UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF A RELIABILITY, AVAILABILITY, MAINTAINABILITY (RAM) SIMULATION MODEL FOR GAS LIFT AND GAS INJECTION SYSTEM

SHARIFFAH NUR SYAZREEN BT SYED MUZAFAR

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ABSTRACT

In oil and gas industry, oil production will reduce over the time as oil fields become mature, causing depletion in reservoir pressure and less oil flow to the surface. When reservoir energy is insufficient to bring the oil flowing to the surface, it is essential to use an artificial lift as a primary oil recovery to maintain the reservoir pressure. After artificial lift have been applied to the reservoir, secondary recovery might be used as an initiative to increase the recovery of crude oil. Based on A significant failure occurred at a power plant in the USA in 1995 as a result of a turbine blading design fault. According to gas turbine technical report, surrounding auxiliary equipment was also damaged costing $11 million. One of the reasons is due to the operating conditions inside gas turbines that can damage the blades through particulates adhering the blades. Turbine blades are very sensitive, any damage can reduce mass flow and effective pressure ration. Therefore, it is crucial to identify which equipment/component in the system is the most critical and need to be paid attention. In this research, the Reliability, Availability and Maintainability (RAM) studies have been conducted as a solution to identify the equipment/component criticality. The purpose of the study is to assess the facility equipment design and its configuration system which focus on the Gas Lift and Gas Injection System. Besides, to identify and rank the systems/components that could be a major contributor to the production efficiency losses in the facility, and to evaluate the impact of modifications and changes to the base case. Reliability Block Diagram (RBD) has been created based on ISO 14224. The modelling is conducted using reliability-based analytical models on selected equipment configuration and assumptions. For this study, the calculation of analytical results was compared with other various cases and in order to improve the reliability of the system, the critical components that required as the capital spare can be identified.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

Most of the oil and gas industry has survived an especially tough few years with weak demand and low prices. It has been difficult to make strategic decisions and plan for the future. Desirable industries to increases their company's revenue make the reliability becomes a will for engineers to find ways of saving costs. Therefore, it is important to ensure the oil reserves of the field can be productively produced at maximum capacity with a lowest possible cost and highest profit margin. Oil reserve of the field can be maximised by applying the Gas Lift and Gas Injection system to the oil field. Typically, Gas Lift is used as the artificial lift process followed by a secondary recovery which is Gas Injection system.

However, any interruption in the system always occurs either in onshore or onshore due to unplanned and planned maintenance activity on equipment. Maintenance takes time and costs to repair or replace every single equipment in the system. Downtime of the equipment or component lead to the production losses in oil and gas upstream process and affect the efficiency of the Gas Lift and Gas Injection system. Therefore, it is the most critical issues to find out which equipment or component in the system that contributes to major production losses as it may affect the country economically.

For instance, if the Gas Lift System consists of a single gas compression system train (1x100% configuration), any maintenance activities associated with the compression system will cause interruption to the gas processing system, which contributes to the production loss when it needs to stop the gas process to repairs or replace the failed component. Therefore, gas lift injection rate throughout the reservoir will be affected and impact petroleum production.

Generally, oil and gas companies always related to cost, time and resources (CRT) to gain beneficial profit in future. However, complex characteristic of natural gas may result in the failure of the equipment. The revenue lost due to the unpredicted