Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram
https://e-journal.undikma.ac.id/index.php/prismasains/index
e-mail: prismasains.pkpsm@gmail.com

January 2023. Vol. 11, No. 1
p-ISSN: 2338-4530
e-ISSN: 2540-7899
pp. 111-123

Work Safety Risk Analysis Using Hazard And Operability Study (Hazop) And Job Safety Analysis (Jsa) Methods In Cv. Xyz

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Received: December 2022; Revised: December 2022; Published: January 2023

Abstract

CV XYZ is a company engaged in the production of fashion. The problem that occurs in CV XYZ is that there are still several cases of work accidents caused by the attitude of workers, the work environment and the tools used during the production process. The purpose of this study is to analyze the potential hazards and the causes of potential hazards, the risk of injury and even work accidents and provide suggestions for improvements to reduce the risk of work accidents so that control and prevention of hazards that arise in the work area can be carried out. The methods used in this research are Hazard and Operability Study (HAZOP) and Job Safety Analysis (JSA). Hazard and Operability Study (HAZOP) is a hazard identification approach in working environment conditions, existing facilities, equipment operation and overall production. Hazop looks for possible causes of accidents and determines the consequences of deviations that occur when a job is done. Job Safety Analysis (JSA) is the identification of hazards by taking into account unsafe act and unsafe conditions. This hazard identification method is carried out by studying a job to identify hazards and potential incidents associated with each step and used to find solutions and control existing hazards. Based on the results of data processing, it is known that the sources of hazards that exist or have the potential for work accidents are the attitudes of workers and the physical work environment and it is known that there are 30 identified hazards from 16 routine activities and 7 of them have the highest risk of intensity in causing hazards in the work area.

Keywords: Hazard; HAZOP; JSA; Work accident

How to Cite: Trisnayanti, A., & Iriani, Y. (2023). Work Safety Risk Analysis Using Hazard And Operability Study (Hazop) And Job Safety Analysis (Jsa) Methods In Cv. Xyz. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram, 11*(1), 111-123. doi:https://doi.org/10.33394/j-ps.v11i1.6593

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INTRODUCTION

The industrial sector is one of the pillars of national development in Indonesia, with favorable impacts on employment, income growth, and equitable development. Industrial competitiveness necessitates that every company optimize all of its human resources, so that human resources become the most significant part and, as company assets, require greater care due to the inherent (hazard) of the workplace. Industrial activities in the production process are usually accompanied by elements which carry the risk of hazards attributable to work in the presence of accidents or diseases that result from the activities performed.

The presence of a threat to occupational safety and health must be averted since the threat will result in losses for the business and harm to the welfare of the employees. Among the numerous types of industries in Indonesia, the convection or fashion sector is one that is expanding at an accelerated rate. Clothing is a fundamental human necessity, so it is not unexpected that the fashion sector is one of Indonesia's most prevalent industries. Numerous major cities in Indonesia are capable of supporting a fashion or convection industry. From Mindhayani (2020) research to identify hazards to occupational safety and health (K3) that

occur, so that control and prevention of hazards that arise in the work area can be carried out. The NBM and QEC questionnaires were used to identify hazards from an ergonomic perspective, while the HAZOP method was used to identify existing hazards. The results of the potential hazard analysis show that the source of the hazard that can or has the potential to cause work accidents is the attitude of workers, physical working environment conditions, slippery floors due to spills of flour and dough for making crackers. In addition, it is known that there is an ergonomic risk in the process of making crackers. The risks experienced are in the form of musculoskeletal disorders and fatigue that appear on the waist, arms, wrists, calves and ankles.

CV XYZ is a medium-sized fashion industry in Bandung that engages in the manufacturing of clothing. CV XYZ provides manufacturing services for clothes to department stores, government agencies, and schools, among others. CV XYZ supports its production using high-risk machines such as cutting machines, sewing machines, and steam machines. This requires all employees to follow K3 regulations in order to limit the risk of workplace accidents. CV XYZ is still a medium-sized industry in which the occupational health and safety framework is not yet completely solid, so as to increase the danger of workplace accidents in CV XYZ, particularly on the cutting machine, sewing machine, and steam engine, Consequently, the researcher will carry out an analysis titled Work Safety Risk Analysis Using Hazard And Operability Study (HAZOP) And Job Safety Analysis (JSA) Methods In CV XYZ

Health hazards can lead to occupational diseases, a source of workplace dangers. Environmental elements, such as chemical factors, physical factors, biological aspects, ergonomic issues, and psychological factors, typically pose health risks. Therefore, Occupational Safety and Health is crucial for our own benefit and that of the working environment (Ningsih & Hati, 2019).

From the research conducted by Pradaka (2021), after identification there are potential hazards but with an average potential hazard (risk level) of moderate risk and the possibility of requiring risk control, analysis of potential hazards can actually reduce the risk of work accidents, risk assessment assessed that work accidents that occur have the possibility moderate, which means that accidents rarely occur within 1 (one) year, there is only 1 (one) accident with serious consequences, risk control has been carried out to control risks in the future, monitoring and evaluation have been carried out so far good. The research conducted by Restuputri & Sari (2015) shows that the results of the identification process carried out using the HAZOP worksheet identified hazards in the safety glass manufacturing production process and found 9 potential sources of danger, including: working environment conditions, broken glass, worker attitudes, electrical panels, scattered wires, hot air, standing water and hazardous chemicals, scattered paper and standing water.

Identifying potential dangers and risks in the workplace plays an essential role in lowering the chance of accidents. Using the HAZOP and JSA methodologies, the goal of this study is to assess the possible dangers and accident rate associated with the production of shirts and to offer suggestions for improvement. The results of the identification are anticipated to be able to reduce the risk of workplace accidents by identifying the potential for workplace accidents to occur in the activities of workers and by maximizing the use of Personal Protective Equipment (PPE).

METHOD

Utilization of descriptive research is the type of research employed. Using qualitative analysis without hypothesis testing, the study describes the status of the item. The investigation describes a variety of data that are then assessed and compared in light of the current state of affairs. This research focuses on enhancing the use of occupational safety and health (K3) in CV XYZ using the HAZOP method to detect potential production-related

hazards. Using the JSA approach, determine the potential hazard and safety control for each work stage. The following steps are taken to perform the HAZOP and JSA analyses.

Stage of Preliminary Study

Preliminary research to gain an overview of the issues at hand in the form of field studies and literature studies (Mindhayani, 2020).

Data Collecting and Processing Phase

This research pertains to the enhancement of the K3 program implementation at CV XYZ through the application of the HAZOP and JSA methods to identify and design controls for potential workplace hazards and occupational diseases. The following actions are carried out during the phase of data collecting and processing:

1. The sequencing of the existing industrial processes
2. The identification of potential dangers in the workplace that cause work-related accidents or illnesses is undertaken.
3. Complete the criteria outlined in Tables 1 and 2 of the HAZOP worksheet in the following order:
   a. Classification of key hazards (hazard) identified (source of hazards and frequency of hazards found).
   b. A description of each operating procedure's deviations is carried out.
   c. A description of the deviation's reason is carried out.
   d. Write an explanation of the causes and effects of these variances.
   e. The creation of temporary measures that are implementable
   f. By identifying the criteria for likelihood and consequences, a risk assessment is conducted.
   g. The HAZOP worksheet is used to rank the detected risk sources according to likelihood and consequence. From there, the risk matrix (shown in Figure 1) is used to decide which risk should be prioritized for improvement. (Retnowati, 2017).

Table 1 Criteria *Likelihood*

Likelihood			
Level	Criteria	Description	
		Qualitative	Quantitative
1	Rare	Predictable, but not only in extreme circumstances	fewer than once every 10 years
2	Less likely	It hasn't occurred yet, but it could at some point	Occurs once every ten years.
3	Likelihood	It ought to have occurred, and it could have occurred/ appeared here or somewhere	Once every 5 years to once a year
4	Likely	Simple to occur and likely to arise in most situations	more frequently than once a year to once per month
5	Almost certainly	Simple to occur and likely to arise in most circumstances	more than 1 time per month

Table 2 Criteria *Consequences/Severity*

Likelihood			
Level	Criteria	Description	
		Qualitative	Quantitative
1	Insignificant	There is no human suffering or injury as a result of the incident.	does not result in missed workdays
2	Small	causes only little damages,	Still be able to work the same

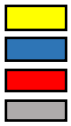
		little loss, and has no significant effects on business continuity	day or shift
3	Medium	hospitalized for a serious injury, no lasting disability, and a moderate financial loss	under 3-day lost workdays
4	Weight	cause severe harm, permanent incapacity, significant financial losses, and negatively influence business continuity	3 or more days of missed work
5	Disaster	Death and significant losses could potentially put an end to corporate operations permanently.	Forever missing a working day

The *likelihood* criterion is one of the risk evaluation criteria. The frequency in quantitative calculations based on firm data or records over a given time period is the basis for Table 2's *likelihood* criteria. In Table 1, the *likelihood* criteria have levels ranging from 1 to 5, with a total of five criteria: level 1 has a rare criterion, level 2 has a low probability criterion, level 3 has a possible criterion, level 4 has a high probability criterion, and level 5 has almost criteria certain (Mindhayani, 2020).

The repercussions or *severity* criteria employed are the *consequences* that will be received by workers, which are qualitatively specified and take the number of lost working days into account (as in Table 2). On a scale from 1 to 5, the *consequences* criteria are identical to the *likelihood* criteria.

Table 3 *Risk Matrix*

RISK LEVEL (*RISK LEVEL*)						
KEMUNGKINAN (*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
SCALE		**1**	**2**	**3**	**4**	**5**
		SEVERITY (*SEVERITY/CONSEQUENCES*)				



Information : Low Risk
Medium Risk
High Risk
Extreme Risk *Calculation Example 1 :*
Likelihood value (L) = 4
Consequences value (C) = 4
L X C = 16 (Located in purple, so in the category 'Extreme'

The risk matrix is a matrix that depicts the outcomes of the multiplication of *likelihood* and *consequences*, both of which have a scale of 1 to 5, as shown in Tables 1 and 2. The four colors that represent the amount of risk are 1) yellow, which denotes a low risk, 2) blue, which denotes a moderate risk, 3) red, which denotes a high risk, and 4) purple, which denotes an extreme risk. These four colors are used to express the level of danger.

4. Using the JSA approach, *potential hazards* were identified and the working conditions of the shirt production area were *safety Control.* The job steps in a job are examined and organized in a list as part of the job safety analysis (JSA) process. JSA is a method for reviewing methods and identifying risky operations in order to make improvements prior to an accident. Each of these steps is reviewed to determine any potential dangers that may be present. A hazard is a condition or activity that, if not appropriately regulated, can result in injury or illness (Sukapto et al., 2018)

After establishing the type of work to be examined and translating the task into work stages, the necessary processes for identifying JSA include investigating and determining the dangers that may arise at each work step, and then deciding the preventative actions that may be performed for each hazard (Nabilla, 2021). The steps in the job safety analysis method are as follows (Ikhsan, 2022):

a Choose a job to evaluate. At this step, location selection, preliminary observations, and interviews are conducted to identify the hazards and risks associated with the job that will be assessed.
b Determine the work's steps and their sequence. At this stage, the steps and sequence of work activities are determined based on prior observations.
c Recognizing and Assessing Dangers During Each Step of Work. During this phase, potential dangers posed by the actions being performed are identified.
d Determine the safest way to complete each phase of the task. At this point, a remedy is devised for each recognized hazard in the workplace.
e Analysis and Discussion Phase
In the analysis phase, the sources and root causes of problems that lead to workplace accidents or process interruptions are identified.
f Conclusions and Suggestions
Conclusions and recommendations are the final stage, consisting of a summary of the results of the analysis and recommendations for process enhancements to reduce or eliminate hazards with the potential to cause workplace accidents.

RESULTS AND DISCUSSION

It is vital to make firsthand observations and understand the flow of the manufacturing process in order to detect the potential dangers in the production process. The sequence of the clothes manufacturing process is as follows:

Pattern Making Process (Design)

Pattern-making is the act of creating paper prototypes of clothing elements to be sewed, such as designs and sizes, to ensure that no errors are made when cutting the fabric and that it is cut according to the specifications of the customer.

Cutting Process (Cutting)

The cutting procedure consists of cutting the fabric in accordance with the created pattern. Paper with an existing design is adhered to a pile of cloth that has been stretched out on a cutting table, and then the cloth is cut using a cutting machine.

Embroidery Process

Embroidery is the practice of applying threads to textile textiles to create a motif in the form of images, letters, or other representations. Embroidering is accomplished with a specialized machine known as an embroidery machine.

Screen Printing Process

The process of screen printing is the application of color to fabrics in order to create patterns. Screen printing techniques vary based on the desired screen printing quality, including plastisol, rubber, dtg, polyfex, and others.

Sewing Process

Sewing is the process of joining distinct garment components into a single garment. Machines such as sewing machines, overdeck machines, overdeck machines, and button machines are utilized depending on the portion of the garment to be sewed.

Quality Control Process

At this point, the sewed garments are inspected to determine if they conform to the criteria or if they require more repairs..

Finishing Process

It is the final stage of processing that includes thread removal, steaming, and packaging. After understanding the production process flow, direct field observations were conducted. The findings on the existing possible dangers and the risk score are detailed in Table 1.

Table 1. Discovery Level Score Hazard

NO	PROCESS	HAZARD FINDINGS	RISK	SOURCE HAZARD	L	C	S	RISK LEVEL
1	MAKE A PATTERN	Long periods of standing in an awkward work position	Back Pain and Wasit Pain	Work Attitude	4	1	4	Medium
		Less lighting	Fatigue in the eyes, can cause minus eyes	Lack of lighting sources fixed on the workbench	3	2	6	Medium
2	CUTTING	The fabric or residual rollan cloth splattered on the floor	Stumble	Employees' attitudes toward storing or organizing heaps of fabric or rolls are not neat.	2	2	4	Medium
		Finger hit by cutting blade	Injured hand	Employees are less conscientio us and attentive at work.	4	2	8	High
		Awkward working position, standing for a long time	Musculoskele tal complaints	Work Attitude	4	1	4	Medium
3	SEWING	Needle punctures on the fingers	Injured hand	Employees exhibit a lack of caution and focus at work.	4	2	8	High
		Improper sitting position/ sitting without pillows/s oft material, prolonged sitting	sore waist	Employees are less concerned with their sitting posture and do not wear soft pads.	4	1	4	Medium
		The lighting position on the machine is dim/less bright.	Tired/dizzy eyes	The lights on and around the engine do not provide adequate illumination.	3	2	6	Medium
4	SCREEN PRINTING	The remainin g dye/che mical remains on the hands.	When eating with your hands, you run the risk of being devoured.	Working carelessly such that the dye adheres to the hands (does not use APD Gloves)	2	1	2	Low
		Awkward working positions	Musculoskele tal complaints, lengthy duration s of standing, and leaning over	Work Attitude	4	1	4	Medium
5	EMBROIDERY	Fingers hit by needles	Injury Hand	Employees are careless at work.	4	2	8	High
6	QC	QC desk	Tired/dizzy eyes	Lights less bright	3	2	6	Medium

NO	PROCESS	HAZARD FINDINGS	RISK	SOURCE HAZARD	L	C	S	RISK LEVEL
		lighting is less The QC table is not in a comforta ble position.	body / back pain and aches	QC table less ergonomic	4	1	4	Medium
7	BUTTON HOLE	fingers exposed to needles	fingers hurt	Employess are less careful/ focus	4	2	8	High
		finger hit by knife	fingers hurt	Employess are less careful/ focus	4	2	8	High
8	ATTACH STUDS	fingers exposed to needles	fingers hurt	Employess are less careful/ focus	4	2	8	High
		broken studs	eyes hurt	Employess are less careful/ focus	4	2	8	High
9	REMOVE THE THREAD	Lighting less than maximu m	dizzy/tired eyes	lights on the process is bright	3	2	6	Medium
		Sitting position that is bent and too long	Musculoskele tal complaints	Work Attitude	4	1	4	Medium
10	STEAM	exposed to Steam	skin blistering	steam engine overheating	3	3	9	High
		gas leak	burning	incorrect gas installation	2	4	8	High
11	PACKING	Storing finished products out of proportion	Waist and body aches when transporting goods	Work attitude a little too much in transporting the goods	4	1	4	Medium
		Crushed pile of products	Injury occurred	Work attitude	4	1	4	Medium

The following risks are associated with the process of creating garments, as shown by the results of the risk score calculation, which are shown in Table 1 :

a. Risks such as the danger of injury, business losses, and worker discomfort are described as high risk and present in the work environment.
b. The work environment has moderate risk, which is described by dangers like musculoskeletal complaints, worker discomfort, pinching, and tripping.
c. Low risk, discovered in the work area, and described as having swallowed waste materials and caused skeletal muscle complaints.

All manufacturing processes include potential hazards, the effects of which won't be seen right away or for some time if the current hazards are not immediately addressed. Analysis using JSA was done in addition to the analysis of hazard identification with HAZOP.

Data from the start of the production process to the end of the packing process are utilized to analyze the risk of work accidents using the Job Safety Analysis method. The outcomes of the Job Safety Analysis of every job in each production division are displayed in the table below.

Table 2. Analysis JSA

No	Types Of Activities	Danger	Risk	Repair recommendations
1	Before beginning the fabric cutting process, create a pattern for the	eyes fatigued by inadequate brightness	Interference on the eyes	Using sufficient lighting

No	Types Of Activities	Danger	Risk	Repair recommendations
	garments that will be prepared.			
2	The created pattern paper should be cut.	Muscle damage to the skeletal system	Disorders or pain in the back, waist and legs, body balance disorders	Using an ergonomic desk so as not to disturb the skeletal muscles
		CUTTING		
1	Transfer the fabric to the cutting table in a big roll so it can be seen.	Crushed roll fabric	Bruises on parts of the body, fainting, cuts on the skin	Knowing the danger factor and the level of difficulty
2	Cutting the exposed fabric in accordance with the created pattern	Exposed machine cut	Scratch wounds, cut fingers	Using gloves, the provision of the box P3K
		Disruption of skeletal muscles	Disorders or pain in the back, waist and legs, body balance disorders	
		Stumble fabric scraps don't apply	Minor injuries	Clean any scattered cloth
		SEWING		
1	putting the cloth that was cut following the design together	Fingers exposed to sewing needles	Injury to the finger, tear the skin of the finger	First aid supplies should be available, and sewing should be done with a finger guard (thimble) or a sewing machine finger guard that is fastened to the sewing machine shoe
		Awkward working position	Sore back, waist and legs	Use a chair with a backrest so that you may relax for a while. Chairs come with plush cushions.
		The lighting less good	Eyes get tired quickly and dizzy	placing lighting on each device
		long-term exposure to engine noise	hearing loss, lightheadedness, and balance issues	Using earplug
		SCREEN PRINTING		
1	creating/preparing dyes	Exposure to chemicals	Shortness of breath/respiratory disorders	Using Mask
		Direct contact with chemical substances	Cause irritation to the skin	Use gloves
2	Screen printing	Awkward working position	Sore back, waist and legs	using a table that is ergonomic to prevent disturbing the skeletal muscles
		EMBROIDERY		
1	Embroidery fabric	Fingers exposed to	Injury to the	Having a P3K box

No	Types Of Activities	Danger	Risk	Repair recommendations
		sewing needles	finger, tear the skin of the finger	available, utilizing a thimble as a finger protector when sewing, and using a sewing machine The shoes for the sewing machine have a finger guard attached
		Prolonged exposure to engine noise	Hearing loss, dizziness, impaired body balance	Using earplug
		QC		
1	Checking clothes	Awkward work position	Stiff back, waist and legs	use an ergonomic table to prevent skeletal muscle disruption
		Less Lighting	Eyes get tired and dizzy	placing lighting on each device
		BUTTON HOLE		
1	drilling button holes	needle-wielding finger	the finger has been hurt, and the finger's skin has been torn.	First aid supplies should be available, and sewing should be done with a finger guard (thimble) or a sewing machine finger guard thatis fastened to the sewing machine shoe
		long-term exposure to engine noise	hearing loss, lightheadedness, and balance issues	Using earplug
		Knife wounds to the fingers	the finger has been hurt, and the finger's skin has been torn	First aid supplies should be available, and sewing should be done with a finger guard (thimble) or a sewing machine finger guard that is fastened to the sewing machine shoe
		PUTTING BUTTON		
1	Attaching clothes buttons	Sewing needle finger	the finger has been hurt, and the finger's skin has been torn.	First aid supplies should be available, and sewing should be done with a finger guard (thimble) or a sewing machine finger guard that is fastened to the sewing machine

No	Types Of Activities	Danger	Risk	Repair recommendations
				shoe
		Broken buttons hit you	damage to the eyes or other facial features	Using face shield or protective goggles
		long-term exposure to engine noise	Hearing loss, dizziness, impaired body balance	Using earplug
		REMOVE YARN		
1	Examine the clothing and cut off any residual thread.	Awkward work position	Sore back, waist and legs	Using an ergonomic desk so as not to disturb the skeletal muscles
		The lighting less good	Eyes get tired quickly and dizzy	Additional lights on each machine
		STEAM		
1	Setting up the steam machine	Rolling engine gas hoses	Tripping over a gas hose	Making gas hose hangers to make them more tidy
	Steam clothes	Heat engine	Blistered hands exposed to hot steam	Using gloves
		Gas leaks	Fire	Provision of fire extinguishers
		PACKING		
1	packaging of finished goods in plastic	Scattered plastic	Movement is limited by stumbling and slipping	provide a plastic storage container
	Resulting from excessive packing	Product hit	Body part bruising and injury	providing a first aid kit and ensuring that the results of packing do not exceed the allowed height

The following phase, based on the HAZOP and JSA analyses, is to develop recommendations or ideas for prospective hazard improvements, which are prioritized according to the highest level of risk associated with their execution. Based on the existing possible risks, the following ideas for improvement are provided:

a. Workers' attitudes can be addressed by recommending K3 training on the use of Personal Protective Equipment (APD), creating a worksheet on the usage of PPE and posting it in the work area so that workers can read it and remind one another. Provide caution and punishment for careless employees.
b. In terms of the working environment, suggestions that may be made include always storing things in their proper location with proper storage, cleaning the work space following the completion of a process, adjusting the lighting in the workplace, and adjusting the work position. furnish apd including gloves and masks.

Thus there is research that supports using the Hazard And Operability (HAZOP) method from Farid & Anggraini (2021) shows that there are 6 types of work accidents with 4 sources of danger. Based on research data from 2015 to 2019, the most accidents occurred in 2019, namely 13 employees. This is caused by the attitude of workers who pay less attention to personal safety. Then found 4 sources of danger that cause work accidents, for employees, namely the attitude of workers, work equipment, foreign objects and wet floors. Based on the source of the hazard, the risk ranking is obtained, namely the attitude of workers has an extreme risk level, work equipment has a low risk level, foreign objects in the work area have a moderate risk level and on a wet floor has a high risk level. So it was found that the attitude

of workers is a priority that must be improved by the company. In line with Budiman et al. (2022) research which obtained the types of accidents that often occur at PT. SEGARA eye irritation due to welding, as well as disability due to exposure to machinery so it is necessary to identify potential hazards using the Hazard And Operability (HAZOP) method and the Fault Tree Analysis (FTA) method at PT. SEGARA by determining the priority scale of the problem. The solution in preventing a work accident that occurs at PT. SEGARA is to use the right PPE and continue to increase knowledge of work safety. The research Marasabessy et al. (2020) results show that the highest risk occurs in initial work in activities A1, A2, A4, B1, B2 with a hazard level of 10-14, while in construction work activities A3, A7, B5, B6, B7, B9, B10, and the final work on C11 activities is included in the medium risk category with a hazard level of 5 - 9. So that recommendations for improvement are more focused on high risk conditions

The supporting research using Balili & Yuamita (2022) Job Safety Analysis method that the results of which show that if work accident risk control is not carried out, it will be very dangerous. Therefore the Job Safety Analysis method was chosen to solve the problem. which contains a list of jobs, number of workers, location or work environment. In line with Mikael Wendy Tulak (2021), this research uses the JSA method, including determining the work to be analyzed, then describing the work from the preparation stage to the execution of the work, identifying hazards and risks by looking at the severity and likelihood of each job, and controlling each job that has been completed. analyzed. The results of the risk analysis at the stage of grass cutting work, get an extreme value of 16. This needs to be controlled based on a risk control hierarchy such as replacing lawn mower blades, machine cover protectors, work SOPs, and PPE. There are 32 hazards and 15 potential risks in each the work of facilities and infrastructure at the Kalimantan Institute of Technology, the results of the risk evaluation on the SAPRAS work, based on the results of the risk matrix, the following results were found Low: 65, Medium: 38, High: 11, Extreme 5.

By using the Job Safety Analysis method, mechanical workers can understand the dangers that will occur if they do not comply with the JSA. From research conducted by Pusparina (2022) at PT XYZ, it turns out that there are still many work accidents at several points in the production area. The potential hazards found are analyzed into 3 methods namely HAZOP (Hazard and Operability Study), What If/Checklist and JSA (Job Safety Analysis) in the hazop method hazard findings are grouped in 23 work areas after that the likelihood and severity values are calculated to get the risk level value and carried out validity and reliability tests that aim to ensure that the data taken is based on research conducted using the SPSS application. The next method is the What If/Checklist which is carried out by distributing questionnaires which can later be identified as risk priorities. Finally, the JSA method is slightly different from the previous two methods because the risk assessment is assessed from the project being undertaken, not from the work carried out every day. Improvements in the JSA method will later be made in a safe work permit or form before carrying out a project or work. In line with Ramisdar et al. (2020) research using the Job Safety Analysis (JSA) work sheet and Hazard and Operability Study (HAZOPs) to obtain research results which show the identified hazards in the loading and unloading process are physical, mechanical and ergonomic hazards. The most dominant hazard identified in each unloading process is a mechanical hazard of 74.5% in the Haulage/Trucking section. Risk assessment shows, the level of risk is not desirable (Undesirable) in the first, third, fourth and fifth work steps and acceptable with control (Acceptable with control) in the second work step

CONCLUSION

Based on the findings of the data processing described previously and the phrasing of the problem, the following conclusions can be taken from this study: According to the results of the HAZOP method's study of potential hazards, the source of danger that might lead to

workplace accidents is workers' attitudes and the physical environment. Due to a lack of caution and lack of information regarding the usage of PPE, the workers' attitude is the most pervasive factor. The study conducted using the JSA approach revealed a total of 16 normal operations with 30 identified hazards. The danger of injury from sharp objects is the most severe of the seven identified risks, according to the existence of seven hazardous activities. This is because to the acute contrasts in production machines, such as needles and sewing knives. The suggested change for the organization is to implement PPE to reduce the likelihood of workplace accidents.

RECOMMENDATION

Recommendations for process enhancements to reduce or eliminate hazards with the potential to cause workplace accidents.

REFERENCES

Balili, S., & Yuamita, F. (2022). Analisis Pengendalian Risiko Kecelakaan Kerja Bagian Mekanik Pada Proyek PLTU Ampana (2x3 MW) Menggunakan Metode Job Safety Analysis (JSA). *Jurnal Teknologi Dan Manajemen Industri Terapan*, *1*(II), 61–69.

Budiman, M. R., Suseno, A., & Wahyudin, W. (2022). Identifikasi Potensi Bahaya untuk Meminimalkan Kecelakaan Kerja dengan Metode Hazard and Operability Study (HAZOP) di PT SEGARA. *Jurnal Ilmiah Wahana Pendidikan*, *8*(9), 333–339.

Farid, M., & Anggraini, W. C. (2021). Analisis Keselamatan Dan Kesehatan Kerja (K3) Menggunakan Metode Hazard And Operability (Studi Kasus. Pt Igasar). *Jurnal Teknologi Dan Sistem Informasi Bisnis-JTEKSIS*, *3*(1), 223–227.

Ikhsan, M. Z. (2022). Identifikasi Bahaya, Risiko Kecelakaan Kerja Dan Usulan Perbaikan Menggunakan Metode Job Safety Analysis (JSA). *Jurnal Teknologi Dan Manajemen Industri Terapan*, *1*(I), 42–52.

Marasabessy, R. S., Hanaulu, A. K., & Latuconsina, M. (2020). Analisis Risiko Kecelakaan Kerja Menggunakan Metode Hazard And Operability Study (HAZOP) Pada Proyek Kontruksi Drainase. *PROFICIENSI: The Journal of the Industrial Engineering Study Program*, *8*(2), 134–142.

Mikael Wendy Tulak, W. (2021). *Studi Hasil Analisis Risiko Pekerjaan pada Bagian Sarana dan Prasarana (SAPRAS) Di Institut Teknologi Kalimantan dengan Menggunakan Metode Job Safety Analysis (JSA)*. Institut Teknologi Kalimantan.

Mindhayani, I. (2020). Analisis risiko keselamatan dan kesehatan kerja dengan metode HAZOP dan pendekatan ergonomi (Studi kasus: Ud. Barokah Bantul). *Simetris: Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer*, *11*(1), 31–38.

Nabilla, P. (2021). *Analisis Penerapan Keselamatan Dan Kesehatan Kerja (K3) Pada Pekerjaan Hot Tapping Steam Pipe Line (Studi Kasus: Departemen Asia Pasific Rayon PT.RAPP)*. UIN SULTAN SYARIF KASIM RIAU.

Ningsih, S. O. D., & Hati, S. W. (2019). Analisis Resiko Keselamatan Dan Kesehatan Kerja (K3) Dengan Menggunakan Metode Hazard and Operability Study (Hazop) Pada Bagian Hydrotest Manual Di Pt. Cladtek Bi Metal Manufacturing. *Journal of Applied Business Administration*, *3*(1), 29–39.

Pradaka, M. (2021). *Analisis Resiko Keselamatan Dan Kesehatan Kerja (K3) Dengan Menggunakan Metode Hazard And Operability Study (Hazop) Pada Department Produksi Iii B Pt. Petrokimia Gresik*.

Pusparina, D. (2022). *Analisis Kecelakaan Kerja Dengan Menggunakan Metode Hazop (Hazard And Operability Study), What If/Checklist Dan Jsa (Job Safety Analysis) Pada PT XYZ*. Universitas Pembangunan Nasional Veteran Jakarta.

Ramisdar, I. O., Ibrahim, H., Mallapiang, F., & Lagu, A. M. H. R. (2020). Potential Hazards in the Loading and Unloading Process: Risk Analysis with Job Safety Analysis and Hazard Operability Study Methods. *Diversity: Disease Preventive of Research Integrity*,

1–7.

Restuputri, D. P., & Sari, R. P. D. (2015). Analisis kecelakaan kerja dengan menggunakan metode Hazard and Operability Study (HAZOP). *Jurnal Ilmiah Teknik Industri*, *14*(1), 24–35.

Retnowati, D. (2017). Analisa Risiko K3 Dengan Pendekatan Hazard and Operability Study (Hazop). *Teknika: Engineering and Sains Journal*, *1*(1), 41–46.

Sukapto, P., Djojosubroto, H., & Permana, H. (2018). Penerapan Metode Job Safety Analysis and Risk Score untuk Meningkatkan Keselamatan dan Kesehatan Kerja pada Departemen Printing, Sewing dan Assembly PT. PAI, Bandung (Suatu Pendekatan Participatory Ergonomic). *Jurnal Kesehatan*, *9*(3), 403–411.