

## Risk Assessment of Optimal Sidetrack Time

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Optimal time of sidetrack is evaluated considering the uncertainties of reservoir variables as it affects production performance and economics based on the uncertainty associated with the sidetrack operation. Analytical production performance schemes are applied to study scenarios of production under natural decline and water-flood recovery using Monte Carlo simulation. Caution should be exercised on assumptions made to simplify the objective function, as it may not truly represent subsurface flow. Full evaluation of sensitivity of time to reservoir variables is possible using a proxy-model based on experimental design due to the complex physical phenomenon of subsurface flow.

*Keywords:* Monte-Carlo, optimization, risk assessment, sidetrack, water-flooding

### INTRODUCTION

Nind (1981) applied Arps' rate-time exponential decline curves to optimize net present value (NPV) for field development, which paved the way for extensive analysis of the risk involved with sidetrack (recompletion) in wells under primary recovery (Lerche and Mudford, 2001; Lerche and Noeth, 2004).

Optimal sidetrack time had been evaluated by Lerche and Mudford (2001) for a well under primary recovery, focusing on the geological and technical uncertainties combined into probability of killing the producing zone and successful sidetrack and production from the zone into which the well had been sidetracked. Other uncertainties include economic parameters without considering the uncertainties of reservoir variables as they affect production forecast. Evaluation of the sidetrack is based on NPV (Johnson and Mather, 1991; Lerche and Mudford, 2001). This study evaluates the optimal sidetrack (recompletion) time for single well production under natural mechanisms and a production well under water-flooding from an injection well to model secondary recovery by water-flooding. For the former case, reservoir variables were of the decline model used to measure the correlation of the variables with sidetrack time. For the case of secondary recovery, simultaneous and sequential sidetrack of both the production and injection wells are investigated. The investigation of effects of reservoir variables finds application to the use of initial information from well test and core flooding experiments.

Risk assessment is based on probability of possible outcomes of sidetracks (Figure 1) by incorporating geological (Lerche and Noeth, 2004; Zabalza-Mezghani et al., 2004) and technical

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