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Sidetrack/Recompletion Time Evaluation by Proxy Model

Ajibola J. T., OroduO. D., SPE Covenant University, Nigeria; Onyeukwu C. A., SPE SPDC Nigeria

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Abstract

Sidetrack during field development and ongoing production arises to exploit bypassed reserves (unswept areas under secondary and/or tertiary recovery), unexploited zones and unforeseen conditions likely to build due to uncertainties and heterogeneity in initially characterizing a reservoir. Whereas recompletion is prone due to sequential production of stacked reservoirs or multiple pay zones that is necessitated by regulation on comingling. The purpose of this paper is to optimize the time for sidetrack/recompletion job in multiple pay zones in view of maximizing returns on investment. A simple case to elicit the workflow is based on two pay zones and applies Experimental Design (ED), and economic analysis in the form of Net Present Value (NPV).

The procedure followed for this study started with the identification of the reservoir uncertainties and their ranges; focusing basically on net pay thickness, porosity, permeability, and time to perform the sidetrack; the reservoirs are assumed to be undersaturated. The Box-Behnken response surface design in ED was used to reduce the number runs to make by generating the most effective combination of variables for the experiment. Experimental runs were conducted with a Black Oil reservoir simulator to give production profile. NPV values using stipulated Oil price, CAPEX, OPEX, tax rate, royalty and production rates were estimated, which was used afterwards to produce the Proxy model in ED and this developed correlation was used to analyse the effect of time changes. NPV computed from the Proxy Model was reasonable; however, a higher level D-Optimal design as against the 2-level design used in this study may be required for a reasonable match of NPV with respect to sidetrack (recompletion) time.

In conclusion, the incorporation of time was successful and gives way to studying the impact of not only reservoir uncertainties but the uncertainty that arises from a success or failure of the sidetrack that further gives way to the application of decision analysis and the evaluation of NPV by Proxy Models for each possible outcome.

Introduction

The reasons for sidetracking an existing well vary from well to well, such as to bypass an obstruction in the well that cannot be removed or can damage the well, to deepen a well or to relocate the bottom of the well to capture additional hydrocarbon reserves, which is often horizontally removed from the original well. Whatever the reason for a sidetrack is it always comes down to one point which is the economics. Restoring or increasing production from an existing well using a sidetrack is usually always a quicker and significantly cheaper way of accessing a new horizon or a better spot in an existing horizon while using the same wellbore especially when the existing zone is depleted or no more prolific. In some cases, the depleted zone is plugged back or abandoned and the new zone is produced by itself. This is the most common type of sidetrack procedure. However a situation may exist where it is desired to sidetrack an existing producing well which is still prolific to a new zone with the aim of producing both zones simultaneously in order to maximize recovery from an asset. For example, say the field lease life runs out in a few years without any chance of renewal. Developments in the drilling and completion technology have made it possible to access these additional targets without losing the existing production interval. However such procedures are not without its risks.