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Safety Evaluation and Risk Assessment for Treated Water Pipe Replacement Fabrication, Installation and Dismantling Process

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Abstract: This study examines and evaluates the hazards and risks associated with fabrication activities carried out at the workplace of pipe service company and even pipe installation activities at the Pengerang Integrated Complex (PIC) during the work process. The input will be processed and evaluated, and then the appropriate control mechanism will be considered. Company best practices should be emphasized, and any findings or deficiencies should be addressed for improvement. The objective of the study is to identify the hazards, assess and evaluate the risks that exist during pipe work and related activities. Next, control measures will be proposed to ensure that the risk of harm is reduced. For that, several methods have been implemented to obtain the information needed to achieve the objective. Visits to the workplace are carried out to obtain clearer information about the plumbing process as well as to see more clearly the dangers in the workplace. Next, existing control measures can be recorded for the risk assessment process. As a result of the assessment, a total of 32 hazards were discovered during the fabrication process. For installation work, there are 32 hazards which are divided into physical, ergonomic, biological and chemical hazards.Dismantling process there are 39 hazards detected due to the work activity of doing work at high places while lifting using a crane at the same time to lower the pipe after dismantling the scaffolding. the level of risk can be determined. Based on the research conducted on this assessment, JHA is more effective than HIRARC. HIRARC is for all routine work or processes in the workplace while JHA is used for non-routine work. Through this method, the dangers found in the

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workplace can be divided according to the level of the type of danger whether physical, chemical, ergonomic and electrical. The results of this study can identify possible or potential hazards during the process. Analyzes hazard levels for activities and recommends improvements to reduce hazards. Employee commitment and support from company management is essential to creating and succeeding in a healthier and safer workplace.

Keywords: Safety Evaluation, Fabrication, Installation, Dismantling Process

1. Introduction

1.1 Research background

The major operations in the pipeline fabrication, installation and dismantling process of pipeline projects for the oil and gas sector are cutting and welding. Employees in this sector face various safety and health concerns as a result of their operations. The study was conducted in selected firms that provide pipe welding services in a workshop/warehouse environment.

One of the most dangerous occupations in the pipeline project and fabrication phase is pipeline welding and cutting. Workers and those in the immediate vicinity are exposed to health risks such as high heat and noise, welding fumes, fires, and explosions. Recent research has revealed that many chemicals produced and released during plumbing activities such as welding can harm welders in the long run, causing lung, brain, and nerve damage, as well as manganism (Parkinson Welders disease), while short-term exposure can cause nausea, dizziness, or irritation of the eyes, nose, and throat. High exposure to manganese in the workplace can lead to adverse neurological effect.[3]

1.2 Problem statement

In recent years, the process is frequent and widely used in oil and gas pipeline facilitation, installation and disassembly of processes on site. It has offered the industry well in the form of fabrication joints, assembly and disassembly processes low in labor intensity, fast in work process speed and high in first time pass rate. The implementation of technologies that increasingly improve quality aspects in work processes and reduce employee exposure to hazards.

However, pipe fabrication, installation and dismantling processes involve a variety of high -risk operations that must be specified and evaluated quantitatively or qualitatively. To analyse the hazards, appropriate risk assessment methods such as site observation, data analysis, and interview sessions must be used.

1.3 Objectives

The objectives of this study are to examine the issues associated with health, safety and environment aspects in the selected pipe welding services workshop. The objectives of this study are:

a) To identify the hazards associated with the pipe service activities conducted.
b) To assess and evaluate the risks associated with the activities to the safety and health of the workers, facility and the environment.
c) To recommend mitigation plan and control measure to reduce the likelihood impact and risk rating level.

1.4 Scope of study

The scope of the study was carried out at the beginning of the project in a workshop/warehouse at a pipe service company where fabrication work was carried out. Next at the end of the project is the Petronas Integrated Rapid Pengerang UF section where the installation and dismantling process works are carried out.

2. Methodology

The methodology of the research investigation is detailed in this chapter. At the outset, literature studies were carried out to learn about the current study's history and applicable procedures.

Site visits were made to learn more about the current condition at the workplace and to monitor pipe welding processes. The severity and likelihood of an incident may then be used to analyse and evaluate the hazards and risks connected with the pipe welding operation. The present control measures are evaluated based on the site visits. It is possible to evaluate and track the efficiency of accident-prevention strategies.

2.1 Site Observation and monitoring

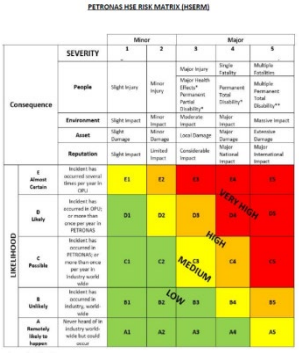
Site inspections were organised in advance and site assessments were conducted at the workplace in order to determine the dangers that present in the research region. Each visit was focused on a distinct work activity in the workshop for the pipe activity for this objective. General workplace inspection checklists are created and adapted to fit the needs of the job based on a set of criteria to identify the dangers that exist for each of the activities performed on the job. The observations are based on actual welding workshop methods for pipe operations.

2.2 Review of document

Job Hazard Analysis (JHA), incident reporting and statistics, and Standard Operating Procedure (SOP) documents were analysed and utilised as references in evaluating the risk rating and control actions that should be prioritised. For machineries such as Cold Pipe Cutting and Tack Welding technique, the machine manual standards were also reviewed and safety precautions were noted.

2.3 Data collection and analysis

JHA or HIRARC forms, as per Department of Occupational Safety and Health (DOSH) Malaysia guidelines and use Petronas HSERM, were used to assess and evaluate the hazards associated with work activities based on data acquired via site observation, document review, and interview sessions Current control measures will be assessed and further mitigation action will be offered to minimise risks based on input and processed data in the HIRARC. In order to provide a safe working environment, ALARP guidelines and implementations will decrease hazards. **Figure 1** shows the use of the Petronas HSE Risk Matrix as a guideline for hazard analysis.



RISK RATING	INTERVENTION
LOW	• Risk is tolerable • Monitor at operational level using procedure/appropriate internal control as per HSEMS • Take corrective action according to availability of resources
MEDIUM	• Undertake control and Recovery Barriers evaluation • Risk is tolerable if supported by ALARP demonstration • Monitor using procedure or appropriate internal control as per HSEMS
HIGH	• Undertake risk reduction by applying appropriate Control and Recovery Barriers • Risk is tolerable if supported by ALARP demonstration • Review and approval of ALARP demonstration by HCU/BU/OPU/Project Head and Senior management with escalation to Business Head
VERY HIGH	• Risk is not tolerable. • Mitigate the risk through control and recovery barriers(s) to reduce the risk to tolerable/ALARP • Review and approval of ALARP demonstration by HCU/BU/OPU/Project Head and Senior management with escalation to Business Head

Figure 1 : Petronas HSE Risk Matrix use as a guideline for hazard analysis

The methodological approached to each objective are summarized in this **Figure 2**.

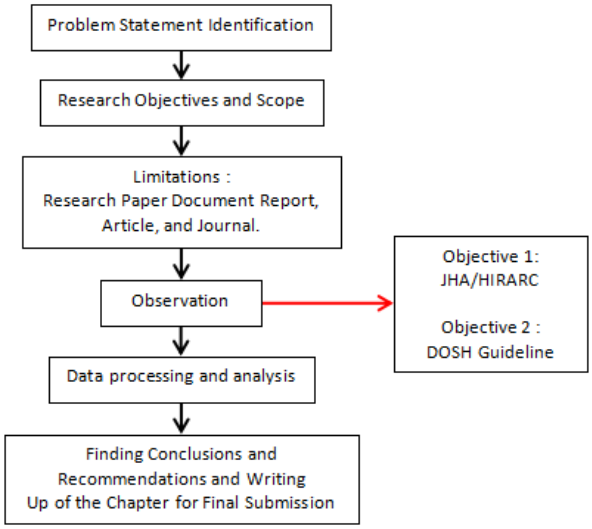


Figure 2 Summarized of Methodology

3. Results and Discussion

The projected outcomes are directly tied to the study's aims and objectives. Expectations to be met as a result of achieving goals. Essentially, the intended outcomes will explain the causes, as well as the reasons for safety and health performance, in full through this study.

In this chapter, the results obtained from the study will be done into the HIRARC or JHA form. The scope of the study has been divided into THREE main activities for pipes, namely:

a) Fabrication (Pipe welding and cutting)
b) Installation (Operation of crane, working at height and pipe jointer)
c) Dismantling Process

3.1 Fabrication

According to the findings of the study, a total of 32 hazards were found during the fabrication process and according to the PEAR element, 9 hazards at a low rate and 11 at a medium rate could be detected. Welding gases from welding activities and noise from pipe cutting activities are two of the most serious risks. Both risks have a somewhat high risk rating. A recommended next step is to supply welding stations with LEVs, whether permanent or portable, to decrease exposure to welding fumes. Installing a portable suppressor to minimise workplace noise may be an alternative for pipe cutting activities. Hazard decisions for fabrication work are summarized in **Table 1**

Table 1 : Summarized of Hazard Fabrication Work

	Physical Hazard	Ergonomic hazards	Electrical Hazards	Chemical Hazards	Biological hazards	Total
Entering the project area	6	2	-	1	2	11
Lifting work	7	-	-	1	-	8
Hot-work	6	1	1	-	-	8
Work overtime	-	2	-	-	-	2
Housekeeping	3	-	-	-	-	3
Total	23	4	1	2	2	32

3.2 Installation

For installation work, there are 32 hazards that are divided into physical, ergonomic, biological and chemical hazards and according to the PEAR element, 6 hazards at a low level and 15 at a medium level can be detected.. Working at high places is the hazard most noticed because the installation process takes place at high places such as the installation of scaffolding and pipes and the control measures that need to be done is to ensure that every employee who works at high places must wear safety harnesses that have been inspected and green tag. Hazard decisions for installation work are summarized in **Table 2**

Table 2 : Summarized of Hazard Installation Work

	Physical Hazard	Ergonomic hazards	Electrical Hazards	Chemical Hazards	Biological hazards	Total
Entering the project area	6	2	-	1	2	11
Installation work	9	3	1	-	-	13
Working at height	2	-	-	-	-	2
Work overtime	-	2	-	-	-	2
Housekeeping	4	-	-	-	-	4
Total	21	7	1	1	2	32

3.3 Dismantling

During the dismantling process, there were 39 hazards in total and according to the PEAR element as many as 7 hazards at a low rate and 15 at a medium rate could be detected as a result of the work activity of doing work at a high place while lifting using a crane at the same time lowering the pipe after dismantling the scaffolding. Hazard decisions for dismantling work are summarized in **Table 3.**

Table 3 : Summarized of Hazard Dismantling Work

	Physical Hazard	Ergonomic hazards	Electrical Hazards	Chemical Hazards	Biological hazards	Total
Entering the project area	6	2	-	1	2	11
Dismantling work	8	3	1	-	-	12
Lifting work	7	-	-	1	-	8
Working at height	2	-	-	-	-	2
Work overtime	-	2	-	-	-	2
Housekeeping	4	-	-	-	-	4
Total	27	7	1	2	2	39

Table 4 : Summarized of PEAR element for JHA fabrication, installation and dismantling process

	Low	Medium	High
Fabrication	9	11	0
Installation	6	15	0
Dismantling	7	15	0

4. Conclusion

Based on the research conducted on this assessment, JHA is more effective than HIRARC. HIRARC is for all routine work or processes in the workplace while JHA is used for non-routine work. Therefore, this study is conducted on a project that takes less than 5 months and the activities carried out are not routine and will change according to the situation that will occur.

The results of this study can identify possible or potential hazards during the process. Analyze hazard levels for activities and recommend improvements to reduce hazards. Can take appropriate action to reduce the possible impact and level of risk rating in the long term.

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