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Wellbore Stability Prediction and Anisotropic Modeling in Highly Tectonic Basin, Eastern India

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Abstract

Wellbore stability analysis has been carried out for wells to be drilled in a highly tectonic area, involving overpressured sands, laminated shales and steeply inclined beds, in Eastern India. Data acquired on wells abandoned in the past with 52 to 73% NPT, have been utilized to generate static mechanical properties and in-situ stress information. The NPT was associated with kicks, stuck pipe, losses, washouts, and heavy reaming. Abnormal pressures were encountered below +/- 200m, including extreme overpressures in some areas. Well walk/direction problems were indicated at least in one of the wells. Most wells could not reach their TD and were abandoned prematrurely.

Considering the nature of the identified problems, safe mud weight windows have been predictied to avoid shear failure in the native formation, slippage along the dipping bedding planes, and mud losses. Both isotropic and anisotropic failure parameters were estimated and utilized in modeling wellbore stability.

The results of the wellbore stability modeleing were utilized in the field to drill a new well to a depth of 10,000 feet. The wellbore initially had to be side-tracked after encountering stability issues and losses. Pseudo-real-time modeling updates to the pre-drill model, based on data acquired while drilling and more recent pore pressure and bedding dips information, resulted in further refinement of the model in the overpressured zone. The implementation of the updated model, which included slight modifications to the wellbore trajectory allowed the wellbore to reach reached the planned objective TD without any major problems. Lessons learned and best practices adapted have been captured and reported. It has been observed from the results that the anisotropy in shale strength, changes in bedding dips and steeply dipping beds, could play a significant role and must be considered when drilling wells in a highly tectonic area.