HEALTH AND SAFETY RISK ANALYSIS OF IRON FABRICATION WORK USING JOB SAFETY ON THE MEDAN MERDEKA FIELD REVITALIZATION PROJECT

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ABSTRACT

Job Safety Analysis (JSA) aims to improve workplace safety by identifying potential hazards in a job or process. Through this analysis, each stage of the job can be evaluated for risk so that appropriate precautions can be taken to prevent accidents or incidents from occurring. The purpose of this study is to analyze a series of iron fabrication activities to find sources of danger and how to control these hazards. This research is qualitative research. The research data used are primary data and secondary data. The data collection methods are interviews, documents, and observations, direct observation of the iron fabrication work division of the Medan Merdeka Field Revitalization project. Data processing was conducted by this research using Job Safety Analysis (JSA). The results of the study found that the hazard that often arises in iron fabrication work is pinched. This is because the stages of work, starting from iron slicing, transporting iron to the machine, and operating the machine, have the potential for pinched hazards that can be experienced by workers, such as limbs that can be pinched by iron, limbs that can be pinched by bar cutting machines, and fingers that can be pinched by bar bending machines. There are hazards that iron fabrication workers must be aware of, namely physical, mechanical, electrical, and ergonomic hazards.

Keywords: *Iron Fabrication, JSA, Pinch, Work Accident*

INTRODUCTION

Occupational safety and health can be understood as the science applied to prevent possible accidents while carrying out tasks in the workplace. In an organization, work safety needs to be implemented collaboratively by leaders and employees so that the risk of accidents can be avoided. In its implementation, leaders can support safety officers by setting up divisions and providing skilled personnel in the field of occupational safety (Budiman, 2024).

Job Safety Analysis (JSA) aims to improve workplace safety by identifying potential hazards in a job or process. Through this analysis, each stage of the job can be evaluated for risk so that appropriate preventive measures can be taken to prevent accidents or incidents from occurring

(Juniarianto & Dwisetiono, 2022). Therefore, each job must be analyzed for risk hazards based on the Peraturan Pemerintah Republik Indonesia No. 50 (2012), which states that operations/working procedures must be provided for each type of work and made by competent personnel through job safety analysis (Peraturan Pemerintah Republik Indonesia Nomor 50 Tahun 2012 Tentang Penerapan Sistem Manajemen Keselamatan Dan Kesehatan Kerja, 2012).

Based on data obtained from the Ministry of Manpower Indonesia in 2023, data on work accident cases in Indonesia reached 370,747 cases. The highest number of cases was in West Java province, with a total of 66,029 cases, with 397 of them being construction services. This indicates that there is still a high incidence of work accidents, especially in construction activities in Indonesia (Alfiana et al., 2024).

Construction projects are a series of complex activities that include planning and execution to build a building or infrastructure, taking into account time, cost, and quality. Construction projects also have the risk of workplace accidents that pose a significant challenge and hinder the smooth running of the project and can cause delays (Barri et al., 2021).

According to data from the Badan Penyelenggara Jaminan Sosial Tenaga Kerja (BPJSTK), there were 157,313 cases of work accidents in Indonesia in 2018, of which the construction and manufacturing sectors contributed 32%. In Lampung Province, 725 cases of work accidents were recorded in the same year, signaling the need for more attention to occupational safety and health in the construction sector (Mansur, 2019). It is important to implement effective preventive measures to reduce the number of accidents, such as safety training, the use of personal protective equipment (PPE), and the implementation of strict safety standards. Such efforts not only protect workers but also help ensure projects can be completed on time and within budget (A. A. Putri et al., 2022).

Construction companies are inseparable from iron fabrication activities. Fabrication is the process of processing components from raw or semi-finished materials that are assembled, formed, and manipulated to produce new goods with added value and certain functions. Thus, fabrication involves a series of jobs to build something, either manually (using human labor) or with the help of automation using factory tools (Agung et al., 2024).

Iron fabrication work usually involves the use of automatic bar bending and bar cutting machines to process cast iron. Therefore, companies need to make worker safety and security a top priority during the iron fabrication process. A bar bender is a machine used to quickly bend iron as desired by the construction operator. On the other hand, a bar cutter is an iron cutting machine that also works quickly. These two tools are very helpful in the project construction process (Sugilar, 2020).

LITERATURE REVIEW

Workplace accidents occur in many different types, as each job has different types of hazards and varying levels of risk. Some work environments are significantly more prone to accidents than others. In general, the greater the risk, the higher the level of skill and responsibility required. According to the Association for Construction Occupational Safety and Health

(A2K4), workplace accidents in the construction industry account for the largest proportion of all workplace accidents (D. N. Putri & Lestari, 2023).

A workplace accident refers to any incident that takes place within the work environment or during commutes to and from the workplace. These accidents are often caused by hazardous conditions related to work methods, machinery, the working environment, the nature of the job, or production processes. Occupational accidents typically result from unsafe actions driven by insufficient knowledge or skills, as well as unsafe attitudes and behaviors. Factors such as worker fatigue and other project-related issues also contribute to the occurrence of such accidents (D. N. Putri & Lestari, 2023).

Construction accidents have a considerable effect on both project operations and the progress of the construction work. They often result in financial consequences, including costs related to delay claims, compensation for accident victims, and overtime expenses for additional work performed by workers. Furthermore, such accidents can lead to the suspension of construction activities for an indefinite period, potentially causing an increase in overall project expenses (Fassa et al., 2021).

Iron fabrication work is a very important job during construction. Iron fabrication work also has a very fatal risk of danger when using bar cutter and bar bender machines. Based on this problem, the researcher is interested in analyzing a series of iron fabrication activities to find the source of the hazard and how to control the hazard.

RESEARCH METHODOLOGY

This research is qualitative research. The research data used are primary data and secondary data. The data collection methods are interviews, documents, and observations. The informants interviewed were 1 HSE (Health, Safety & Environment) staff, 1 safety officer, and 1 K3 administration. The variable studied was the potential hazards that occur in the iron manufacturing process. The interview was conducted by directly interviewing the key informant, namely the HSE staff, because he knew the main information about the iron fabrication work division in the revitalization project. Then, the main informant interview was conducted with the safety officer because he always went directly to the site and investigated if there was an accident to the workers and K3 administration, who always helped to provide first aid or take care of the workers to go to the hospital. Documents were collected from office archives of workplace accident data. Observation was carried out by directly observing the ironworking division of labor in the revitalization project on site.

Processing of data obtained by observation in this study using Job Safety Analysis (JSA) developed by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) in OSHA 3021 2002 (Revised). The purpose of a JSA is to evaluate a specific phase of a job. JSAs are used by listing the specific work steps or tasks to be observed. These work stages are identified by looking at and assessing the potential hazards that can be caused by the work stages, then the risks that can occur due to the hazards that occur, and controlling the hazards to reduce the incidence of occupational injuries and illnesses. Methodological triangulati-

on was carried out in this study by combining different data collection methods/techniques, namely interviews, documents, and observations, in order to obtain a more comprehensive perspective. This research was approved by PT Cimendang Sakti Kontrakindo on October 15, 2024, with the number 015/CSK-KSO/K3/X/2024.

REASEARCH RESULTS

Results of The Interviews and Documents Occupational Accidents

Interviews were conducted to find out how the work culture exists in the Medan Merdeka Field Revitalization Project. The interview also aims to find out the division of labor and how each division of labor works. The informant in the interview was an HSE staff member of the merdeka field revitalization project. The following are the results of the interview:

What are the most high-risk jobs/divisions in this revitalization project?

"All divisions have their own hazards because it is a construction project. All work has hazards, like in MEP (Mechanical, Electrical & Plumbing), it can be related to electricity, the formwork division is related to height, the iron division is pinched by its hand machine, it can also bounce iron, and the scaffolder is also a height hazard." (HSE Staff)

What are the most workers in the work division?

"Iron fabrication, Nanang foreman on the ground floor." (HSE Staff)

What is the most fatal danger in iron fabrication?

"Limbs pinched by the most dangerous machine, if it had happened, the worker at the bar bending machine was doing iron, his finger was caught between the iron and the machine, the machine was bending the iron so twisted his finger. Moreover, exposed to the bar cutter machine." (HSE Staff)

How was it treated?

"You have to go to the hospital; you have to amputate the finger if it's broken." (HSE Staff)

Then iron fabrication work is a high-risk job, right?

"Yes, it is one of the riskiest jobs among other jobs at the moment, because now the work is getting smaller and there are already several jobs/departments ready." (HSE Staff)

The interview results revealed that the iron fabrication division in the merdeka field revitalization project employed the largest number of workers, and it was also one of the divisions with potential workplace hazards.

We receive from the K3 office document archives in the form of work accident documents from January 2024 to September 2024, the following data on work accidents in the field of Merdeka Revitalization Project Medan:

Table 1. Work Accident Data

Number	Occupational accidents	Date of Incident
1	Hand scratched by iron	16 Januari 2024
2	Head hit by iron lifted by coworkers	1 Maret 2024

3	Hand injured by falling iron	22 Maret 2024
4	Finger pinched by iron	3 April 2024

Although all of the above accidents are classified as medical treatment cases, HoweverIt can be seen that 4 of these accidents occurred in iron fabrication work, indicating the need for work-related handling and the caution of iron fabrication workers.

Interviews were also conducted with the main informant, namely 1 safety officer who always goes directly to the scene when an accident occurs, and interviews were also conducted with 1 K3 administration person who always helps provide first aid or take workers to the hospital. Therefore, we interviewed him to ask about the accidents that occurred. The following are the interviews we conducted with the safety officer and K3 administration.

Iron Fabrication Accident, January 16, 2024

What is the chronology of the accident?

"He was about to put the finished iron down when he wanted to go to the pile of iron that had been formed; he slipped and fell, his hand was pointing at the iron, and this arm (forearm) until the wrist was scratched." (Safety Officer)

"He fell, and his right hand was bleeding from the iron." (K3 Administration)

Why did he slip?

"Puddles of water, the ground there has become mud from yesterday's rain; you stepped on the slippery right and left of the iron when you fell, and your hand went to the iron." (Safety Officer)

No cleaning of the area means?
"There is, but they don't seem to do it every day." (Safety Officer)

When and where did the incident occur?

After lunch, it was around 1 or 2 o'clock in the iron fabrication area next to the canteen. (Safety Officer)
I came to the office at 2 o'clock, I was in the iron fabrication area near the canteen. (K3 Administration)

Were you immediately taken to the hospital or what?

I was first taken to the K3 office and given first aid. If he wants to go to the hospital, he will be taken to the office. (Safety Officer)

After he was treated, he was immediately taken to the hospital because the wound was long and deep. (K3 Administration)

Iron Fabrication Accident, March 1, 2024

What is the chronology of the accident?

"He was tidying up the iron that had been cut., from the other direction, a co-worker lifted the iron without looking right or left, the victim's head was hit by the iron." (Safety Officer)

"Head hit by the iron lifted by a co-worker, bleeding from the right temple of the eye." (K3 Administration)

How was the worker working? Did he not see the victims around him?

"The one who lifted the iron was not careful; there was no looking around, and the victim did not know that a co-worker was lifting the iron." (Safety Officer)

When and where did the incident occur?

"The afternoon before lunch, I think, in the production area on the ground floor." (Safety Officer)

"12 noon to the office, iron fabrication." (K3 Administration)

How was the accident handled?

"First aid at the office, then taken to the hospital if he wants." (Safety Officer)

"The right temple of his eye, which was bleeding due to iron scratches, was first stopped with gauze, and then he was taken to the hospital." (K3 Administration)

Iron Fabrication Accident, March 22, 2024

What was the chronology of the accident?

"He was working downstairs arranging iron; from above, the helper suddenly threw the iron without looking down, hitting his finger below; his little finger was bleeding." (Safety Officer)

"Hit by the iron thrown by the helper, it fell from above." (K3 Administration)

Was there no warning from the driver when he dropped the iron?

"No, that's the stupid thing: the helper didn't look at it; he didn't even say if he was going to throw it. Luckily he didn't hit his head." (Safety Officer)

When and where did the incident take place?

"I remember it was 10 o'clock in the morning in the iron splicing area." (Safety Officer)

"10 o'clock, iron splicing area." (K3 Administration)

How was the accident handled?

"Taken to the office for first aid and then to the hospital." (Safety Officer)

"The little finger was broken, and there was temporary bleeding. We tried to give first aid, and then he was taken to the hospital for treatment only." (K3 Administration)

Iron Fabrication Accident, April 3, 2024

What was the chronology at the time of the accident?

"He and his colleague were lifting 5 meters of threaded iron; the iron was being lifted from the warehouse to the production area. When the iron was being lowered, he was still holding the iron, so his finger got caught between the stacks of iron." (Safety Officer)

"The little finger was pinched by the iron when I was lowering the iron." (K3 administrator)

When and where did the incident occur?

"It happened this morning at 11 o'clock in the iron fabrication area." (Safety Officer)

"Around 11 o'clock, iron fabrication area." (K3 Administration)

How was the accident handled?

"As usual, he was first taken to the office for treatment and then to the hospital if he wanted." (Safety Officer)
"The little finger was bleeding, and the nail almost fell off; the patient was given first aid and then taken to Murni Teguh Hospital." (K3 Administration)

Iron Fabrication Work Stages

There are stages of work in the iron fabrication division in the field of Merdeka revitalization project, namely:

Before doing work, it is necessary to inspect the tools and materials in the work area. The tools used in the iron fabrication division are bar cutting machines and bar bending machines. The machine needs to be inspected to see if the machine is still in good condition. All parts of the machine are checked, starting from the blade, engine gears, dynamo, and electrical cables, all of which need to be checked regularly.

The first stage of work is lifting threaded iron material from the warehouse to the fabrication area. Iron is manually lifted by up to 3 workers because the length of the iron is about ± 4 meters.

Then, after the iron arrives at the fabrication area, the iron is then transported by workers to be placed on the bar cutting machine. Iron that has been in the bar cutting machine will be cut according to the needs of the field in terms of size and quantity.

Then after the iron is cut as needed, the iron is transported to the bar bending machine. The iron is formed according to the needs in the field. These irons can be used in a variety of different ways depending on the shape made using a bar bending machine.

Hazard and Risk Identification Using JSA

Construction work cannot be avoided from hazards or the risk of accidents in the workplace. A potential hazard refers to anything that has the possibility of causing an incident that could result in loss. Meanwhile, the risk of workplace accidents is a combination of the consequences of a hazardous event and the chance of the event occurring (Vinezzia, 2021).

Job Safety Analysis (JSA) can be used to identify hazards that can arise from each stage of work and is an important step in occupational safety and health management. Identify the risks caused by the hazards that arise. Potential hazards that can come from various factors such as physical, chemical, biological, ergonomic, and psychosocial. The following is a JSA table of the iron fabrication work stages.

Table 2. Job Safety Analysis of Iron Fabrication Work

Stage of work	Hazard	Risk	Controlling
Tool & Material Inspection	Electrical short circuit when starting the engine	1. Electrocution	1. Conduct a Toolbox Meeting (TBM) before starting work. 2. Make sure there is no electricity on the equipment or machine to be used before turning on the machine to the socket. 3. Make sure there is no chipped cable. 4. Make sure all equipment used has been inspected and given permission to be used such as bar cutting and bar bending machines. 5. Wear gloves. 6. Check and wear complete PPE before performing work.
	Tripping over scattered materials	1. Bruises, cuts/injuries.	1. Perform housekeeping before work and after work 2. Pay attention to where you are walking and focus on your work. 3. Wear complete PPE during work.
	Slipping due to puddles	1. Bruise bumping when slipping 2. A fall that causes a sprained joint	1. Drain standing water around the work area. 2. Wear full PPE during work.
	Pierced by a Nail	1. Injured	1. Perform housekeeping before work and after work. 2. Pay attention to your steps and the surrounding area. 3. Wear safety shoes while working.
Manual lifting Iron material from Warehouse	Finger pinched by iron	1. Bruises, cuts/injuries 2. Bleeding fingers and broken nails	1. Pay attention and focus on the object of work. 2. Pay attention to the placement of the

to Fabrication Area			lifted material carefully. 3. Good communication between colleagues when going to do manual lifting so that there is no miscommunication during lifting. 4. Wear safety gloves.
	Hand injured by falling iron	1. Scratched finger 2. Bleeding finger	1. Use caution in all work activities 2. Pay attention to the surrounding area 3. Good communication between coworkers 4. Use safety gloves 5. Use complete PPE
	Pierced by an iron tip	1. Injured fingers and hands	1. Pay attention to the place where the hand grasps the iron, avoiding puncturing the iron. 2. Do not rush to perform manual lifting 3. Good communication between colleagues when going to do manual lifting so that there is no miscommunication during lifting 4. Wear safety gloves
	Leg crushed by iron	1. Bruises 2. Pinched leg 3. Foot injury	1. Not slamming/throwing the iron during laying 2. Do not rush to perform manual lifting 3. Good communication between colleagues when about to lay iron 4. Wear safety shoes while working.
	Limbs hit by iron	1. Bruise/injury	1. Pay attention to the surrounding area. 2. During lifting, pay attention to the surrounding area so that the iron carried does not hit other people.

			3. Wear complete PPE (helmet, shoes, and gloves).
	Tripping over materials	1. Bruises/injuries 2. Falling material	1. Get rid of unused items 2. Pay attention to where you are walking and focus on your work. 3. Place the iron according to its size and arrange it neatly. 4. Wear safety shoes while working.
	Overload	1. Musculoskeletal disorders of the back 2. Material fall	1. Do not lift iron weights alone if they are too heavy. 2. The load lifted should not be too heavy; a maximum of <55 kg for a load lifted by 3 people 3. Good communication between colleagues
	Awkward posture and lifting technique	1. Musculoskeletal disorders of the Hand and Shoulder. 2. Causes the spine to bend (scoliosis). 3. Cramps and sprains	1. Do not bend over when lifting the iron from below as the weight rests on the waist. 2. The waist does not rotate when lifting the weight. 3. The wrist position is not open.
Manual Lifting Threaded Iron to Bar Cutting Machine	Finger Pinched by Threaded Iron	1. Bruises 2. Injured finger	1. Pay attention and focus on the object of work. 2. Carefully consider the placement of the lifted material. 3. Good communication between colleagues when going to do manual lifting so that there is no miscommunication during lifting 4. Wear safety gloves.
	Limbs hit by iron	1. Bruises 2. Injured 3. Scratched	1. Pay attention to the surrounding area. 2. During lifting, pay attention to the surrounding area so that the iron carried

			does not hit other people. 3. Wear complete PPE (helmet, shoes, and gloves).
	Awkward posture and lifting technique	1. Musculoskeletal disorders of the hands and shoulders. 2. Causes crooked backbone (scoliosis)	1. Do not bend over when lifting the iron from below as the weight rests on the waist. 2. The waist does not rotate when lifting the weight. 3. The wrist position is not open.
	Overload	1. Musculoskeletal disorders of the back 2. Material falling on the foot	1. Do not lift iron weights alone if they are too heavy. 2. The load lifted should not be too heavy; a maximum of <55 kg for a load lifted by 3 people 3. Good communication between colleagues
Cutting threaded iron using a bar cutting machine	Limb Pierced by Iron	1. Injured 2. Bruised	1. Watch your step and the surrounding area. 2. Pay attention to the place where the hand grasps the iron, not too at the end to avoid the iron being punctured by the hand. 3. Focus on working and moving the iron. 4. Wear PPE during work.
	Finger Pinched by Iron	1. Bruises 2. Injured finger	1. Focus on the object of work. 2. Careful placement of the lifted material 3. Wear gloves when operating tools.
	Pinched by Bar Cutting Machine	1. Leg cut/pinched by the blade 2. Severed finger	1. Focus on the object of work while performing work. 2. Make sure there is a moving part machine guard installed. 3. Keep hands away from the blade when the lever is pulled.

			4. Wear full PPE during work.
	Iron bounces off the machine	1. Head and body injuries	1. Make sure the machine can operate properly 2. Make sure the machine blade is not damaged 3. Make sure the threaded iron fits on the rock plate 4. Hold both sides of the iron when the lever is pulled 5. Wear full PPE during work
	Hand Scratches the Surface of Threaded Iron	1. Hand injured 2. Hand scratched	1. Make sure the threaded iron fits on the rock plate 2. Wear gloves when working
Manual Lifting of threaded iron according to size to bar bending machine	Finger Pinched by Threaded Iron	1. Bruises 2. Injured finger	1. Focus on the object of work 2. Careful placement of the lifted material 3. Wear gloves
	Limbs hit by metal	1. Injured 2. Bruised	1. Pay attention to the surrounding area 2. During lifting, pay attention to the surrounding area so that the iron carried does not hit other people. 3. Wear complete PPE (helmet, shoes and gloves).
	Overload	1. Material falling on the foot 2. Musculoskeletal disorders of the back	1. Do not lift iron weights alone if they are too heavy 2. Make sure the manual handling technique is correct
Bending of threaded iron using a bar bending machine according to shape	Pinched bar bending machine	1. Injured finger 2. Machine twisted finger 3. Broken finger	1. Make sure the iron is positioned on the plate 2. Keep hands and fingers away from the machine before the lever is pulled. 3. Keep your eyes focused on the

		machine and be more careful in your work 4. Wear complete PPE (helmet, shoes and gloves)
Slipping due to puddles	1. Hand scratched by iron due to falling	1. Drain standing water around the work area. 2. Clean up materials scattered around the work area 3. Wear full PPE during work.
Head hit by iron lifted by coworkers	1. Right eye temple bleeding	1. Good communication between coworkers 2. Be careful at work and always pay attention to the surrounding area
Finger pinched by threaded iron	1. Bruises 2. Injured finger	1. Focus on the work object. 2. Place the lifted material carefully. 3. Wear gloves

The table's results reveal that pinched hazards frequently occur in iron fabrication work. This is because the stages of work, starting from lifting iron, transporting iron to the machine, and also operating the machine, all of these stages have the potential for pinched hazards that can be experienced by workers, such as limbs that can be pinched by threaded iron, limbs that can be pinched by bar cutting machines, and fingers that can be pinched by bar bending machines.

In line with research conducted (Noviyanti, 2020), there are indeed several potential hazards in the production room, including being scratched or punctured by iron, pinched or tripped when pulling iron, and bouncing iron, which can cause injury.

Based on the results of the table above, the worst risk is that the fingers are severed at the iron cutting stage of the bar cutting machine. Workers must be careful when operating the bar-cutting machine; workers must ensure that their fingers are away from the blade before pulling the machine lever.

DISCUSSION

Physical Hazards

Physical hazards are factors in the workplace that can physically affect workers' activities. These are caused by the use of machinery, equipment, materials, and environmental conditions around the workplace that can cause occupational disorders and diseases (Sriagustini & Supriyani, 2021).

Physical hazards are one of the risk categories related to occupational health, including noise, extreme temperatures, ionizing

radiation, non-ionizing radiation, extreme pressure, and vibration, all of which can exert physical stress on the human body. These hazards can arise in the work environment of operators. Therefore, it is important to address physical hazards in order to minimize or prevent problems from occurring (Rahmayanti & Artha, 2015).

Physical hazards, according to (Mawardani & Herbawani, 2022) for example, such as being pinched, falling, cut, bumped, or hit by objects or tools. The physical hazards identified in the merdeka field revitalization project in iron fabrication are pinched iron, tripping, slipping, being punctured by nails, being hit by material, hitting hard objects, and being scratched.

Mechanical Hazards

Mechanical hazards are hazards found in moving objects or processes that can cause harm. Mechanical hazards originate from mechanical equipment or moving objects with mechanical forces either manually driven or with a drive (Nour, 2022). Mechanical hazards are one of the main risks in the workplace, stemming from moving, sharp, or large and heavy objects. These risks can cause injuries to workers, such as being slashed, punctured, pinched, crushed, cut, or hit (Sriagustini & Supriyani, 2021).

This mechanical hazard has a very fatal risk. The mechanical hazards identified in the merdeka field revitalization project in the iron fabrication work are being pinched by the bar cutting machine, pinched by the bar bending machine, and pinched by moving objects such as gears and fingers cut by the blade of the bar cutting machine. The same thing was found in the research (Mayadilanuari, 2020). that the highest potential hazard in his study was mechanical hazards. In moving or rotating machinery, generally dangerous parts such as gears are protected with safety caps designed by the manufacturer. However, there are times when workers or operators open these caps for reasons of work efficiency without considering the risks that may occur (Hutabarat, 2021).

Machine guards have a very important role in maintaining the safety of workers in an industrial environment. With guards in place, the risk of accidents caused by moving or rotating machinery can be significantly reduced. Without guards, workers become more vulnerable to various types of injuries, ranging from lacerations that can lead to infection to fractures that require more intensive medical treatment. Therefore, the presence of these guards is not only important to protect workers' health but also to ensure smooth operations and reduce costs incurred due to accidents (Friend & Khon, 2023).

Electrical Hazard

Electricity is a very important source of energy for society because it can be easily converted into other forms of energy. Although electricity has many benefits, it can also harm people if it is not accompanied by adequate knowledge, understanding, and skills regarding its use (Mudawari et al., 2021).

Electrical hazards refer to the risks associated with using electrical equipment and systems that can cause injury or damage, including electric shock and fire. According to research published in the journal (Vela, 2020), Electrical hazards often result from factors such as poor maintenance, use of inappropriate tools, and lack of safety training for workers. The

research emphasizes the importance of preventive strategies, such as regular safety audits and proper training, to reduce the risks associated with electrical hazards in the workplace. Implementing these measures can help create a safer work environment and minimize the potential for accident (Cantika & Sofyan, 2024). The mechanical hazards identified in the merdeka field revitalization project in the iron fabrication work are electric shock from the bar cutting and bar bending machines.

Ergonomic Hazards

Ergonomics is a discipline that combines technology and art to create harmony between tools, work methods, and the environment with human abilities, capabilities, and limitations. The goal is to create healthy, safe, comfortable, and efficient working conditions so as to increase productivity (Siagian & Simanungkalit, 2022). Ergonomics also focuses on creating a rational balance between various aspects, such as technical, economic, anthropological, and cultural aspects, in every work system. This aims to achieve a better quality of life (Dinanty et al., 2023).

Based on the regulation of the minister of labor of the Republic of Indonesia No. 5 of 2018 concerning occupational safety and health (Peraturan Menteri Ketenagakerjaan Republik Indonesia Nomor 5 Tahun 2018 Tentang Keselamatan Dan Kesehatan Kerja, 2018), The fifth section discusses ergonomic factors that can be caused by several things, such as work positions, ways of working, inappropriate work postures while working, places that are not in accordance with anthopometry, work tool design, and lifting loads that exceed capacity.

Ergonomic hazards identified in the merdeka field revitalization project in iron fabrication work are the wrong iron lifting technique, and the load lifted is too heavy. These hazards can cause musculoskeletal disorders. Musculoskeletal disorder is a disorder of the muscles or skeleton caused by the load received by the muscles continuously for a long time and will be able to cause complaints in ligaments, tendons, and joints (Asnel & Pratiwi, 2021).

In this study, ergonomic hazards were also found, namely awkward work postures. Based on research conducted (Hudriah et al., 2023), it was found that there was an influence between work posture and musculoskeletal disorder in transport workers; this means that the better the work posture, the smaller the workers affected by musculoskeletal disorder.

CONCLUSION

There are several hazards that must be aware of in iron fabrication work, namely physical hazards, mechanical hazards, electrical hazards, and ergonomic hazards. Identification of hazards in iron fabrication work using JSA found that the worst risk is the severed finger as a result of the finger being pinched by the blade of the bar cutting machine at the threaded iron cutting stage. The lightest risk is tripping over materials or work tools. Before doing work, workers should attend a toolbox meeting to increase workers' awareness to work more safely and not endanger people around them. Focus and not behave unsafely during work. Communicate well with coworkers to avoid missed communication that can cause work accidents. Avoid behaviors that want to finish quickly during work because this means workers will do work in a hurry. Perform housekeeping before and after work to clean unused items in the work area. Use complete PPE

(helmets, shoes, vests, and shoes) while in the project area.

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