The Effects of Complex Geology in Planning Long Horizontal Wells

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ABSTRACT

As horizontal drilling has become the main development method in both conventional and unconventional play types, new challenges have arisen in well planning. Remaining in zone is a key objective of any horizontal program and is complicated by many factors including the thickness of the vertical window, the presence and magnitude of faulting and dip changes along the well's trajectory. Over the course of drilling three dozen wells in different geologic settings, O'Brien Energy Company has developed a detailed planning method to remove as much uncertainty pertaining to structural complexity prior to spudding the well. Using a series of case studies from East Texas, we can illustrate the importance of a multi-disciplinary approach, using all available data at our disposal, in interval targeting. Because geosteering interpretations are made incrementally along the well path, it is important to set expectations prior to spud. Describing each well using a specific geologic model, constrained by well control, is the best way to plan each trajectory and set expectations. Well control is the only true point in the subsurface that can be reliably targeted. In areas of complex faulting and dip changes however, straight line approximations breakdown as do well-to-well correlations. This complicates geosteering interpretations and the result is lost time, due to being out of zone, and unnecessary tortuosity in the wellbore. Therefore it is important to include seismic data, where available, to account for fault positioning and offsets as well as anticipated dip changes. Small variations in these phenomena can augment steering problems as turning the bit takes time and is impacted by the rock types being drilled through. Unfortunately, seismic resolution is often an order of magnitude more than the interval being targeted so these data will not be as helpful during drilling and could mislead the technical team if overly relied upon. Lithological data from cuttings in offset wells can also be incorporated to constrain position vertically in the event there are discernible changes with depth.

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