Verification of a Real-Time Rheology Application through Hydraulics Modeling

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Abstract

The use of real time data of drilling fluid properties has emerged as a new enhancement to well construction for the industry. The current accessibility of real time fluids rheology capture devices has enabled the availability of data that can enhance the current Equivalent Circulating Density (ECD) models and predictions. The data provided by these new technologies need to be verified and compared to conventional measurements to ensure validity and possibly highlight measurement gaps. The purpose of this paper to compare both conventional hydraulics calculations with current real time hydraulic modeling when applied to a changing fluids property schedule. The testing schedule is designed to validate the sensitivity to rheology changes which directly affect the calculation of ECD through these newly introduced real time measurement devices. The Automated Fluids measurement device is a real time dual pressure device which utilizes fluids pressure drops that are measure over the span of two diameter pipes. The measured pressure drops are correlated to equivalent Fann 35 reading that are used by hydraulics models to calculate an ECD for a well. The data provided by the measurement unit is able to distribute the data via visual display program for real time monitoring of drilling fluids properties.A dynamic fluids test schedule was used to verify the sensitivity and capability of the measurement device to measure two types of drilling fluids. The schedule focused on test two primary types of drilling fluids which included water based system and an invert emulsion drilling fluid. The densities of the fluids were varied from unweighted to a maximum weight of 16.0 ppg. The rheology of fluids were modified incrementally through the addition of viscosifer to each fluid type. The targeted visocisity increases were carried out to verify the responsiveness of the measurement device. The data collected from the associated testing highlighted the capability of the measurement device’s capability to accurately measure the rheology of the fluids. The information collected enabled to accurately calculate the hydraulics calculations in a real time for drillings which in the past relied on data that could be 8 to 12 hours out of date. The drilling fluids changes could be easily seen in the measured through the subtle addition of viscosifiers and/or density changes. The accuracy of the data could be related to 2-3 % difference between traditional and the measurements device for high rpm readings while only deviating 1 rpm readying all low end rheology data. The data collected shows these real time measurement devices can provide a significant advantage to well construction automation for drilling engineers throughout the project. The information can be used on a real time basis to maximize the narrow margin drilling windows in the ever changing landscape of high profile complex projects.