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Geomechanics And Drilling Fluid Solution in Eliminating Stuck Pipe Incidents in Weak Shale Formation and Highly Depleted Brown Field

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Abstract

Most drilling problems are caused by wellbore instability issues which result in nonproductive time. These issues include stuck pipe, caving, lost circulation, differential sticking, and tight holes, requiring more time for treatment and therefore additional drilling costs. Field A is well known for its wellbore instability related to weak shale and depleted sands which pose high risk of differential sticking and stuck pipe. This requires critical solutions related to the mud weight selection, bridging material solution and ultimately direct impact to casing point selection to mitigate the challenges.

Innovative solutions on bridging material selection and mud weight determination have been initiated via series of analysis from offset wells analysis and simulations. The geomechanical model was constructed using offset well log data and calibrated with drilling data such as leak -off test (LOT), modular formation dynamics tester (MDT) as well as drilling events. Model verifications between the predicted geomechanical model and the actual borehole failure were performed to examine the model accuracy and to determine the suitable mud weight to drill the problematic interval of interbedded weak shale and depleted sands. The high overbalance from the depleted sands lead to risk of differential sticking and stuck pipe. Hence, extensive simulations and lab tests are done in selection of bridging agent size to reduce the fluid invasion into formation and minimize the filter cake formation.

Zero stuck pipe incident recorded in the field with the optimum mud weight and bridging agent selected across the interbedded weak shale formation and depleted sand interval. Isolation of the problematic shale helps to successfully mitigate the weak shale problems in boreholes. The bridging material selection has also been proven to contribute to the success through real time fluid invasion analysis. No fluid invasion observed in the shallow and deep resistivity in the depleted sand sections and no caving observed indicating no wellbore instability issue.

This paper intended to document the solutions to mitigate the stuck pipe issue in the field as best practice to be carried out in the future.