Wellbore Stability: Special Considerations for the Marcellus Shale

Julie Kowan, Baker Hughes, and See Hong Ong

Abstract

Wellbore stability problems such as tight hole, pack-off, stuck pipe, inflow and lost circulation are most commonly associated with conventional reservoirs but also occur in unconventional reservoirs. Prevention of wellbore instability saves time and money and can often be achieved by deriving a field-specific geomechanical model to inform the drilling recommendations. A basic geomechanical model consists of an understanding of the pore pressure, vertical stress, orientation and magnitude of the horizontal stresses and the rock properties, though of course there are additional complexities that sometimes need to be considered.

We will use a generalized Marcellus shale example to illustrate some special considerations regarding wellbore stability in unconventional reservoirs. First, as many areas of the Marcellus have fissile shale bedding, we will investigate how much additional mud weight is required to prevent excessive wellbore collapse when weak bedding planes are present. We will show that in some cases, the mud weight required to control shear failure is high enough to cause pre-existing fractures and faults to slip, which can cause additional mud to invade the formation. In such cases, if mud invasion cannot be prevented through the use of lost circulation materials, raising the mud weight can actually exacerbate the instability. We will also examine the feasibility of underbalanced drilling and the effect of model uncertainties on our predictions.