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Smart Ultra-Inhibitive Ecological Drilling Fluid an Engineered Proposal to Drill in Narrow Window Offshore Environments

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Abstract **- The increase in complexity and associated cost with wells as a result of harsher environments , drilling more extended reach drilling and develop new deep-water fields, has generated for most of operators from drilling segments to keep interest in smart ultra-inhibitive ecological drilling fluid. This aspects is demonstrated in the number of the most oil and gas journals that are currently in the world. This paper will show that the ultra-inhibitive ecological drilling fluid can be a solution to drill ERD wells in narrow window offshore environments.**

Keywords: Drilling, Ultra-Inhibitive, Offshore

I. INTRODUCTION

There are countless ways to cause formation damage, downhole loss of drilling fluid or run properly a ecological system in narrow window drilling applications, all are biggest economic challenges while drilling, especially in offshore environments even in deep water operations. For this reasons is important to have and continue improve an ultra-inhibitive ecological system which is unique, cost effective water-base alternative to synthetic or oil-base fluids, [1], [4] .

This new system is designed to provide better rheological properties in narrow windows environment with an primary goal to provide lower ECDs at equal or better drilling performance through a flat rheology profile.

II. EXPERIMENTAL DESIGN AND TESTING

The purpose of the present paper is to demonstrate using software, which takes into consideration the temperature and pressure profile, which the rheology model proposed of the ecological improved drilling fluid system is compared to a drilling fluid based on synthetic oil with a flat rheology, used in offshore wells X1.

The degree of comparison between equivalent circulation densities provided by improved ecological drilling fluid respect almost identical the data recorded by power while drilling tool during drilling the well X1.

In graphs provided by the PPRT software (pressure profile in real time), is presented the application example, where the ecological drilling fluid system was tested for drilling a section, [2].

The analysis made on ecological improved drilling fluid, it was carried out under the drilling conditions of section: 12.25 x13.5 in, including only the drilling from depth: 20650 ft. (6294m) la 22001 ft. (6706 m), together with the comparison the data also from pull out of hole the drilling string, from: 22001 ft. (6706m) at 198 ft. (60 m) up to bottom hole assembly (BHA).

Table 1.1 Properties of improved ecological drilling fluid

Properties	Value	Properties	Value
Mud weight, kg/m^3	1500 – 1750	HTHP Filtrate, cc/30min	<3.0
Funnel viscosity, sec/litru	55 – 80	MBT, kg/m^3	< 42
R3/R6	3-5 / 5-7	pH	9.0-9.5
PV, cP	< 42	Pm	3.0 - 6.0
YP, lb/100 ft^2	5 – 15	Pf/Mf	2.5-4.5 / 3.0-6.0
Gels, 10s/10m, lb/100ft^2	3-5 / 8-10	Chlorides, mg/L	>90 000
		Hardness (Ca^{++})	250 – 450

III. MEASUREMENT TECHNIQUES AND RESULTS OF FIRST PART

The second part of the actual paper present the simulation of the ECD (equivalent circulation density) of the ecological improved system, during circulation the well with the 10.75 in liner at total depth. In the next table is representing the properties of the ecological improved drilling fluid system, [3].

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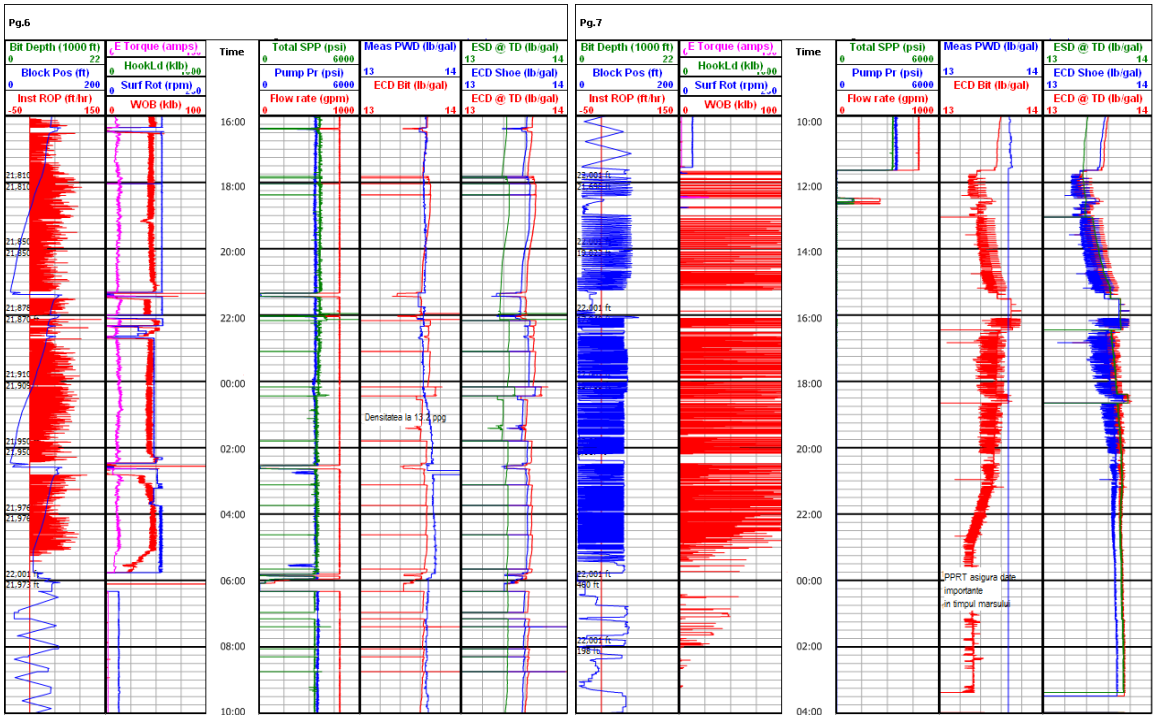

Figure 1.1. ECD simulation during drilling and pulling out of hole

IV. CONCLUSIONS OF FIRST PART

From comparison between ECD (equivalent circulation densities) recorded by the power while drilling tool from wellbore X1 and ECD provided by the ecological improved drilling fluid, it can be concluded that the values predicted by the PPRT (pressure profile real time) program, shows a good correlation of data with those obtained in a flat rheologies synthetic mineral drilling fluid, [5],[6].

It is shown that power while drilling tool, not ensure the ECD values during run in hole / pool out of hole of the drill string and/or running casing. While using the PPRT soft toghether with the improved ecological drilling fluid, provide good values of ECD also during the tripping operations. The minimum ECD provided by the ecological fluid is a great aspect when the drilling operations are performed in narrow windows sections and in deepwater environments. Use of improved ecological drilling fluid with almost a flat rheology, and superior inhibition for an environmentally friendly water-based, minimizes the effect of temperature on rheological properties. The system can help to drilling in environment sensitive areas and when operating in narrow window between pore pressure and fracture gradient,[7].

V. MEASUREMENT TECHNIQUES AND RESULTS SECOND PART

Simulation of equivalent circulation density during well circulation with the 10.75 in liner at total depth.

Input data:

Flow rate: 252 gallon per minute (6 bpm), it is equivalent to: 954 liters/minute.

Temperature model: Circulation well profile.

Initial equivalent static density at total depth: 14.6 pounds per gallon equivalent with 1750 kg/m^3.This initial equivalent static density, for simulation the liner circulation is adjusted for 60 hours with the well in static conditions.

Total depth in oilfield system: 20161 feet measure depth / 10321 feet true vertical depth, which are equivalent in international system: 6145 meters measure depth / 3146 meters true vertical depth. In the figure below, it is presented the program which performs the proposed simulation:

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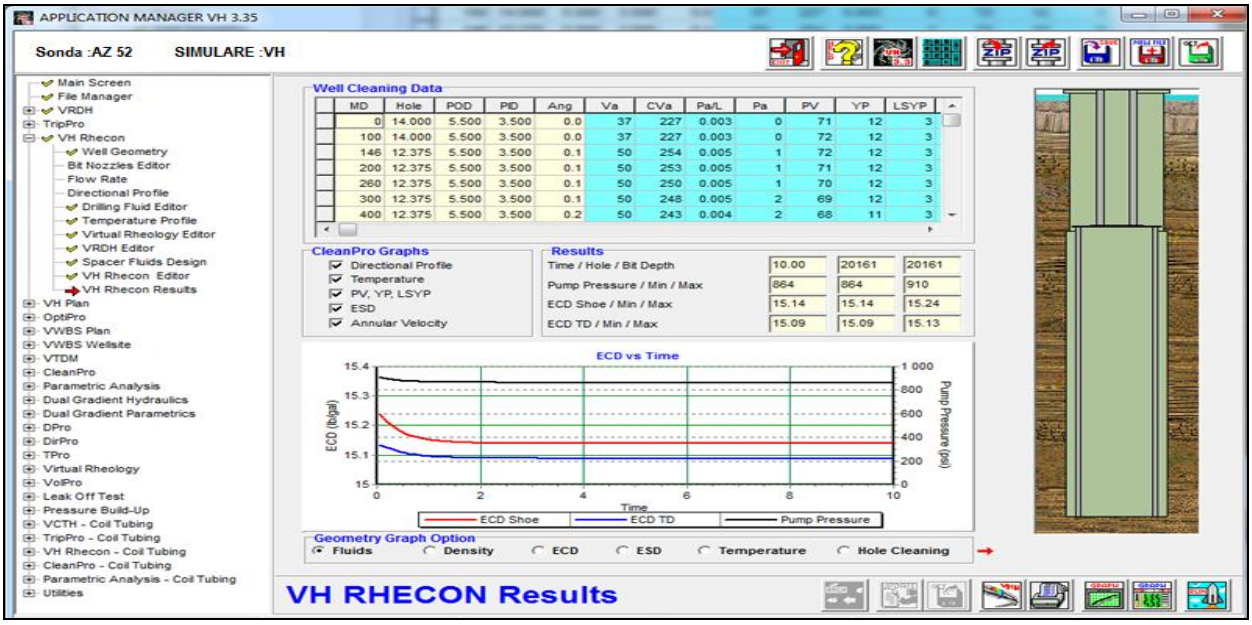

Figure.1.2 The results of10.75 in liner circulation at total depth – Simulation program VH Rhecon with circulation profile.

Table 1.2: Simulation results for equivalent circulation density for 10 ¾ in liner

Flow rate: 954 litres/minute (	ECD-ul	Circulations hours
Start ECD at shoe	15.24 ppg / 1830 kg/m^3	0
Start ECD at total depth	15.13 ppg / 1810 kg/m^3	0
ECD at shoe	15.14 ppg / 1820 kg/m^3	0.75
ECD total depth	15.09 ppg / 1800 kg/m^3	0.75
ECD Final at shoe	15.14 ppg /1820 kg/m^3	8
ECD Final at total depth	15.09 ppg /1800 kg/m^3	8

VI. CONCLUSIONS

Simulations results using the improved ecological drilling fluids (for well condition: AZ52), are presented in the below table. A sample of ultra-inhibitive ecological drilling fluid was developed in the laboratory and his results successfully was tested with a dedicated software which was taken into consideration the pressure profile and temperature effects of the new developed system.

This trial demonstrates that by using adequate concentrations of products, proper technology and methods it is indeed possible to reliably raise to use ultra-inhibitive ecological drilling fluids based on water base systems and develop comparative ECD with synthetic base muds.

Results:

1)Reducing equivalent circulation density starts immediately and flattens after 45 minutes of circulation of improved ecological drilling fluid.

2)Equivalent circulation density at total depth (20161 feet/ 6145 meters) and also ECD at 13 5/8 in casing shoe (6680ft/2036 m), both values are stabilized at a minimum after 2 hours of circulation the well

3)The circulation of well up to two hours can reduce the ECD with approximate 0.1 pounds per gallon (10 kg/m^3) at casing shoe and also at total depth.

4)Extensive circulation is not able to reduce more the equivalent circulation density.

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