Baker Hughes combines geomechanics expertise with proprietary software to generate highly robust geomechanical models that evaluate the potential risk of wellbore instability. Our comprehensive modeling approach will help you better understand the link between wellbore instability and geomechanics, while providing recommendations on specific operational practices that can reduce costs and optimize drilling parameters.

**Improve wellbore stability with accurate geomechanical modeling and detailed model calibration**

Prior to constructing the geomechanical model, Baker Hughes performs a comprehensive review of available data acquired in existing offset wells. Each piece of data, from drilling reports and well logs to surface and downhole measurements, is extensively reviewed and analyzed by expert consultants to extract the most meaningful geomechanical information. Mud weights, rates of penetration (ROP), and intervals where drilling problems occurred (kicks, lost circulation, excessive caving) are combined with log-derived rock properties and stress and pressure data to build a complete understanding of the geomechanical properties of the field.

Baker Hughes uses advanced proprietary software packages such as GMI•SFIB™, GMI•WellCheck™, GMI•Imager™, and GMI•Caliper™ to analyze the parameters that control wellbore instability and determine the operational practices that mitigate risks.

We rigorously test the validity of our geomechanical model by comparing it against actual drilling experiences and wellbore failures observed in previous wells. Once the model is validated, the derived, field-specific geomechanical model is used to predict the mud weights and casing-seat depths required to prevent...
borehole collapse and/or lost circulation in the proposed wellbore trajectory. The resulting safe mud window and optimal casing-seat depths are represented in simple, yet highly informative color-contoured diagrams and log-type displays. These plots provide an easy way to see how changes in mud weights, drilling directions, and casing set points will affect stability and the potential for lost circulation in any of your planned wells.

Increase profit through quantitative risk analysis
Baker Hughes enhances the value of our models by performing quantitative risk analysis (QRA) to quantify the effects of model uncertainties on the predicted mud weights and to define how different parameters in the geomechanical model affect the predicted likelihood of drilling success. At the end of the QRA analysis, Baker Hughes can identify and recommend acquiring specific data necessary to reduce the model uncertainty.

Leverage the latest shale stability techniques
If water-based muds have been used or are being considered, Baker Hughes can use chemoporo-elastic models within our GMI•WellCheck software to investigate the impact of chemical effects. These models assess the importance of time-dependent formation weakening due to chemical mud-rock interactions. Baker Hughes can also determine the impact of weakly bedded or fissile shale and fractured rock on wellbore stability. The additional failed rock caused by these unexpected weaknesses can result in the total collapse of horizontal and highly deviated wells.

Enhance underbalanced drilling plans
Baker Hughes can predict whether a section of your well can be drilled underbalanced by calculating the minimum mud weight required to maintain a limited amount of breakout. The approach uses a coupled, time-dependent poro-elastic solution for stresses, combined with a brittle-elastic failure model for instabilities that develop above the bit. The analysis can predict the degree of instability as a function of hole size and rock properties, including grain size. Outputs include the width of failed zones in both compression (breakout mode) and tension (spalling mode) as a function of underbalance, ROP, and rock strength. The modeling results allow you to select the optimal mud pressure and drilling design to limit the volume of failed rock for your planned well.

Evaluate additional trajectories or modify well design
Baker Hughes can include a copy of GMI•WellCheckCD™ software, which is a fully functional version of GMI•WellCheck, tied to the geomechanical model developed for the study field. Using input files designed specifically for the study field, you will be able to evaluate any wellbore trajectory in terms of mud weight options for improving wellbore stability.

To find out how our geomechanical modeling approach can reduce the risks of wellbore instability in your next well, contact your Baker Hughes representative or visit us online at www.bakerhughes.com/geomechanics-consulting.