

*New Innovations in Borehole Stability Analysis for Horizontal Wells*

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Borehole instability during well construction can take many familiar forms such as stuck pipe, hole squeezing, lost circulation, severely enlarged hole and difficult directional control. Many related problems can arise when these problematic boreholes finally reach their target and are completed, including: uncertain formation evaluation, poor cementing, casing deformations, casing wear, and ineffective perforating. Borehole instability costs the global oil and gas industry several billions of dollars a year in downtime, extra well construction costs, and lost production.

This poster describes how the latest release of Advanced Geotechnology’s **STABView™** well planning software and **ROCKSBank™**, a rock mechanical and petrophysical database, can be used to reduce unnecessary costs associated with borehole instability, lost circulation and undesirable fracturing in a variety of difficult geological settings. These problem costs are often associated with borehole instability in weak, fissile or reactive shales, especially in tectonically disturbed areas, such as the Canadian Rocky Mountain Foothills. Advanced well planning tools can be used to determine the optimal window of bottomhole pressure or mud density and fluid properties for drilling vertical, horizontal and deviated wells in these settings. A number of predictive methodologies have been developed for assessing borehole instability risks, ranging from relatively simple linear elastic models through to more complex non-linear models that require numerical simulation. In addition to selecting an appropriate model for a given borehole instability risk analysis, the accuracy and applicability of these model-based predictions depend heavily on the criteria used to identify the onset of unacceptable levels of risk – e.g., the probability of getting stuck, not being able to clean the hole, losing circulation, or developing a large annular area to be cemented.

This poster first summarizes the key factors contributing to borehole instability. Several examples of advanced borehole stability analysis techniques are shown including: the generation of a drilling risk and mud weight window profile (Figure 1); elastoplastic yielded rock predictions, polar plots for directional well planning in weak dipping shales; techniques to calibrate analyses to offset well caliper logs; a novel coupled borehole instability-multiphase flow modeling procedure for underbalanced drilling; and a numerical geomechanical model to assess the probability of intersecting a well to be abandoned with a horizontal twisting fracture.