimization performed in different geological realizations may give different well designs. Therefore, planning of these wells require extensive modeling studies to simultaneously optimize well placement,lateral branches and the inflow valve configurations for equalizing fluid flow along the entire wellbore while taking into account the various geological uncertainties.

West Africa will play a very important role as deep-water production increases over the next decade. Considering the high cost of drilling in the deep-water and limited number of drilling slots, risk reduction and a minimization of exposure to early water production become critical to a higher success rate of such wells. Adequate knowledge of the workflow involved in modelling such wells with the seamless coupling of geological uncertainties will allow the right wells to be drilled in the right places and so reduce risk and enhance total oil recovery.

This paper describes an integrated workflow to model maximum reservoir contact wells in the presence of geological uncertainties. First, different geological realisations were screened based on volumetrics after which representatives were selected. Potential well locations were then identified and different well design scenarios applied on each representative. For each representative, optimum well design scenario was selected based on oil recovery and water breakthrough. Finally, well placement, numbers and length of laterals and valve configurations were further optimized for selected scenarios. The extensive modelling of the MRC wells under different geological uncertainties offers a better understanding of the reservoir dynamics, which will facilitate better reservoir management decisions.