A REVIEW ON THE USE OF OFFSET WELL DATA AND ITS ANALYSIS FOR A SUCCESSFUL WELL PLANNING AND DESIGN.

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ABSTRACT

Prior to undertaking any drilling campaign, the process of offset well analysis is of paramount importance. When performed accurately and presented properly it provides the basis for all design work and risk analysis. This paper basically reviews the different drilling data collected from the offset wells and its functions. With the increasing complexity of wells being drilled to optimally access as much of the reservoir as possible, an integrated drilling risk assessment strategy needs to be presented to address the increasing level of challenges and risks. Most drilling problems have been accepted as an inherent part of the drilling process. As a result, there has been a great amount of effort put forth to find solutions for said undesirable events after they occur preventing drilling problems is essential to the economics of such projects. Casing Drilling has been successfully practiced for more than a decade, and has proven to be a unique approach in reducing drilling problems and associated NPT. So in this paper we try to review the benefits of Casing Drilling methodology to reduce drilling problems and associated NPT.

Keywords: Offset well data, Pipe sticking, loss circulation, Kick, Gas cut, wellbore instability, Casing while drilling

1. INTRODUCTION

The most important aspect of preparing the well plan, and subsequent drilling engineering, is determining the expected characteristics and problems to be encountered in the well. A well cannot be planned properly if these environments are unknown. Therefore, the drilling engineer must initially pursue various types of data to gain insight used to develop the projected drilling conditions. This data are collected from the offset well.

An Offset well is an existing wellbore that may be used as a guide for planning a well. Many offset could be referred to in the planning of a well, to identify subsurface geology and pressures. Offset well data maybe combined with seismic data and prior experience. Where offset data is lacking, well planners will be more conservative, allowing for a greater range of contingencies and expenses.

The existing offset well do provide useful insights in accordance to new well planning. It also tells us that there are few drilling issues which involves kick, loss circulation, gas cut, drag, shale caving, stick pipe. This problems may be arise in drilling a new well.

In order to address these challenges, more upfront in-depth planning and analysis must be performed. Often times, a review of the drilling issues are performed around symptoms of drilling events to respond to them, but not necessarily to determine why these events happened in the first place – the root cause. This shows when contingencies are built into a well plan to account for the NPT consequences of these drilling events observed in offset wells. In order to proactively address these increasing risks and hazards, development and incorporation of a detail risk mitigation strategy is required. In order to avoid multiple mitigations for different risks and hazards a Trouble Free Drilling with Casing while Drilling was introduced which is a process focused on preventing the Drilling Problems.

1.1 HOW DOES OFFSET WELL FUNCTION?

Offset wells provides some of the best well histories available**.** With offset drilling data, we can review detailed histories of nearby wells and adjust our plans accordingly. [1] Provides us some of the important functions that is important for planning a new well. From the offset data we can identify how we can improve drilling efficiency of a new well. We analyze how we can drill wells better. If another one in the area took 120 days, we ask, 'how can we drill it in 90 days? The data is in a quick reference format so we can make informed decisions and avoid past problems.

The offset well also helps us to save time and money. With Offset Drilling Data, we can review detailed histories of nearby wells and adjust our plans accordingly. Access to this information saves us time and money. If you don't fully understand drilling problems on the old wells and corresponding drilling mud systems, then you may be fishing – which can cost a lot of money – or risk losing a well. We use Offset Drilling Data to optimize drilling programs for operators and ourselves. These plans can help reduce drilling time and serve clients better.

It also helps us to optimize well design. It provides a wealth of information, such as mud, pipe setting depth and drilling times. We know what's been done in the past and can design a well and budget properly.

[1]We analyze the estimated drilling times from offset drilling data. It saves us from calling five to six different contractors about casing depth, bits, mud properties, geological trouble areas such as lost circulation or over-pressured areas. Offset Drilling Data saves us a lot of time and work. We were better prepared to estimate more time for the first well drilled in the area. Without it, we would not have planned for nearly enough time and would probably have been 50 percent over AFE.

1.2 INFORMATION IS OBTAINED ON:

[2] Describes the areas from where we can obtain the information of the offset drilling data. Fig 1 gives a brief information about from where the offset drilling data is collected.

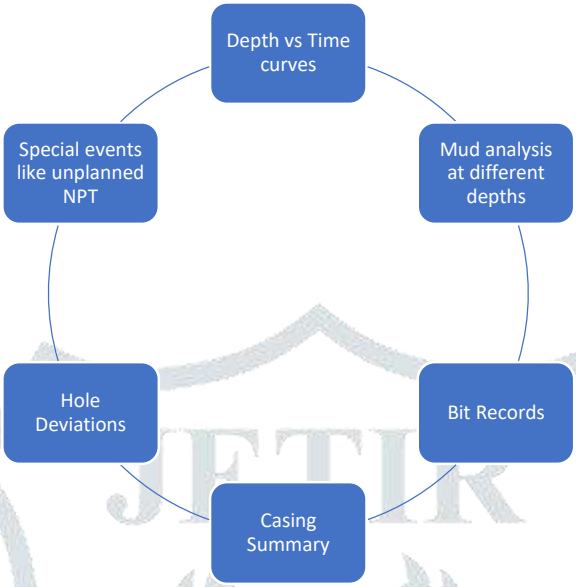

Fig 1: Offset drilling data obtaining information.[2]

2. LITERATURE REVIEW

Offset drilling data provides critical information for ensuring a proper well design. [1] The offset well data is a collection of data that helps the Drilling Engineering team to understand what may be encountered in the sub-surface while drill string proceeds in the downhole and before starting an authority for expenditure (AFE). As the offset comprises of drilling curves with respect to the depth, it helps the performance analysts, drilling engineers, production engineers, operations and service providers to improve the well program evaluation of even the deepest and longest wells from hours to minutes. Improving drilling operations through improved information also assists in cost control and safety. The work here aims at investigating and integrating historical drilling performance from neighbouring wells into prospect well design. Trajectory similarity will be performed using well surveys (dogleg severity, inclination, and azimuth). The conclusion of the work is expected to come up with a database with pre-defined metrics from where a Drilling Engineer can retrieve information of wells that are similar in terms of trajectory and geology, and rank those wells accordingly, and also access key events and hazards history for the offset wells.

3. PROBLEM, CAUSE & SOLUTION (PCS) ANALYSIS:

The risk analysis consists of evaluating the information and regional experience from the offset wells along with incorporating the drilling, geomechanical and geological models to identify the root cause of an observed event. Considering the importance of risk analysis, [3] integrated projects take the necessary time for a pre-drilling evaluation to determine the root causes of problems and to define a proactive strategy to prevent and/ or mitigate the identified risks. The table 1 below shows some of the drilling problems, its causes and mitigation.

Table 1: Drilling problems, its causes and mitigations. [3]

PROBLEM (S)	CAUSE(S)/ REASON(S)	SOLUTION(S)/ MITIGATION(S)
Loss circulation	fractured, cavernous, or have high permeability formation	1. Maintaining proper mud weight 2. Using LCMs like Fibrous, Flaked, Granular etc.
Tight hole	Unstable wellbore	1. .Back reaming 2. Use of stabilizer
Kick	1. lost circulation 2. Insufficient mud weight. 3. Swabbing.	1. The hole should be filled with some type of fluid to monitor fluid levels if lost circulation occurs. 2. to maintain a mud weight slightly greater than formation pressure. 3. Pull pipe out of hole with reasonable speed
Gas cut	Trip gas	Use of technique that reduce or avoid the incorporation of tripping operation thus, there is relatively less chance for trip gas.
Pipe stuck	1. Reducing bit size from wear and tear 2. Due to mechanical sticking	Increase the torque and drag

4. CASING WHILE DRILLING

Casing Drilling is a process in which a well is drilled and cased simultaneously. The original purpose of developing Casing Drilling technology was to eliminate Non Productive Time (NPT) associated with tripping and running casing. [4][5]During early implementation of the technology, other benefits were seen while drilling with large diameter casing as less drilling problems were observed even though it was originally thought that drilling with the large pipe would instigate more problems. Some of the most notorious drilling problems are stuck pipe, well control events, lost circulation, wellbore instability, and drilling induced formation damage. Since there is no tripping of the drill string during Casing Drilling, this helps with many of the above mentioned problems. Most importantly, this helps with well control issues. Also, the small annulus brings about a high annular velocity that eliminates a lot of cutting transport issues, especially at critical angles.

[5][6][7] Casing Drilling reduces mud loss to the formation. The Plastering Effect creates a high quality mud cake which seals off the wellbore and prevents fluid transfer between the borehole and the formation. It is proposed that the combined forces of high annular velocity, pipe rotation and the proximity of the casing wall to the borehole results in drill cuttings being crushed and smeared against the formation, creating a much less permeable wall cake. The proposed mechanism is shown in **Figs. 2-A to 2-C**:

Fig. 2-A: Casing is forced against the bore wall as it advances into the borehole.[6]

Fig. 2-B: As mud is smeared into the formation, filter cake builds up on the borehole wall.[6]

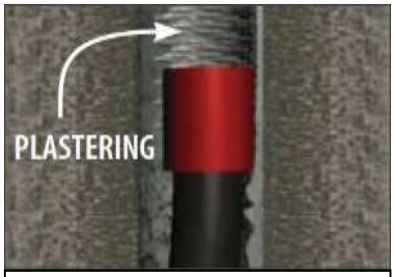

Fig. 2-C: Filter cake and cuttings are plastered against the borehole wall, sealing porous formations.[6]

[5]Casing Drilling technology offers several benefits that help mitigate wellbore stability problems. These benefits are the reason Casing Drilling is frequently selected as the superior method for drilling challenging wells that conventional drilling methods could not easily handle.[6]Stuck pipe is one of the most common drilling problems that is both time consuming and expensive. At the onset of Casing Drilling, it was believed that stuck pipe will be a major problem for drilling with large diameter pipes. However, a decade of experience in troublesome zones has proved that casing doesn't get stuck and Casing Drilling is found to mitigate the hazard of stuck pipe. Today, wells with stuck pipe problems are considered good candidates for Casing Drilling. [6][7]Historically, the emphasis of drilling operations has been to drill wells cheaply and quickly without much consideration for the resulting impact on well productivity. Formation damage occurs frequently and rapidly during drilling operations with potentially severe consequences. The Plastering Effect of Casing Drilling reduces solids and filtrate invasion, resulting in less skin damage and improved productivity. It also reduces formation damage due to cement filtrate by creating a gauged wellbore and proper casing/wellbore standoff.

5. CONCLUSION

The risk analysis based on root cause identification yields better definition of effective strategies for prevention and mitigation events during well construction and completion, because practices and technologies can address the problems in the right way.

[7]The origin of the problems are diverse, ranging from geomechanical, operational, or geological, but all of them need to be considered and evaluated in a holistic approach with the combination of technologies, field experience, procedures, expertise, operational practices, real time monitoring, collaboration and decision making. All technical groups (geoscience and engineering) involved in the well construction and completion must work together on the risk analysis in order to develop the mitigation strategies for different events, regardless of the origin of these events, in order to select adequate practices, product, technologies, and expertise, with everyone having the commitment to ensure safe operations.

- It is always safer to prevent drilling problems rather than dealing with them. Casing Drilling has been recognized as a process focused on proactively eliminating drilling problems.
- Most drilling problems happen while tripping. With Casing Drilling there is no tripping of the drill string at TD and also no need to casing running afterwards. Therefore all wellbore problems associated with these operations are eliminated.
- Continuous drilling is a key factor in successful deployment of Casing Drilling technology.
- Field observations have proven that the Plastering Effect reduces lost circulation, improves wellbore stability, enhances wellbore quality, strengthens the borehole, and mitigates drilling-induced formation damage.
- Utilizing the Plastering Effect, Casing Drilling operations have been completed in difficult and troublesome zones that could not have been accomplished with conventional drilling.

6. REFERENCE

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