Abstract

Wellbore Stability Issues in Shales or Hydrate Bearing Sediments

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Wellbore instability can be an immediate result of stress redistribution following the removal of the rock mass. Due to the fine-grained nature, low permeability and saturation with pore fluid, shales are susceptible to time-dependent wellbore instability. Processes related to transport of fluid, solutes and heat between the drilling fluid and the formation fluid can increase the formation pore pressure rendering the wellbore unstable. The proper design of the drilling fluid can counteract wellbore instability. Lower and upper bounds on mud weight are determined from mechanical stability criteria. Once the drilling fluid type and weight is decided, the pore pressure increase due to mud pressure penetration mechanism can be calculated. Manipulation of the chemical potential mechanism by knowing the membrane efficiency of the shale-mud system and utilizing the right salt concentration in the drilling fluid can suppress the pore pressure increase and stabilize the wellbore.

Abstract

Drilling in gas hydrate bearing sediments (HBS) presents an unquantified hazard to the safe and cost effective drilling in deep water particularly as the number of oil and gas fields being developed in deepwater and onshore arctic environments is increasing. Coupled numerical modeling supported by experimental data conducted on HBS can be used to assess the stability of a wellbore drilled in such sediments and to investigate the integrity of the casing due to circulating hot fluids.

The presentation draws on the application of numerical modelling, laboratory rock testing and knowledge of the processes critical to shales and hydrate bearing sediments to provide predictive tools to the stability of wellbores drilled in these challenging formations. The presentation then touches on the application of geomechanical modeling and testing to the problem of sand production prediction, an area of major concern to the oil industry.