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Analysis of Electrical Submersible Pump With 120% Overload Setting Point in the SLN Area

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ABSTRACT: In the SLN field, there has been an increase in the setting point by 120% to optimize fluid production and minimize the production decline previously caused by a setting point of 110%, which resulted in temporary well shutdowns. Wells HFU01 and HFU02 in this area experienced shutdowns, suspected to be caused by overload in the electrical submersible pump. Overloaded pumps were identified through alarms originating from the switchboard on the surface, where the alarms were triggered by three cables connecting the switchboard to the motor of the electrical submersible pump. This study aims to determine the impact of overload setting point on wells HFU01 and HFU02, which have not shown improvement after the overload setting point adjustment. The research methodology involves analyzing pump failures due to overload in the electrical submersible pump in wells HFU01 and HFU02 located in the Sumatera Light North Area, which affects the well production. From this research, it is suspected that the wells that have not shown improvement after the overload setting point change may be caused by worn-out, aged pumps with low efficiency, and pump cavitation issues. Through this research, these issues can be addressed, leading to improved well production and run life of the electrical submersible pump, ultimately reducing pump failures in the wells.

KEYWORDS: Electrical Submersible Pump, Overload Setting Point, Pump Shutdown, Well Production

1. INTRODUCTION

The well located in the Sumatera Light North Area has been produced in a long time vulnerability using a natural flow production system and has suffered the impact of pressure reduction which has caused the production rate to decline. Sucipto (2018) has successfully conducted research when the pressure from a production well is not high enough in lifting fluids with natural flow, then an artificial lift method can be performed as one way to be able to lift fluids to the surface. There are a number of production problems that can arise in natural flow wells, among them the reduced productivity of formations that can be caused by corrosion, coning due to water or gas, reduced production rate caused due to emulsion, scale, paraffin, and corrosive problems (Tarek, 1946).

A decrease in production can be caused by pressure decreases during the production process, so that the wells are not able to produce natural flow. In this case, artificial lift methods are required, i.e. pump installation or gas injection. Artificial lift methods consist of many types and can be chosen based on the production problem and the characteristics of fluids and formations. One of the most commonly used artificial lift methods is electric submersible pump. Submersible pump is pump that are installed in the area of well holes to artificially produce oil that can be driven by an electric motor. Consideration in choosing the Electrical Submersible Pump (ESP) because its adaptable application can be used on sloping wells and offshore wells, requiring minimal space for surface equipment, easy to operate, as well as surface treatment (Fauzi et al., 2020).

The research was conducted to address the overload problem of an Electrical Submersible Pump (ESP) pump installed in the Sumatera Light North Area. Overload occurs when the motor ampere exceeds the normal limit, and can be caused by several factors such as low voltage, weight of the type of fluid pumped, damage to the electric cable, and difficulty rotating the pump (ESP Dismantle and Inspection Report, 2023). Overloads can interfere with the performance of ESP and slow down the production speed of wells. The aim of this study is to find ways to address overload problems, evaluate overload setting point settings, and improve the run-life of ESP. Thus, the study is expected to be a reference for professionals in the field in analyzing overload on ESP pump and improving run-Life of the pump and well output. In this study, the author will analyze the various factors that contribute to the occurrence of overload at ESP pump, and find the right solution to address the problem. The researchers will also evaluate the overload set up of the setting point currently used, and look for ways to improve run-life of ESP pump.

2. METHODOLOGY

In this study, research performed by analyzing secondary data from the field. Below is a flow diagram shown by Figure 1.

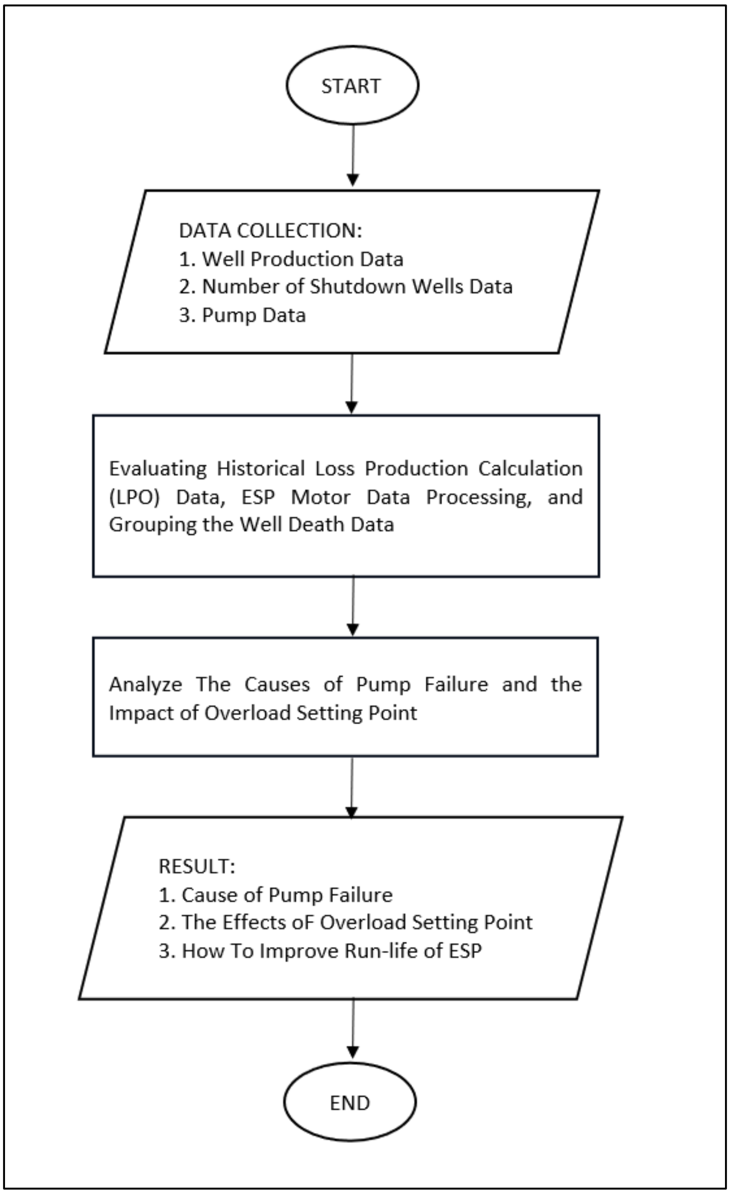

Figure 1. Research Workflow

The secondary data that has been obtained includes data on the production of wells and the number of dead wells. The data processed on the evaluation of the history of Loss Production Oil (LPO) data, the processing of ESP engine data, and the grouping of data related to the death of well. After the data has been successfully processed, the researchers performed data analysis on the cause of the pump death on the well and the impact of the setting of the overload setting point. The results of this study are to be able to find out the causes of the dead pump, to know the effects of setting the point of overload to 120%, and to find ways to improve the run-life of the electrical submersible pump.

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3. RESULT AND DISCUSSION

In this section, we will explain the cause of the death of the pump at one of the wells in the Sumatera Light North Area. The death of this pump was caused by an identified overload. The overloaded pump can be identified through the alarm that comes from the surface switchboard. The alarm comes from three cables connected between the switchboard and the motor on the ESP pump. The current that flows on the three wires must be balanced and the amount of current depends on the load carried by the motor.

In Sumatra Light North Area, the overload setting point has been upgraded to 120% to optimize fluid production and prevent the previous decrease in production caused by overloading the setting point of 110%, which temporarily left the wells dead. Overloads can occur when the ESP is undergoing too high loads during operation. Overload occurs when the incoming current exceeds the normal limit, especially when the pump works at high performance or when the pumps become hot. ESP do not have a cooling fan like other motors, but the cooling system depends on motor oil and flowing fluids. The load on the motor is influenced by the type of fluid that flows. If the fluid is lighter, then the load of the motor will be lighter and the flowing electric current will decrease. However, if the fluids become heavier, such as when there is sand produced along with fluid, the load on a pump will be heaviest and the current flowing will increase.

The wells in the Sumatera Light North Area, the HFU01 and HFU02 wells, suffered a decrease in production due to the overload of the ESP motor pump. Due to overload, the two wells became obstruction in producing oil to the surface. So with these barriers, there is a difference in the amount of production in each year. In the face of significant loss rates of output, the step taken is to reset the setting point of overload to exceed the previous limit. Initially, overload parameter settings varied between 110% and 120% according to the API recommendations. When first installed, the overload point setting was set to 110% based on information on the motor nameplate and determined by the factory based on the type of pump motor used as well as its function and usage. However, this setting causes the pump to die which affects the output produced. Therefore, the rule was changed to 120% to address pump deaths due to overload. Although there were improvements after the overload setting point was turned to 120%, there are still some wells that are still suffering from pump death.
The following will explain the cause of overload for the two wells that still suffered the death of the pump after the increase of the overload setting point.

Table 1. Overload Analysis Result in the SLN Area

Well Name	Problem	Solution
HFU01	Worn Out Pump	- Replace the pump that has used more than 480 days - Perform DIFA to determine the cause of the pump's decreased efficiency
HFU02	Sand Problem	- Perform DIFA to remove sand and foreign material that enters the pump

From the description of Table 1, 2 wells that have not been improved after given overload setting point settings to 120% is due to sand entering the pump (sand problem) and the pump is obsolete. In HFU02 wells, sand and other foreign material entering the fluid can cause overload pumps due to increased fluid weight due to the presence of foreign material. An electrical submersible pump has a motor ampere that is regulated from the outset by taking into account the load of fluid that the pump will subsequently lift. With the sand produced, the electrical submersible pump becomes an overload indicator that can be detected from above the surface by looking at the alarm inside the switchboard. DIFA is an inspection process for a dead pump, where the electrical submersible pump is dismantled and the sand that enters the pump is removed.
By removing the sand that enters the pump, the pump will be cleaned of the sand and foreign material so that the pump can be reused. At the HFU01 well, the pump in operation already has a pump run-life of more than 480 days. Where with this long service life the pump efficiency is reduced, the pump becomes worn out, and the pump performance is not optimal. So it is necessary to dig up the pump so that the pump can work normally. Thus, both the HFU01 wells and the indicated overloaded HFU02 wells can return to oil production with increased output because the cause of overload is already known. And with the evaluation and analysis, the problems that exist in the wells HFU01 and HF02 can be solved according to their respective problems and with the existence of this evaluation, the effect that occurs on the well that is in the Sumatera Light North Area is that the output can be increased and the run-life of the electrical submersible pump can also increase because successfully dealt with.

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4. CONCLUSION

In order to avoid overload problems in wells HFU01 and HFU02, a pump replacement can be performed for wells where the pump is obsolete, has power disruption and worn out. DIFA (Dismantle Inspection Failure Analysis) is performed to wells that have suffered evacuation in order to remove the sand that enters the electrical submersible pump.

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