UNIVERSITI PUTRA MALAYSIA

ASSESSMENT OF RELIEF VALVES (RV) PERFORMANCE IN PETRONAS CARIGALI, SARAWAK OPERATIONS, MIRI

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By

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Project Paper submitted in partial fulfilment of the requirement for the Degree of Master of Science (Emergency Response And Planning) In the Faculty of Engineering, Universiti Putra Malaysia

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LIST OF ABBREVIATIONS

1. RV -	Relief Valves
2. SKO -	Petronas Carigali Sarawak Operations
3. SBO -	Petronas Carigali Sabah Operations
4. PMO -	Petronas Carigali Peninsular Malaysia Operations
5. PCSB -	Petronas Carigali Sendirian Berhad
6. SSB -	Sarawak Shell Berhad
7. MCOT -	Miri Crude Oil Terminal
8. MLNG -	Malaysian Liquefied Natural Gas
9. HHP -	High High Pressure
10. LP -	Low Pressure
11. PSI -	Pound per square inch
12. CIMG -	Carigali Inspection and Maintenance Guidelines
13. CBM -	Condition Based Maintenance
14. RCM -	Reliability Centered Maintenance
15. IDAMS -	Inspection Data Analysis and Maintenance System
16. LIP -	Locked-In-Potential
17. IOBT -	Integrated Oil Boost Team
18. BDO -	Baram Delta Operations
19. UPC -	Unit Production Cost
20. MTBR -	Mean Time Between Repairs
21. ESD -	Emergency Shut Down
22. API -	American Petroleum Institute
23. FMA -	Factories and Machinery Act
24. ASME -	American Society of Mechanical Engineers
25. CORAL -	Cost Reduction Alliance

Abstract

Abstract of Research Project submitted to the Faculty of Engineering, Universiti Putra Malaysia in partial fulfilment of the requirement for the Degree of Master of Science (Emergency Response and Planning).

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Faculty: Faculty of Engineering

The objective of conducting this study is to asses the performance of various types of relief valves (RVs) installed on the platforms of PETRONAS CARIGALI SDN BHD, Miri, Sarawak in the offshore facilities. There is a strong concern on the impact of the certification process of relief valves. It is not only risky but incurs downtime and deferment of crude oil and gas production. At the end of this study, a various model or types of RVs performance are compared.

Collection of data is taken from a secondary source from the contractor's workshop that is contracted to do the relief valve certification work. The data available is a sample of some relief valves that have undergone the certification

process for the last three years, 1998 up to 2000. The major variables used in the data consist of RV Model, RV Designed Set Pressure, Pop Test Pressure, and calculation of Error percentage.

A total of 543 RVs pop test data were collected. The observation is that 40% of the overall RV sample collected shows good performance while 20% were found leaking. The other 40% popped either beyond or before the healthy range of set pressure. Overall this means, 60% of the RVs at the offshore platforms are not performing according to their original design.

These RVs are further categorised by their model. The majority of the models used are AND Greenwood and Cosby models which have at least 20% of the units leaking - 20% and 28% respectively.

CHAPTER ONE

INTRODUCTION

1.1 Background

PETRONAS Carigali Sdn. Bhd. (PCSB) is a wholly owned subsidiary of PETRONAS. PCSB was formed to augment the exploration and development activities of the foreign oil companies and through its participation, to enhance the pace of development of the upstream sector in the country. The headquarters of PCSB is in Kuala Lumpur, where the Managing Director's office, Exploration Division, Development Division and the Commercial Division are located. In Malaysia, PCSB operates in three regions viz: -

Sarawak Operations (SKO)

Peninsular Malaysia Operations (PMO)

Sabah Operations (SBO)

PCSB also has an outfit that operates overseas operations.

For the purpose of this project, Sarawak Operations (SKO) will be the base to carry out the research.

1.1.1 Sarawak Operations (SKO)

SKO consists of Baram and Balingian fields offshore Sarawak and a Miri Crude Oil Terminal (MCOT). It is based is in Miri, Sarawak. Baram Delta and Balingian are among the oldest and most prolific oil-producing areas. SKO is operating all the fields. The average oil production is 120,000 barrels of oil per day, which is about one-sixth of Malaysia's crude oil production. A large quantity of associated gas is also one of the major products produced offshore. They are mainly exported to MLNG plant in Bintulu, Sarawak.

SKO operates nine fields in Baram Delta and three fields in Balingian areas consisting of 100 structures offshore of Sarawak waters. These offshore structures ranges from several categories of platforms, from small "jackets" up to compressor and production stations with overnight accommodation.

1.1.2 A typical operation of SKO's Production Platform

The basic function of an offshore production is to control and separate the well fluids. From the well-bore the fluids flow to the surface through the production tubing to the wellhead or Christmas Tree. From the flowline the fluids enter the manifold area where, depending upon the wellhead pressure, they are diverted to separators of different ratings. There are normally three production separators, which are operated at different pressures. The High High Pressure (HHP) Separator is operated at approximately 1200 psig, and the Low Pressure (LP) Separator is at 50 psig. Fluids from the surge vessel are then metered and

pumped ashore through the subsea pipelines to Miri Crude Oil Terminal (MCOT) to be further processed (see Figure 1.1)

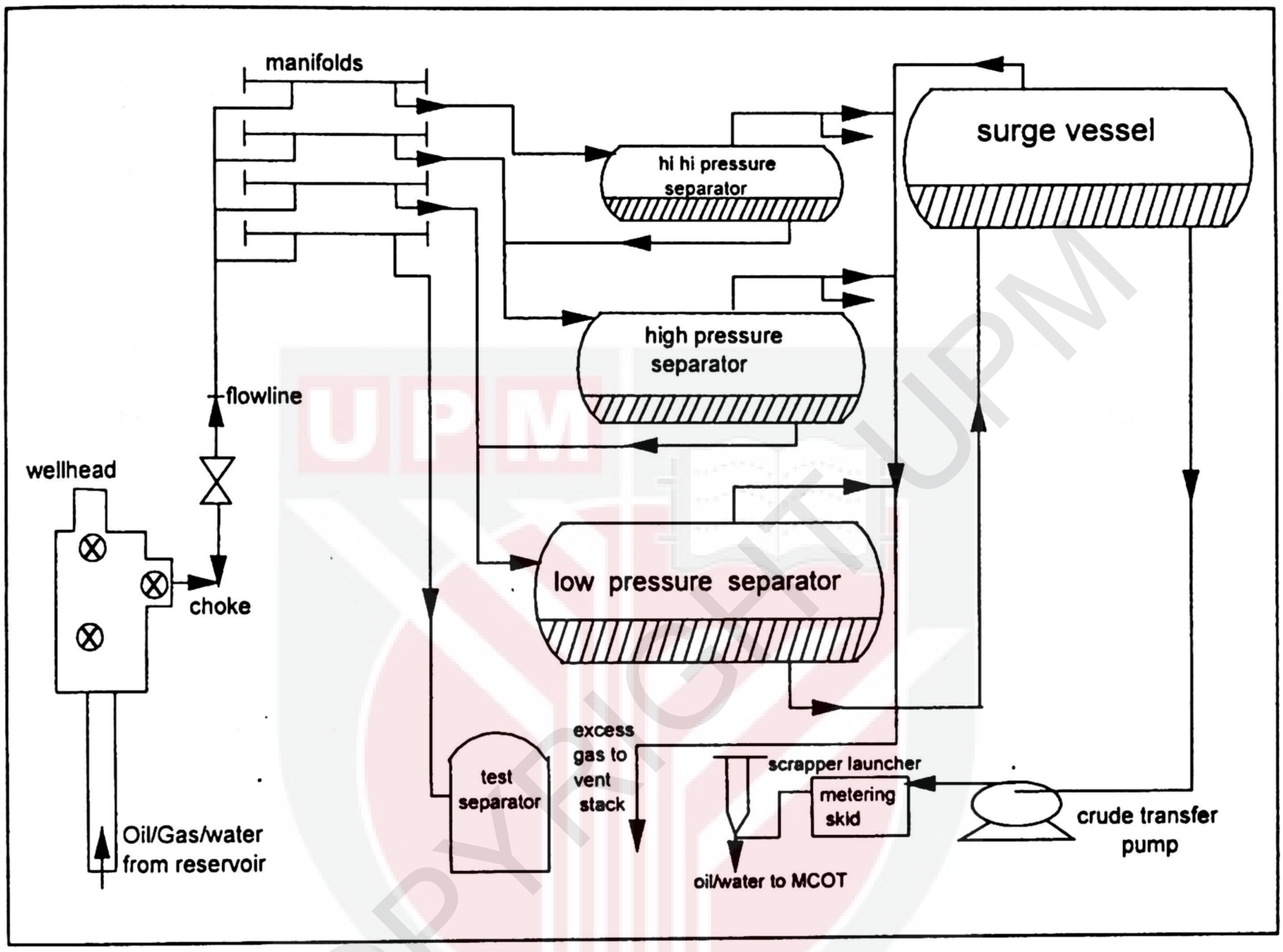

Fig 1.1: A schematic diagram showing a typical operation of a production platform

A platform has safeguarding systems that will automatically shut down the whole station or process equipment whenever an abnormal or dangerous condition exists on the station or in any of the major process equipment. It can also be manually shut down by pulling any one of the many emergency shut down kill knobs located at strategic points on the platform. When the station is shut down,

all emergency shut down valves will close, all producing wells close-in, all separators depressurised by releasing the pressure through the remote vent stack. The liquid is retained inside the process separators.

1.2 Problem Statement

In PETRONAS Carigali, there are twenty-one different models of Relief Valves (RVs) installed offshore serving various services. Maintaining these different models is costly with regard to stock. Different model would require different set of parts to be stocked. Some of these RVs require special approach in maintaining them and special tools are required.

The maintenance cost of each RV ranges from few hundred to several thousand ringgit. Inspection and Maintenance Guidelines 1997 (CIMG, 1997) states that all pressure relieving devices in all offshore platforms must be certified /overhauled every three years. The certification is required to ensure the reliability and integrity of all relief valves (RVs) are intact. Prior to year 1997, the frequency of RV certification was every two years. Ironically in the same year, an incident involving relief valve occurred at Betty Production platform. A sum of 150 barrels of crude oil was reported spilled into the sea as a result of failure on two units of relief valves. Incident of this nature is detrimental to the company's image because the environment is affected.

1.3 Objective of Study

The objective of this study is to assess the past performance of various types or models of RVs pop test when they were tested and inspected at the workshop after two years of service. The performance of the various models will be checked by comparing the pop test pressure (observed pressure) and the designed set pressure (expected pop pressure). At the end of this study a performance comparison of different types of RVs will be revealed and recommendation will be made to slowly phase out the poor performers. This will minimize the types of RVs installed offshore and their maintenance cost.

SKO has adopted an interval of three years between inspections of all RVs since 1998 after the introduction of new RVs certification procedures. Under the new procedures, all RVs that are subject to certification test must undergo complete overhaul, after which they will be tested after three years in service. Prior to 1998, it was done every two years. Previous procedures were adopted from Sarawak Shell Berhad (SSB), and not as stringent as the new ones where the complete overhaul of RVs is only required if the "error" of the as found pop test result is negative and exceeds 10%.

1.4 Limitation

The only records of the past pop test reading are kept at the contractor's workshop. Judging from the quality of these records, there has been no quality check done on them. Some of the data are missing from the test certificates. Among the most frequent discrepancies observed were cases where the Pop

Test readings, Date Tested, Make and RVs service columns were left blank. For RVs with missing pop test readings, they were assumed to be 'faulty' RVs. It is also difficult to compare the RVs pop test reading one to one, say 1997's data and 1999's data because of the inconsistency in the records being kept in the contractor's files. Similar RVs pop test result may not be found in the next set of test records.

Out of the 1238 units of RV population in SKO, only 543 pop test certificates were available at the workshop. One of the reasons why this happened is because of the change from the old to the new contractors in 1997. Some of the RV reading certificates got misplaced in the process of handing over.

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