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A Study on Safety Assessment in A Pipe Concrete Industry

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Abstract: Pipe manufacturing process is considered as high risk activities as the process involved huge pipe and crane. This study was aimed to identify, assess the hazard and risk involving spun pipe process. In order to achieved the aims, the research objectives for this study were to identify hazard and risk related to spun pipe manufacturing process, to analyze identified hazard and risk related to spun pipe manufacturing process and to recommend workable management plans to overcome implementation problems in each work procedure which has been carried out at spine pipe production process. The interview method was used to collect data and the data was analyzed using hazard identification, risk assessment and risk control matrix. The risks were analyzed using the risk matrix method. Out of the 26 hazards identified, the risk score indicates that 27% of the hazards were low risk levels, followed by 50% of them were medium risk levels, and 23% of them were categorized as high hazard levels. A total of 26 hazards were found during the task of producing pipe concrete. These dangers are broken down into safety dangers, which include physical hazard, ergonomic hazard, psychological hazard and chemical hazard. The risk control for high and medium risk identified were recommended to the management.

Keywords: Pipe Concrete, HIRARC.

1. Introduction

Pipe concrete manufacturing industry is an industry that has a high risk of occupational accidents because the industry changes according to the phase of the development project [1]. Defines safety as an unexpected or uncontrollable incident caused by environmental causes, human factors, or a combination of any of these elements, especially in the manufacturing industry. The condition will impede productivity and may result in physical injury to workers, death, property damage or other unfavorable outcomes. Furthermore, whether or not these elements are acknowledged, every accident has a cause, as is general knowledge. Most workplace accidents are brought on by management mistakes made by the firm itself. Every company is required to give its employees a secure environment, as is common knowledge. However, a lot of firms continue to disregard the requirements stated by DOSH

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Department of Occupational Safety and Health Malaysia (DOSH). Organizations, such as officers or contractors who are on duty, do not care about the safety of their employees. The majority of production (Spun Pipe) personnel in the manufacturing industry always use "spinning" machinery to create a pipe-like concrete product. In other words, the utilization of relies on their everyday work. The majority of production (Spun Pipe) personnel in the manufacturing industry always use "spinning" machine to create a pipe like concrete product. In other words, the machine they utilize at work is essential to their ability to complete their everyday tasks. The majority of their management does not offer sufficient instruction on how to use the equipment. Additionally, the management did not develop a safety policy, a subcommittee for a project, or any safety signage in the appropriate locations, all of which are basic safety requirements in the workplace. For example, at a construction site, the management has to put up a 'safety first' sign which means workers have to prioritize safety first when entering the manufacturing area.

2. Methods

2.1 Qualitative Methods

Research that necessitates close observation is referred to as qualitative research. For qualitative research, a small sample of participants in a group is all that is needed to produce high-quality information [2]. Qualitative methods involve gathering information through interviews or in-depth observation are particularly suitable [3]. In qualitative research, observations, essay-style questions, and unstructured or semi-structured interviews are employed as a means of gathering data. Because the study sample is small, information from documentation materials, interviews, and observation recordings are employed to boost the study's dependability and reliability.

2.2 Research Design and Data Collection

Entire process of linking empirical data to research finding from concept unaliasing the issue to the data collecting, analysis, and reporting processes is known as research design [4]. The design of this study is a plan or strategy for a study. Below shows Figure 1 and Table 1 (flow chart and research objective) showing the framework of this study.

Figure 1: Flow Chart

Table 1: Research Objective

Objectives	Method	Data
RO 1: To identify hazard and risk of spun pipe manufacturing proses	Field Observation & Semi-structured interview	Pipe concrete work hazard
RO 2: To analyse hazard and risk of spun pipe manufacturing proses and make improvements for effectiveness in each workplace procedure	Interview	Work guidelines method HIRARC
RO 3: Recommend workable management plans to overcome implementation problems in each work procedure which has been carried out at G-Cast Concrete Production Sdn. Bhd.	Focus group discussion	The result of information and research that has been produced

2.3 Collection of Primary Data

Primary data is information that has been collected through research using various relevant techniques. The primary data for this study was collected through observation and interviews. This methodology was designed to further explore the aims of the study and confirm the statements and issues of the study. In addition, primary data, as defined by [5], is information collected from natural sources to address research issues. Researchers obtain this data through experimental procedures or field investigations, including surveys, observations, interviews and other methods.

2.4 Secondary Data Collection

The definition of secondary data given by [6], is information collected by other researchers. For example, recent data or information previously collected for research. The knowledge is still appropriate and relevant for use in addressing research issues, building information, or creating new approaches for ongoing studies.

2.5 Hazard Identification, Risk Assessment and Risk Control.

Hazard is closed relationship with the risk. Risk is a metric for assessing and analying danger. Additionally, measurements are done by determining the gravity and timing of potential dangers. In other words, a risk assessment isa comprehensive examination of identifying risky circumstances, procedures, and activities, as well as other workplace risks. To show how risks are distributed throughout the plant and different parts of the workplace, risks are presented in a variety of ways. Each risk assessment result included in the risk matrix is crucial for decision-making about risk management. Risk can be calculated using the following formula:

Risk (R) = Likelihood (L) x Severity (S)

Where the likelihood can be referred to Table 2. The severity can be referred to Table 3. The risk level can be referred to Table 4. Based on the risk matrix, the risk shall be controlled based on Table 5 below.

Table 2: Likelihood (L) of an occurrence

LIKELIHOOD (L)	EXAMPLE	RATING
Most likely	The most likely result of the hazard/ event being realized	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might be occur at some time in future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1

Table 3: Severity (S) of hazard

SEVERITY(S)	EXAMPLE	RATING
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5
Fatal	Approximately one single fatally major property damage if hazard is realized	4
Senior	Non-fatal injury, permanent disability	3
Minor	Disabling but no permanent injury	2
Negligible	Minor abrasions, bruises, cuts, first aid injury	1

Table 4: Risk Assessment Matrix

	Severity (S)				
Likelihood (L)	**1**	**2**	**3**	**4**	**5**
5	**5**	**10**	**15**	**20**	**25**
4	**4**	**8**	**12**	**16**	**20**
3	**3**	**6**	**9**	**12**	**15**
2	**2**	**4**	**6**	**8**	**10**
1	**1**	**2**	**3**	**4**	**5**

High	
Medium	
Low	

Table 5: HIRARC Description

RISK	DESCRIPTION	ACTION
15-25	**HIGH**	A HIGH risk requires immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion.
5-12	**MEDIUM**	A MEDIUM risk requires a planned approach to controlling the hazard and applies temporary measure if required. Actions taken must be documented on the risk assessment form including date for completion.
1-4	**LOW**	A risk identified as LOW may be considered as acceptable and further reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measures should be implemented and recorded.

3. Results and Discussion

3.1 Result Risk Assessment

The area used to produce the condenser is production of spine pipe. Total of 26 hazards that have been identified. The methods used are Observation, work activity categorization, HIRARC plans are all methods used to identify hazards. Three types of low, medium and high hazards are identified through the risk assessment procedure. In addition, each hazard that is evaluated will be collected information in order to get the results that should be obtained. The Table 6and Figure 2 below shows the results for month (March until June) and Figure 3 result of the risk assessment.

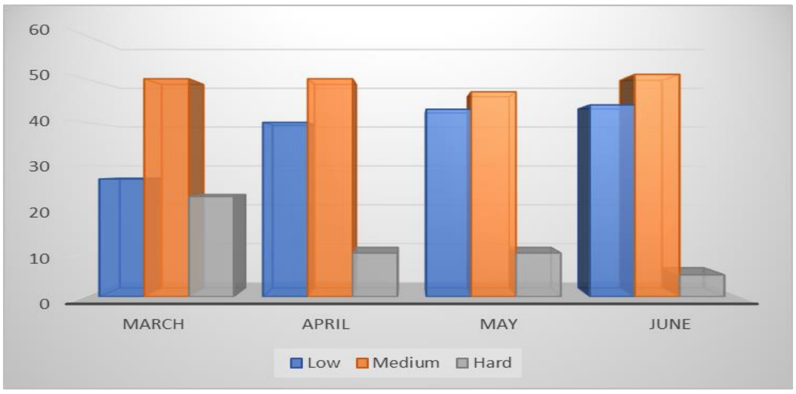

Figure 2: Result for month (march until June) risk assessment

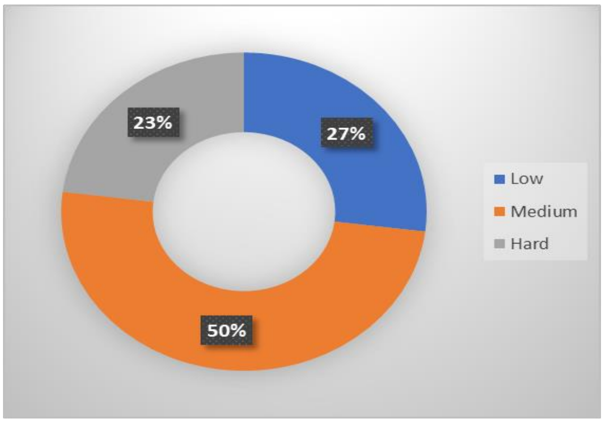

Figure 3: Result of risk assessment

According to the total results in Figure 3 above, of the 26 hazards found, the risk score indicates that 27% of the hazards have low risk levels, followed by 50% of them that have medium risk levels, and 23% of them that have high hazard levels. A total of 26 hazards were found during the task of producing pipe concrete. These dangers are broken down into safety dangers, which include physical hazard, ergonomic hazard, psychological hazard and chemical hazard. The results are shown in Figure 4.4 below shows of the hazard classification.

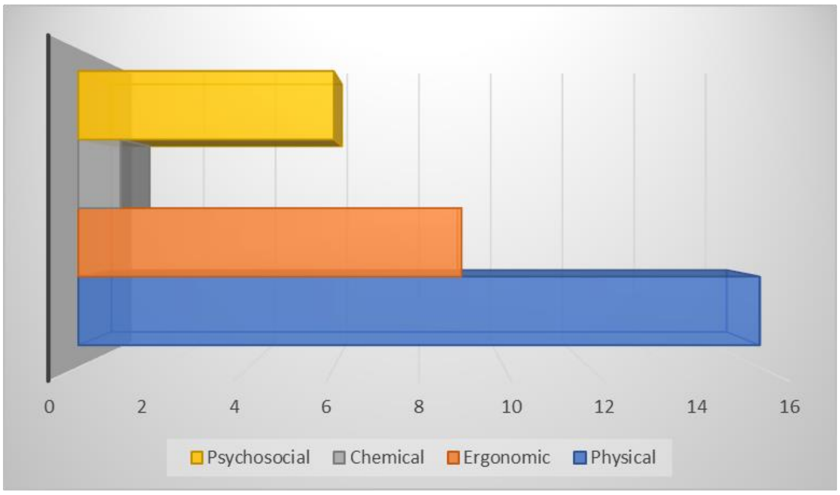

Figure 4: Results of hazard classification

Table 6: Details total Classification

Hazard	*Total Classification*	*Percentage*
Physical	16	50%
Ergonomic	9	28.13%
Chemical	1	3.12%
Psychosocial	6	18.35%

According to Table 6, the aforementioned statistics, physical injury accounts for the biggest percentage, reaching a maximum of (50%). Here are the percentages for the ergonomic hazards (28.13%), psychosocial hazards (18.75%), and chemical hazards (3.12%). This data shows that chemical hazards are a low risk in the pipe and concrete production industry. Figure 5 below displays the risk specific level rating for each type of hazard classification based on the findings for each type of hazard class in the manufacture of condensers area shown in HIRARC: Risk assessment value.

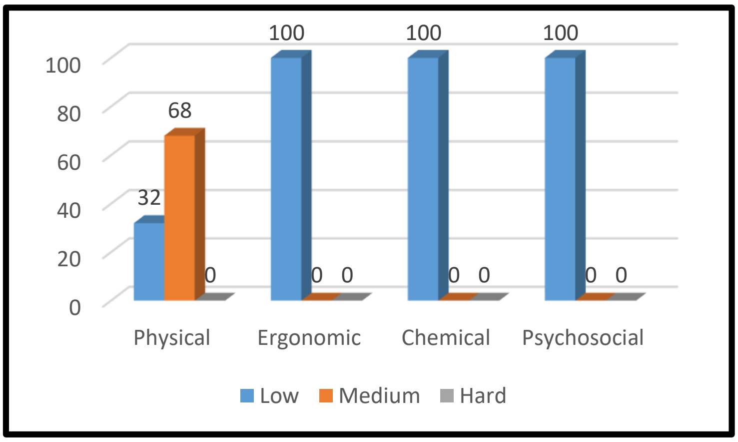

Figure 5: Percentage of risk level according to hazards

In line with findings for all hazard categories, the manufacturing area for condensers had a physical hazard rate of 50%, with 65% of risks being considered to be of moderate risk, 30% as medium risk, and 5% as high risk. Ergonomic risks make up 28.13% of all hazards, and 100% of them are classified as low risk, followed by medium risk and high risk, respectively. Other than psychological risk, which accounts for 18.35% of the overall hazard, 100% denotes mild risk, moderate risk, and 0% denotes high risk. The final percentages are 100% for low risk, medium risk, and high risk, respectively, for chemical dangers, which account for 3.12% of the overall danger. Because physical risks only have a modest probability of 30%, most have a risk control action plan in the condenser production locations.

3.2 Critical Safety Hazard

The expected danger for the most critical safety hazard is Physical danger because it involves the physicality of workers who do pipe concrete works such as lifting heavy cement bags resulting in workers suffering back injuries or back pain. In addition, sharp materials can also cause injury to the human body, it can result in a critical wound, possibly causing a bacterial infection in the wound. Sharp objects are the most common cause of significant internal injuries manufacturing of concrete pipe works.

3.1. Risk Control Measure

Risk assessment data findings processing using the HIRARC approach can be used to rate some of the advised activities as having moderate risk or severe risk. The recommendation action plan were tabulated in Table 7 below.

Table 7: Risk Control of each activity/hazard

No.	Activity	Cause	Consequence	Action
1	**Wire Cage Machine**	Excess welder (Spark)	Burn skin	1. Replace dangerous material or less risky procedures with replace 2. Custom built the machine so worker not use hand. 3. Using the foam padding to minimize harsh, sharp, and painful direct contact. 4. Provide SOP for safety at working with Sharp material. 5. Provide appropriate (PPE)
2	**Welding Machine**	Excess welder (Spark)	Burn skin	1. Replace dangerous material or less risky procedures with replace 2. Provide safe working platform 3. Training should be provided to give exposure about risk involved 4. Provide SOP for safety at working with Sharp material. 5. Provide appropriate (PPE)
3	**Install Pipe Mould**	Sharp material (Rebar)	Finger cut	1. Replace dangerous material or lessrisky procedures with replace 2. Using the foam padding to minimize harsh, sharp, and painful direct contact. 3. Training should be provided to give exposure about risk involved 4. Provide SOP for safety at workingwith Sharp material.

No.	Activity	Cause	Consequence	Action
				5. Provide appropriate (PPE)
4	**Spinning Machine**	Sharp material (Rebar)	Finger cut	1. Replace dangerous material or lessrisky procedures with replace 2. Custom built the machine so workernot use hand. 3. Using the foam padding to minimize harsh, sharp, and painful direct contact. 4. Conducting safety briefing on safework practice before working 5. Training should be provided to give exposure about risk involved 6. Provide appropriate (PPE)
5	**Uninstall Pipe Mould**	Sharp material (Rebar)	Finger cut	1. Replace dangerous material or less risky procedures with replace 2. Using the foam padding to minimize harsh, sharp, and painful direct contact. 3. Training should be provided to give exposure about risk involved 4. Provide SOP for safety at working with Sharp material. 5. Provide appropriate (PPE)
6	**Storage Area (Forklift)**	Struck forklift (Worker)	Bodily injury	1. Replace dangerous material or lessrisky procedures with replace 2. Provide safe working platform 3. Training should be provided to give exposure about risk involved 4. Provide SOP for safety at workingwith Sharp material. 5. Provide appropriate (PPE)

4. Conclusion

As conclusion, the study was aimed to identify, assess the hazard and risk involving spun pipe process. In order to achieve the aims, the research objectives for this study were to identify hazard and risk related to spun pipe manufacturing process, to analyze identified hazard and risk related to spun pipe manufacturing process and to recommend workable management plans to overcome implementation problems in each work procedure which has been carried out at production area. The interview method was used to collect data and the data was analyzed using hazard identification, risk assessment and risk control matrix. The risks were analyzed using the risk matrix method. Out of the 26 hazards identified, the risk score indicates that 27% of the hazards were low risk levels, followed by

50% of them were medium risk levels, and 23% of them were categorized as high hazard levels. A total of 26 hazards were found during the task of producing pipe concrete. These dangers are broken down into safety dangers, which include physical hazard, ergonomic hazard, psychological hazard and chemical hazard. The risk control for high and medium risk identified was recommended to the management.

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