SPE-183386-MS

Systematic Field Validation of New Casing Wear Quantification Process

F. Aichinger, N. H. Dao, L. Brillaud, B. Nobbs, Drillscan; A. Delapierre, C. Pinault, X. Rossi, Total E&P

This paper was prepared for presentation at the Abu Dhabi International Petroleum Exhibition and Conference held in Abu Dhabi, UAE, 7–10 November 2016.

Abstract

Casing wear predictions are necessary for a fit-for-purpose, cost efficient casing design. In order to achieve a reliable casing wear prediction from simulations, three objectives have to be met: (1) Accurate modelling of mechanical work, (2) accurate derivation of casing wear from mechanical work and (3) accurate wear factor calibration through MFCL (Multi Finger Caliper Log) interpretation. The paper presents a theoretical description of all three steps and their application on a representative field case, highlighting recent improvements and reducing uncertainties at each step with a focus on a newly developed MFCL interpretation methodology.

To accurately derive the mechanical work an advanced stiff-string model[(3)] is used to simulate the history of side forces for each rotating operation, of each BHA, which was in contact with the casing. Accurate surveys and small calculation increments are vital. Operation parameters must be data mined with great care.

To properly derive the wear from simulated mechanical work, a 3-D oriented wear model is used. This 3D mesh is able to distinguish the influence of different contact geometries on the wear groove shape and the location of thinnest wall thickness. Due to the usage of an advanced stiff-string model, drillstring body contact points are identified and therefore the wear model allows the input of different wear factors for different types of contacts (Tooljoint, Pipebody, Torque reducer)[(12)]. Additionally, the model allows the application of linear and non-linear wear models.

To properly calibrate wear factors, a reliable and robust MFCL log interpretation must be conducted. Wear is commonly measured by comparing the results of a MFCL to a base MFCL, which ideally was taken at the beginning of the section. In the standard process, the maximum measured diameters per joint of both MFCLs are compared. A more accurate single run-MFCL interpretation methodology will be presented, which relies on statistical analysis of the casing shape.

It was found that the standard MFCL interpretation methodology may be the weak link in the chain. The standard methodology led to significant exaggeration of the wear factor(s), especially if the calibration was done based on mild levels of wear. Casing wear prediction remains a complex issue, due to uncertainties concerning wear and friction factor. The new MFCL calibration methodology, including a robust stiff-string torque and drag model, is capable of significantly reducing the levels of uncertainty. Overall the complete methodology is the basis for accurate wear prediction and reduces the need of casing over-engineering.

Introduction

Casing wear predictions are necessary to perform casing design and maintain well integrity, without excessive overdesigning. Common industry practice is to calculate wear factors valid for specific fields, by back-modelling wear simulations to fit MFCL wear measurements on offset wells. The wear factor(s) obtained are assumed to represent field conditions and are used to predict casing wear in wells of the same field (or sections of the same well) [(2)].

Frequently – even though this practice was successfully applied in some cases - wear could not consistently be predicted, not in the same field, nor even within the same well. This experience has led to skepticism about the usefulness of casing wear predictions. Consequently, operators tend to over-design their casing strings rather than optimizing them.[(2)]