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Optimizing Lateral Well Spacing by Improving Directional Survey Accuracy

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Abstract

Optimizing lateral well spacing is a challenging problem that has significant economic consequences. The intent is to drill the fewest number of horizontal wells that will effectively maximize reservoir drainage. Successful field development requires spacing horizontal wellbores at an optimum distance that minimizes overlapping drainage areas without stranding reserves. There are many variables that must be considered when determining lateral spacing such as hydraulic fracture geometry and reservoir properties. However, a variable that is often overlooked is wellbore positional uncertainty. It is common to ignore the contribution that inaccurate directional surveying has on lateral wellbore spacing. The purpose of this paper is to demonstrate how inaccuracy in standard directional surveying methods impacts wellbore position and to recommend practices to improve surveying accuracy for greater confidence in lateral spacing.

Standard directional surveying by measurement while drilling (MWD) is subject to numerous error sources which can be estimated by the Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA) error model (Grinrod 2016). These error sources are quantified and modeled as three dimensional Ellipsoids of Uncertainty (EOUs) which provide drillers a mechanism for measuring positional uncertainty associated with the wellbore trajectory. The ISCWSA error model can be used to predict the statistical distribution of wellbore positions in order to gain an understanding of how far actual well paths might deviate from the surveyed position. Furthermore, some of the greatest error sources represented in the error model can be significantly reduced using In-Field geomagnetic Referencing (IFR) and Multi-Station Analysis (MSA) in order to improve the accuracy of the MWD surveys (Maus 2015). Performing advanced survey management analysis to raw MWD data and correcting identified systematic errors in real-time improves the accuracy of the well placement as the wellbore is drilled.

In order to reliably determine the most optimal lateral well spacing, positional uncertainty should be considered and applied to reservoir simulations and production models. Furthermore, applying IFR and MSA survey corrections to standard MWD surveying can improve horizontal wellbore positional accuracy by 50 to 60 percent (Maus 2015), thus leading to better decisions for optimizing field development and maximizing wellbore value.