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Risk Mitigation: Evaluation of Rig X, Rig Y, and Rig Z Performance by Analyzing Non-Productive Time on Drilling Activities in Field "A"

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Abstract. *The study examined the non-productive time (NPT) of drilling activities on rigs X, Y, and Z in field A. It utilized the pareto chart approach to identify the specific type of NPT that was the primary issue during the drilling operation. Moreover, seeking methods to rectify and enhance the efficiency of X, Y, and Z rigs in carrying out drilling operations. According to the conducted research, the operational performance of rigs X, Y, and Z may be characterized by their work performance percentages, which are 90%, 92%, and 85% respectively, in completing drilling activities. The primary factors contributing to non-productive time (NPT) on rig X are rig maintenance and drilling issues, while rigs Y and Z experience NPT due to maintenance activities and unforeseen circumstances. To classify the NPT repair rig, it is necessary to perform preventative maintenance, inspect vital components, and replace any spare parts with authentic replacements. Unmanageable categorization involving the installation of matting boards near wellpads and the incorporation of mobile fleets. To effectively categorize NPT hole issues, it is necessary to optimize the rate of penetration (ROP), ensure the mud filters are not excessively thick, and prioritize thorough hole cleaning.*

1. Introduction

Energy is a resource that is quite important in human life and is an important factor that drives world activities. As time goes by, increasing global energy demand forces oil and gas companies to drill more to produce more oil and gas to meet global supply and demand (1).

To carry out drilling, each location condition clearly requires the role of the rig as a special equipment installation for carrying out drilling activities. Drilling activities are one of the most complex, risky activities, and require precise timing and significant costs (2). So in its implementation, drilling activities are carried out according to high safety standards, timely implementation with efficient costs (3).

It cannot be denied that many problems are actually unplanned events that will result in non-productive time (NPT) encountered during drilling operations (4). The time spent fishing, pipe stuck, weather, tool transportation, lost circulation, and tripping in/out can be counted as NPT (5). Non Productive Time (NPT) is understood as an event that causes the drilling operation to cease (6). Good drilling operating performance is measured by having low non-productive time (NPT). The existence of NPT itself not only leads to budgetary usage that is sometimes unpredictable but also leaves hydrocarbon production delayed (7).

Non-Productive Time (NPT) is unproductive time because there are several problems that cause downtime which disrupts well repair and maintenance activities during operation time (8). The cause of NPT is unexpected weather or technical problems (9). In this research, non-productive time (NPT) was analyzed on rigs that only carry out drilling activities in field A, namely rigs In order to find solutions to improve the performance of rigs X, Y and Z in carrying out drilling operations.

Non-Productive Time (NPT) is defined as the time when drilling operations are stopped or penetration is very low (10). According to (11) Non Productive Time (NPT) is the main cause of delays in drilling projects and large cost overruns in project drilling due to standby costs and penalties on equipment and personnel. NPT tolerance that can be accepted by PT. Pertamina Hulu Rokan is 10% of the total drilling time.

2. Methods

This type of research is a case study with data obtained from the company in the form of a daily report which will be re-managed by analyzing any problems that occur that hinder the progress of drilling operations and are not in accordance with what has been planned (NPT). Then classify the NPT and add up the total NPT and drilling operation time on rigs.

2.1 Research Location

The research was carried out on well-X rig, well-Y rig and well-x rig located in the working area of PT. PHX in Riau Province as in Figure 1.

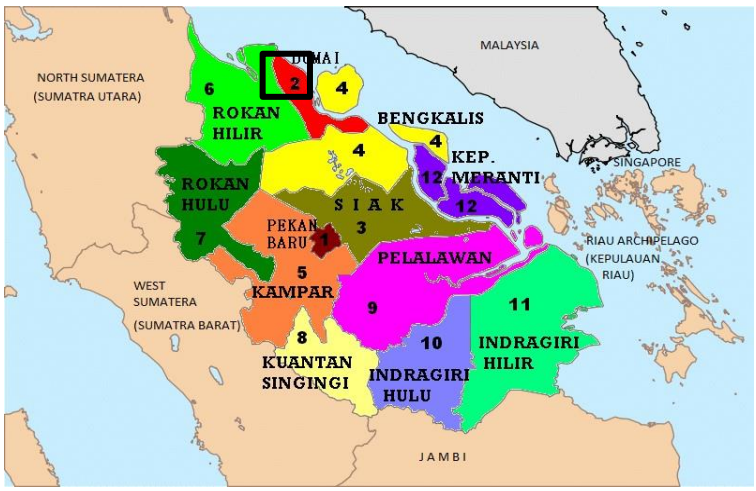

Figure 1. Research location

The NPT classification used by the PT. PHX is as follows:

1. Uncontrollable, is an uncontrolled NPT problem such as Location, Daylight, Weather, Community Issue, and others
2. Repair Rig, is a NPT issue when repairing the rig.
3. Hole Problem is an NPT matter with subsurface problems such as well hole problems, etc.

2.2 Data Collection

The types of data used in this research include primary and secondary data. Primary data is obtained directly through field observations and interviews with the sources of PT PHX.

Secondary data in this study include related literature, research journals, reference books and corporate reports such as daily drilling report, NPT Rig Well data and ODR Rig.

3. Results

3.1 Calculating Rig Operating Time

Determining the performance of rigs X, Y and Z in field A is obtained by calculating unproductive time, productive time, and total operating time. When calculating the performance value of each rig X, Y, and Z using cumulative NPT time data and also total operating time to produce rig performance percentages as in Table 1 and Figure 2.

Table 1. Operational Performance Values of Rigs X, Y, and Z

Description	Rig X	Rig Y	Rig Z
Non Productive Time (hr)	595	226	1,227
Total operating time	5,888	2,948	8,213
% Rig Performance	90%	92%	85%

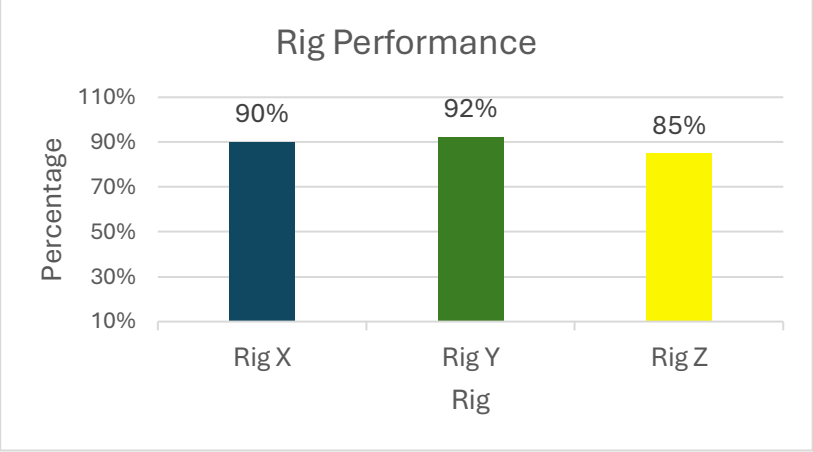

Figure 2. Rig Performance

The performance of the Rig X, Y and Z is obtained by calculating the total operating time as a whole and by getting the amount of non-productive time in the operation, it can be continued by calculating the performance of the three rigs. In accordance with the Table 1, it is known that each rig has a different NPT in completing drilling activities. After carrying out calculations to get a comparison of the operational performance percentages of the three rigs, it can be seen that rigs X and Y have performance percentage values of 90% and 92%. Meanwhile, Rig Z has the lowest performance percentage with a value of 85%, which means it has an NPT above the value that the company can tolerate, namely 10%.

3.2 Pareto Chart

After doing the calculation of the performance values of the third rig, then a pareto chart is created to find out the most dominant problems in the NPT category as in Figure 3.

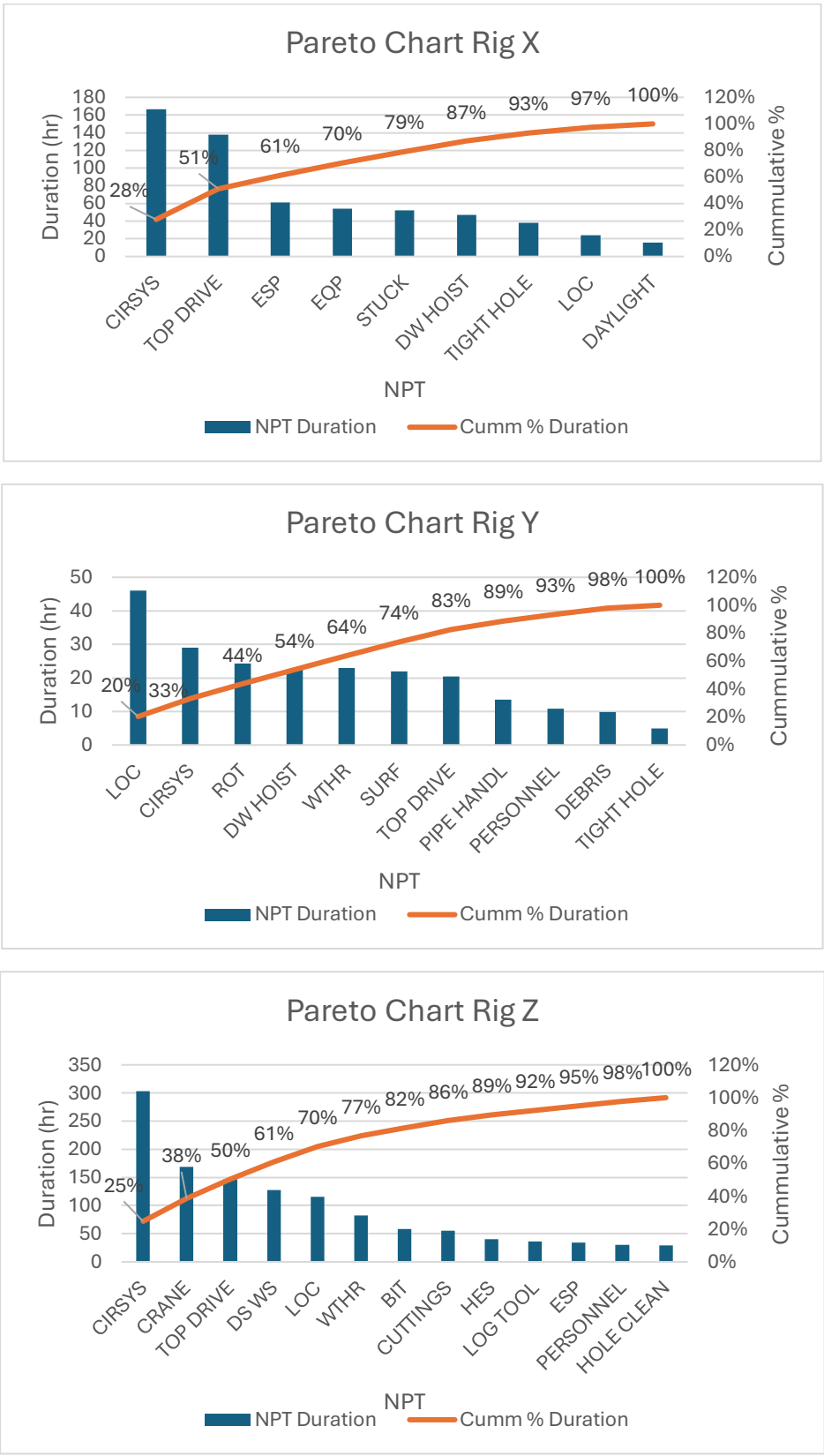

Figure 3. Pareto Chart Rig Well X, Well Y and Well Z

From Figure 3 is obtained the NPT classification that occurs on rig X with a total duration of 595 hours and sorted according to the longest duration. Analysis of the pareto diagram in Figure 3 of the classification of NPT that dominates 80% on the rig X in accordance with the concept of pareto i.e. with composition 80-20. From the results of the pareto chart above it is obtained that NPT CIRSYS, TOP DRIVE, ESP, EQP, STUCK, and DW HOIST. There are 2 company classifications based on major namely repair rigs with details CIRsYS, Top DRive, ESP, EqP, DW Hoist.

The NPT classification was conducted on the Y rig, lasting a total of 226 hours and organized based on the longest duration. By analyzing the Pareto diagram in Figure 3, it can be observed that NPT LOC, CIRSYS, ROT, DW HOIST, WTHR, SURF, and TOP DRIVE collectively account for 80% of the cumulative duration, resulting in delays in the operation of the Y rig. There are two main firm classifications based on major, namely repair rig. The details of these classifications include CIRsYS, RO, DW HoIST, Surf, and TOPDRIVE. Regarding significant uncontrolled factors related to location (LOC) and weather (Wthr).

The NPT classification yielded findings for rigs Z and NPT, with a total length of 1,227 hours. Figure 3 can be examined based on the Pareto diagram. NPT CIRSYS, CRANE, TOP DRIVE, DS WS, LOC, WTHR, and BIT account for 80% of the total duration generating delays in the operation of rig Z. There are two firm classifications based on major repair rigs: CIRsYS, TOPDRIVE, DS WS, and BIT.

4. Mitigation Recommendation

The mitigation recommendations of NPT classification on each rig include:

1. Repair rig is to ensure that preventive maintanance is carried out according to schedule, perform regular checks on each critical part, replace spare parts with OEMs (original parts), and improve crew competence.
2. Uncontrollable by the way the rig contractor performs inspection/checklist before using the crane, ensure all administrations are met, the installation of matting board around the wellpad, the use of sirtu around the Wellpad, and the addition of the moving fleet.
3. Hole problem is the control of drilling parameters such as ROP optimization, mud cake filter so that it doesn't get too thick and does the hole clean as much as possible.

5. Conclusion

Based on the data analysis and calculations that have been carried out, it is concluded as follows:

1. The operational performance of the three rigs can be known that rig X and Y have a percentage of work performance with values of 90% and 92% in the completion of drilling activities with a percent value of NPT below the company's tolerance values. Rig Z with 85% which has NPT above 10% of the value that can be tolerated by the company.
2. The main cause for NPT at the time of performing drilling operations is in NPT rig X classification is repair rig and hole problem. For rig Y and Z there are classifications NPT repair Rig and uncontrollable.

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