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Analysis of Occupational Health and Safety (OHS) on the Cable Tray Support Farming MSP Fabrication Project Using the Hazard Identifications and Risk Assessment (HIRA) and Hazard and Operability (HAZOP) Methods

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ABSTRACT

A business in Gresik City that works in the steel fabrication industry is called PT. Swadaya Graha. A cable tray project is one of the joint ventures that PT. Swadaya Graha and PT. Triraya have finished. Workplace mishaps are unavoidable when working on a project. There were multiple work accidents on the cable tray construction project from February 2023 to May 2023, according to the work accident report of PT. Swadaya Graha. One of these workplace mishaps leaves a victim with minor wounds and burns. In order to encourage employees to stay vigilant and exercise caution whenever working on a project, this research was done to reduce the likelihood of workplace accidents and to learn about the possible risks associated with working on a cable tray project. Using the methods of Hazard Identification and Risk Assessment (HIRA) and Hazard and Operability (HAZOP), this study located potential danger sources in the cable tray project work. This investigation produced 35 potential hazard findings, including 5 dominant potential hazards (hazards with the highest level value) and several recommendations for corrective measures that could benefit the company, such as adhering to the SOP that has been established.

Keywords: *Work Accidents, Potential Hazards, Cable Tray, HAZOP, HIRA*

Introduction

Occupational Health and Safety (OHS) prevents accidents, disability, and death due to accidents at work[1]. Safety Work (safety) is the safety of workers, and whether they are using a machine, aircraft, work tools, or processing processes, the workplace and environment are also guaranteed[2]. Regardless of the type of work environment, occupational health and safety (OHS) must be implemented because it can prevent and lower the likelihood of accidents[3].

For example, work accidents and health problems often occur when implementing the cable tray project,a big concern for steel fabrication companies. The impact is an increase in company budget expenditure. The steel fabrication industry recognises the significance of occupational health and safety in the development and implementation of projects involving personnel, technical equipment, materials, and management. Thus, it is important to pay attention to occupational health and safety issues[4][5]. A pattern of risk management, which includes risk assessment, risk mitigation, potential hazard analysis, risk control, monitoring, and evaluation, is required to lessen or even completely eliminate the hazards that may cause workplace accidents. Ensuring that there are no accidents is the aim[6]. Facilitating each worker's use of Personal Protective Equipment (PPE), such as safety shoes, masks, earplugs, helmets, and gloves, is one way to reduce work-related accidents[7].

PT. Semen Gresik (Persero), Tbk is the company that founded PT. Swadaya Graha, a services provider. PT. Swadaya Graha and PT. Triraya are working on a cable tray project; this company is involved in steel construction and fabrication from February 2023 to May 2023. The cable tray project is a collaboration project between PT. SwadayaGraha with PT. Triraya, the construction itself took 4 months. The cable tray is a piece of equipment that functionsas a cable installation route to protect from environmental factors or overheating problems caused by heat buildup. According to information gathered from staff interviews with Occupational Health and Safety (OHS), work accidents are undoubtedly occurring during the cable tray project[19]. Stroom stings are among the most common mishaps that occur when working on a cable tray project. It may inflict mild to serious injuries on employees. Research employing the Hazard and Operability Study (HAZOP) and Hazard Identification and Risk

Assessment (HIRA) techniques is required to lower the frequency of work-related accidents. The purpose of this study is to identify potential risks associated with the cable tray project, identify the most significant risks through risk assessment calculations utilising the Hazard Identification and Risk Assessment (HIRA) method, and offer suggestions for mitigation utilising the Hazard and Operability Study (HAZOP)[12][20].

Research Methods

Research Concept

The research was conducted on the cable tray project at PT. Swadaya Graha. This research was conducted for 4 months, namely February 2023 to May 2023. This research aims to identify and assess hazards and provide risk control for dangers that occur during cable tray project work. This study employs the Hazard and Operability Study (HAZOP) and Hazard Identification and Risk Assessment (HIRA) methodologies.

An attempt is made to determine the risks associated with a processing unit that deviates from its intended design in a hazard and operability study. Hazops is an extremely methodical, exhaustive, and comprehensive technique. Although HAZOPS was first created exclusively for industry, it can be applied to other tasks as well[8]. To find potential hazards and conduct hazard analyses, you can use the Hazard and Operability Study (HAZOPS) method. Using this approach, risk management is put into practice and the company's approach to occupational safety and health is guaranteed[9]. According to the findings of research by Restuputri & Sari (2015), HAZOP functions in a methodical manner by searching for different contributing factors that enable work accidents to happen, identifying negative outcomes from deviations, and offering suggestions or steps that can be taken to lessen the impact of potential risks that have been identified[10][11].

Hazard Identification and Risk Assessment (HIRA) is the process of identifying potential work hazards by characterising potential hazards and evaluating the risks that arise from risk assessment using a risk assessment matrix[16][17]. Risk assessment is one of the essential elements for implementing the Occupational Safety and Health Management System, and Hazard Identification and Risk Assessment (HIRA) is a technique for identifying work accidents[18].

Research Variable

Several risk variables were obtained in this study. These risk variables are literature studies, field observations, and interviews with Occupational Health and Safety (OHS) staff. These will be used as assessment material when distributing the questionnaire to respondents. The head of the Occupational Health and Safety (OHS) division participated in this study as a respondent. Meanwhile, there are 35 potential hazards listed in the statement of potential hazards that the head of the Occupational Health and Safety (OHS) division must evaluate for likelihood and consequences.

Research Steps

1. Determine potential risks by reading up on the subject, seeing things firsthand, speaking with employees of the Occupational Health and Safety (OHS) division, and sending out surveys to the division head.
2. Questionnaires were distributed as part of the data analysis process, which also involved risk assessment and determination using the Hazard Identification and Risk Assessment (HIRA) method and risk controls using the Hazard and Operability Study (HAZOP) method.
3. Recap the risk factors, risk assessment, and risk control related to occupational health and safety.

Results and Discussion

Identification of Potential Hazards and Risk Assessment Using the Hazard Identification and Risk Assessment (HIRA) Method

In order to ascertain the current risks associated with the cable tray project work, potential hazards are identified. The identification process comprised staff members and the head of the division in charge of occupational health and safety, as well as field observations and interviews with important informants. The 35 hazard findings that were derived from the outcomes of these interviews will be assessed by the head of the Occupational Health and Safety (OHS) division using a questionnaire.

Following the completion of a questionnaire by the head of the Occupational Health and Safety (OHS) division, the risk assessment is conducted. In order to respond, the K3 division head chose a value between 1 and 5 for each likelihood and severity column[21]. The likelihood and consequences criteria are required to perform risk assessments when conducting hazard analysis using Hazard Identification and Risk Assessment (HIRA). The table displays these requirements[22]. The criteria used to determine the likelihood of an accident risk based on frequency per unit of time (day, month, or year) are referred to as likelihood criteria[23]. Concurrently, risk impact criteria, or consequences criteria, are categorised according to how serious the potential impact of risk events is[24].

Table 1. Likelihood Criteria

Level	Criteria	Description	
		Qualitative	**Semi-Qualitative**
1	Rarely happening	It's conceivable, but not only inextreme cases	Occurs less than once in 10 years
2	Slight chance of it happening	Hasn't happened yet butmay appear at one time	1 time in a span of 10 years
3	Might happening	It should happen and may haveoccurred here or elsewhere	Happened 1 time in 5 years to 1 time everyyear
4	Most likely happening	It can quickly occur and mayappear under circumstances that happen most	Occurs more than 1 time per year to 1 timeper month
5	Almost certainly will happen.	Happens frequently, is expected to appear under certain circumstances, and happens most	Occurs every month or more than once permonth

Table 2. Concequence Criteria

Level	Criteria	Description	
		Severity of injury	**Working days**
1	Not significant	The incident didn't cause injury and didnot result in loss of material	No lost days of work
2	Low	The incident caused minor injuries thatcould have been treated with first aid and resulted in material losses.	Lost days of work on the sameday
3	Medium	The incident caused serious injury, required hospital treatment and resulted in losses ofenough material.	Lost workdays under 3 days
4	High	The incident caused serious injury, resultingin permanent defects and major material losses.	Lost day of work more than 3days and or more
5	Disaster	The incident caused the victim to die and caused a huge loss	Lost days of work forever

The risk matrix table is used to process the obtained likelihood and consequences values in order to determine the level of risk severity when assessing the risk severity. A difference in score risk value or risk level is indicated by each colour[25].

Table 3. Risk Matrix

Scale		Consequences				
		1	2	3	4	5
Likelihood	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

Where:

Red indicates that the consequence is at extreme risk, yellow indicates that the result is at high risk, green indicates that the consequence is at moderate risk, and blue means that the result is at low risk[26].

Determine the risk value, which can be obtained by multiplying likelihood and consequence. The results can be seen in the table below.

Table 4. Identification of Potential Hazards and Risk Assessment Results Using the Hazard Identification and Risk Assessment (HIRA) Method

No	Work Process	Potential Hazard	L*	C*	L*C	Risk Level
1.	Marking Process	Struck to scratches from materials	3	3	9	High
		Be squeezed of materials	3	3	9	High
		Falling of materials	3	2	6	Medium
		Be pressed down of materials	2	2	4	Medium
		Stumble of materials	1	2	2	Low
2.	Cutting Process	Exposed to smoke and dust	3	3	9	High
		Hit by sparks	3	4	12	Extreme
		Tripping over the remaining cutting material	3	3	9	High
		Stroom stung	3	5	15	Extreme
3.	Machining Process	Injured (scratched)	3	3	9	High
		Exposed to gram splashes	3	4	12	Extreme
		Injured (scratched)	2	2	4	Medium
		Wildfire	3	3	9	High
		Stroom stung	4	4	16	Extreme
		Hit by a spark	4	3	12	Extreme
4.	Setting Process	Material collapses	3	3	9	High
		Hit by a hammer	4	3	12	Extreme
		Pinched	4	3	12	Extreme
5.	Welding Process	Stroom stung	4	4	16	Extreme
		Exposure to welding light	4	3	12	Extreme
		Noise	4	4	16	Extreme
		Exposed to smoke and dust from welding	4	3	12	Extreme
		Exposed to welding sparks	4	3	12	Extreme
6.	Painting and Sandblasting Process	Exposed to painting mist	4	3	12	Extreme
		Exposed to paint splashes in the eye area	4	3	12	Extreme
		Exposed to paint or thinner	4	3	12	Extreme
		Exposed to silica sand dust	4	3	12	Extreme
		Compressor explosion	3	3	9	High
		Exposed to compressor vapour blast	3	4	12	Extreme
		The pressure used is too high	4	4	16	Extreme
7.	Packing and Delivery Process	There are no sirens or warning signs	3	2	6	Medium
		Pinched by material	3	2	6	Medium
		Sling belt or wire sling broken	3	2	6	Medium
		Forklift tire leak	2	2	4	Medium
		Overcapacity	2	2	4	Medium

From the analysis results in Table 4, it was found that 5 variables had values in the highest extreme category. For more details, see table 5.

Table 5. Dominant Risk variable

No	Work Process	Potential Hazard	L*C	Risk Level
1.	Cutting process	Stroom stung	15	Extreme
2.	Machining process	Stroom stung	16	Extreme
3.	Welding process	Stroom stung	16	Extreme
4.	Welding process	Noise	16	Extreme
5.	Painting and Sandblasting process	The pressure used is too high	16	Extreme

Hazard Risk Analysis, Hazard Sources Analysis, and Dominant Risk Control Using the Hazard and Operability (HAZOP) Method

Interviews with the head of PT. Swadaya Graha's Occupational Health and Safety (OHS) division yielded information on hazard sources and risk[13]. Human carelessness, manufacturing procedures, materials, and equipment are examples of risk sources[15]. The table below shows the hazard sources and risk analysis.

Table 6. Hazard Risk Analysis and Hazard Sources Analysis of Dominant Hazard Using the Hazard and Operability Study (HAZOP) Method

No	Work Process	Potential Hazard	Hazard Risk	Hazard Sources	L*C	Risk Level
1.	Cutting process	Stroom stung	Electric shock, burns	Human negligence, equipment	15	Extreme
2.	Machining process	Stroom stung	Electric shock, burns	Human negligence, equipment	16	Extreme
3.	Welding process	Stroom stung	Electric shock, burns	Human negligence, equipment	16	Extreme
4.	Welding process	Noise	Hearing disorders	Production process	16	Extreme
5.	Painting and Sandblasting process	The pressure used is too high	Material damage	Equipment	16	Extreme

Next is the dominant risk control process. Risk control is used to anticipate and also reduce the occurrence of work accidents[14]. Dominant risk control will be carried out on 5 risk variables in the extreme category, including:

1. The same dangerous variable exists in the cutting, machining and welding processes, namely stroom stung. The appropriate control measures are to use complete APD, especially safety gloves, be more careful in areas prone to work accidents, and comply with the established SOP.
2. In the welding process, there is a dangerous variable: noise. The appropriate control action is to use complete APD, especially headphones, and comply with the established SOP.
3. There is a dangerous variable in the painting and sandblasting process, namely, the pressure used is too high. The appropriate control action is to use complete APD, especially headphones, and comply with the established SOP.

Conclusion

The author has reached the following conclusions based on the findings of her research and discussion: 35 potential hazards were found after potential hazards in the cable tray project were analysed and identified. Five potential risks during the marking process, five risks during the cutting process, five

risks during the machining process, three risks during the setting process, five risks during the welding process, seven risks during the painting and sandblasting process, and five risks during the packing and shipping process. When working on cable tray projects, human error, manufacturing procedures, and machinery are the most frequent sources of risks. Control measures for discovered and adjusted hazards include using complete and appropriate PPE, adhering to established SOPs, and being more careful when in work accident-prone areas.

Even though this research provides relatively strong evidence in finding potential hazards, hazard risks, and sources of hazards in cable tray projects, carrying out further research by examining other collaborative projects to find more potential hazards and recommendations for improvements will be much better because by doing this In this way, workers will be much more protected from work accidents. Think about integrating one research method, such as Job Safety Analysis (JSA) or Hazard Identification, Risk Assessment, and Determining Controls (HIRADC), to provide readers with a deeper understanding of the field of occupational health and safety.

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