A MATHEMATICAL MODEL TO PREDICT BACK PRESSURE USING CONSTANT BOTTOM HOLE PRESSURE TECHNIQUE IN MANAGED PRESSURE DRILLING

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ABSTRACT

Drilling through narrow mud window sections using conventional drilling method has been very challenging as it could easily lead to drilling hazards such as; lost circulation, kick, borehole instability etc, thereby causing an increase in Non Productive time (NPT). Managed Pressure Drilling (MPD) is a drilling technology that can be used to precisely control the wellbore annular pressure profile so as to mitigate drilling hazards and eliminate NPT. In this study, back pressure was estimated using the pore pressure, hydrostatic pressure and the Annular Frictional Pressure Loss (AFPL) at various hole intervals using the Constant Bottom Hole Pressure (CBHP) technique of MPD. A Mathematical model was developed to predict backpressure as a function of the Bottom Hole Circulating Pressure (BHCP). Three regression models (linear, quadratic and cubic) were developed for the 12 1/4" and 8 1/2" hole sections respectively from the initial accurately estimated values of back pressure for these intervals. The models were validated with actual field data from a typical MPD well in West Africa. The quadratic regression model gave the best approximation for the two hole sections with an 81% accuracy for the 12 1/4" hole section and a 91% accuracy for the 8 1/2" hole section. These developed models provide an easy and efficient means of predicting back pressure from the BHCP and also the Equivalent Circulating Density (ECD) for MPD operations.

Keywords: Managed Pressure Drilling, Rheological Models, Backpressure, Regression Analysis.