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ANALYSIS OF OCCUPATIONAL SAFETY AND HEALTH (OSH) RISKS AT THE STERILIZER STATION USING THE HIRARC METHOD AT PT KHARISMA ISKANDAR MUDA NAGAN RAYA

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Abstract

Occupational Safety and Health (OSH) is a key priority in both government and private palm oil mills. PT Kharisma Iskandar Muda is a company that applies OSH in every production process. Despite preventive efforts, workplace accident risks still exist. Company data shows that in 2023, there were 5 recorded accidents, while in 2024, there were 3 accidents, 1 moderate and 2 near-miss incidents at the sterilizer station. This study aims to analyze potential hazards by calculating risk values, interpreting the results, and recommending controls to reduce accident risks. The research uses a qualitative method with a case study approach at the sterilizer station. Data collection involved field observations, in-depth interviews, and purposive sampling. Risk analysis was conducted using the HIRARC method. The findings identified 6 work activities with potential hazards: 1 activity posed an acceptable risk, 1 moderate risk, 3 substantial risks, and 1 extreme/unacceptable risk. The conclusion indicates signs of potential accidents related to these activities. Recommended controls include daily monitoring, regular electrical panel inspections, improving worker focus, adding safety signage, enhancing SOPs, and ensuring consistent use of personal protective equipment (PPE).

Keywords: HIRARC, Occupational Safety and Health (OSH), Sterilizer Station

Introduction

Occupational Safety and Health (OSH) is an aspect related to the welfare and safety of individuals who work, both at the workplace and at project sites. Its aim is to prevent work-related accidents and occupational diseases to ensure and maintain the health of employees [1]. The implementation of Occupational Safety and Health (OSH) is very important for all companies, including palm oil mills owned by both the government and private sectors. Business operators need to manage the risk of workplace accidents currently to reduce the number of accidents that occur. Additionally, the implementation of Occupational Safety and Health (OSH) is also important to protect workers so they can achieve optimal work results [2].

Globally, the implementation of Occupational Safety and Health (OSH) is regulated by the Occupational Safety and Health Administration (OSHA). The standards set by OSHA influence many countries around the world in protecting workers from injury risks and hazardous working conditions, helping companies improve safety and manage risks, ensuring legal compliance, and enhancing productivity. The Indonesian government has issued national policies and regulations related to Occupational Safety and Health (OSH), including Law No. 1 of 1970, which was subsequently reinforced by Government Regulation No. 50 of 2012 on the Implementation of the Occupational Safety and Health Management System [3].

Quoted from the International Labour Organization (ILO) report in 2023, there were 370,747

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cases of workers losing their lives. Most of the cases were contributed by the wage earners group, accounting for 93.83%, 5.37% of cases from the non-wage earners group, and 0.80% from the construction services group [4]. Based on the findings from the processing of BPJS Employment Insurance regarding work accidents and occupational diseases in 2022, there was a continuous increase in cases by about 5.7% from 2021, with 234,370 incidents recorded, resulting in 6,552 worker deaths [5]. According to data from the Aceh Province BPJS Employment, there were 105,182 work accident cases in 2016, 80,392 cases in 2017, and 157,313 cases in 2018. Poor supervision, occupational health and safety behaviours in the workplace, and substandard implementation of occupational health and safety are the main causes of these incidents [6].

PT Kharisma Iskandar Muda is a company engaged in the processing of palm oil, converting palm fruit into Crude Palm Oil (CPO) and palm kernel. PT Kharisma Iskandar Muda has several processing stations in its production process, starting from the fruit reception/weighing station, sorting/grading station, loading ramp station, boiling/sterilizer station, threshing and empty bunch press station, digester and press station, clarification station, nut and kernel station, boiler station, engine room station, and water treatment plant (WTP) station. Where the process at each station involves machines and equipment that certainly pose potential hazards to the workers [7].

This research focuses on the sterilizer station at PT Kharisma Iskandar Muda. Based on direct field observations and interviews with several sterilizer operators, it was found that the sterilizer station poses a high risk of danger to the safety and health of the workers. Based on the daily work activities, the types of work activities that pose hazards at the sterilizer station include operating the electrical panel, opening and closing the upper sterilizer door, placing fresh fruit bunches into the sterilizer tube, opening and closing the lower sterilizer door, cleaning and maintaining the machine and the sterilizer station area, and removing fruit from the sterilizer using a gala pipe tool. These activities can cause work accident hazards (electric shock, explosion, fire, slipping, falling, exposure to noise, exposure to dust, exposure to hot steam, oil splashes) and accident risks (burns, blisters, fractures, hearing impairment, respiratory issues, up to death).

Based on data and direct field observations, in 2024 at the sterilizer station of PT Kharisma Iskandar Muda, there was 1 work accident with moderate severity experienced by the maintenance team during repairs, and 2 near-miss incidents by operators without causing injuries. Even though the company has implemented OSH procedures such as the use of PPE, safety training, and the provision of health and emergency response facilities, employee non-compliance with existing protocols is still found. This indicates a discrepancy between the regulations set by the company and employee adherence to occupational health and safety, which can increase the risk of hazards and work accidents.

HIRARC is an identification process aimed at recognizing potential hazards that may arise in daily activities or extraordinary activities within the company. This process is followed by assessing the risks of each identified hazard. The results of this risk assessment can be used to design hazard control programs aimed at reducing existing risks and preventing workplace accidents [8]. The HIRARC approach must be regulated, managed, and implemented in the workplace, serving as a guideline to prevent workplace accidents, including preventing accidents from occurring, and if an accident does occur, it becomes a way to prevent further accidents in the future [9].

Methods

This type of research is qualitative with a case study approach that involves specific perspectives from informant sources to gain an in-depth understanding and explore natural findings that emerge from daily interactions in the work context. Data collection was conducted through field observations, in-depth interviews, and document analysis. Field observations were carried out to directly witness the dynamics occurring in the workplace, in-depth interviews allowed the researcher to delve into the experiences, views, and perceptions of informants in a more personal and detailed manner, and document analysis.

The research was conducted from February to June 2024. The sampling in this study used purposive sampling techniques, considering the experience, knowledge, and involvement of workers in implementing Occupational Safety and Health (OSH), resulting in 5 informants: 1 key informant (HSE), 3 main informants (sterilizer station operators), and 1 supporting informant (process assistant). This research analyses the potential risk levels of workplace hazards using the HIRARC method, which is a process of hazard identification that occurs in all work activities at the sterilizer station, followed by risk assessment of the identified hazards and implementing risk control measures to minimize the likelihood of accidents.

HIRARC Method in Case Study Resolution

There are several steps or stages in the case study resolution regarding OSH risk analysis using the HIRARC method. The first step is initial observation by directly observing the area and work activities, conducting brief interviews with workers and field supervisors to obtain initial information about frequently occurring safety and health issues, and visual documentation such as photographs. Then, identify safety and health related problems after obtaining an initial overview, such as collecting accident or near-miss data that have occurred, and identifying potential hazards from work activities directly, supported by a literature review involving reading several relevant literatures to strengthen the analysis. The next step is further observation to deepen the analysis by conducting an in-depth risk assessment to measure the level of hazards previously identified and determining appropriate control strategies.

Hazard Identification

Hazard identification is a method to identify potential hazards in work-related activities, which is also the initial stage before the risk assessment step [10]. Hazard identification is carried out to help workers work more carefully and remain vigilant.

Risk Assessment

Risk assessment is a procedure to evaluate potential risk hazards. The purpose of risk assessment is to ensure that risk controls related to processes or work activities are at an acceptable level. To assess the level of risk and suggest control measures, data analysis in this study needs to calculate the likelihood value, which is the probability of occurrence, and severity, which is the level of impact severity resulting from an accident for each previously identified risk [11]. Here are the likelihood criteria table and the severity criteria table.

Table 1. Likelihood Criteria

Level	Kriteria	Explanation
1	Rarely	An incident may occur under special/extraordinary conditions/after many years, for example, once in the lifetime of the factory or more than 5 years/almost never happens.
2	Unlikely	An event may occur under certain conditions, but it is unlikely to happen, for example, occurring once every 5 years/rarely occurring.
3	Possible	An event will occur under certain conditions, such as happening once every 3 years/happening occasionally.
4	Likely	An event may occur in almost all conditions under any circumstances, for example, occurring once a year/very likely to happen in almost all situations.
5	Almous Certain	An event will occur under all conditions, for example, it happens repeatedly every 3 months/ it occurs in almost all situations.

Source: Standard AS/NZS 4360:2004

Table 2. Severity Criteria

Level	Kriteria	Explanation
1	Insignifican	No injuries occurred, minor impact on occupational health and safety, first aid required but the worker can return to work.
2	Minor	Minor injury/illness requires medical treatment. The worker can return to work but experiences a decrease in performance. No lost time injury.
3	Moderate	Moderate injury/illness requires special treatment, resulting in loss of work time. and cause losses
4	Major	Permanent injury/severe illness, resulting in permanent physical disability due to work.
5	Catastrophic	Fatalities/deaths of more than one person or permanent disabilities of more than one person due to work, causing significant losses.

Source: Standard AS/NZS 4360:2004

Potential sources of hazards will then be ranked based on this risk level and will also serve as a guide for appropriate control recommendations for the existing issues. The actual risk assessment is conducted using a risk matrix, as shown in the table below.

Table 3. Risk Matrix

Likelihood	Severity				
	1	2	3	4	5
1	T	T	A	A	A
2	T	A	M	M	S
3	A	M	M	S	S
4	A	M	S	U	U
5	A	S	S	U	U

Table 4. Risk Category

Trivial	1-2
Acceptable	3-5
Moderate	6-9
Substansial	10-15
Unacceptable	16-25

Source: Standard AS/NZS 4360:2004

Explanation

T (Trivial)	: The risk is still acceptable, no action required.
A (Acceptable)	: Low risk, no additional action required, requires monitoring.
M (Moderate)	: Moderate risk, actions must be taken to reduce the level of risk. Risk reduction measures must be implemented within a specific time (12 months).
S (Substantial)	: High risk, must take action to reduce the level of risk. Risk reduction must be implemented within 6 months during a specific period.
U (Unacceptable)	: The risk is unacceptable/extreme, the work should not be carried out until the risk level is reduced. Work is stopped and should not be carried out if the risk cannot be reduced, (minimum administrative control).

Risk Control

To eliminate or minimize the risk of work accidents to a tolerable level, risk control is very important to follow up on the prioritized hazards identified in the previous stage [12]. The Hierarchy of Control approach can be used for risk management.

1. Elimination

The goal of elimination is to permanently remove the source of workplace hazards. In terms of hazard risk control, elimination should be the first achievable priority. Elimination is carried out by moving the current work items or work systems in the workplace in an effort to eliminate the cause of the hazard.

2. Substitution

Substitution is an effort to replace hazardous practices or materials with safer or less hazardous alternatives so that their presence is always within reasonable and safer limits when used.

3. Engineering Control

Engineering is an effort to reduce risk levels by altering the design structure, machine work objects, equipment, and processes so that operators do not come into direct contact with hazardous materials.

4. Administration Control

The main objective of administrative control is to create and implement SOP (Standard Operating Procedure) procedures, install safety signs and warnings about potential hazards, regulate and monitor all employees and work restrictions, and verify that all employees and work regulations are complied with

5. Personal Protective Equipment (PPE)

Personal protective equipment functions to reduce the severity of the implications of existing hazard risks. The recommended PPE is the one that meets the requirements and must be worn by every employee depending on the type of their work.

Results

Hazard Identification

Based on the results of field observations and in-depth interviews conducted at the sterilizer station at PT Kharisma Iskandar Muda, the hazard identification can be seen in Table 5.

Table 5. Hazard Identification Results at the Sterilizer Station

No	Work Activity	Hazard Identification	Health Risk/Impact	Picture
1	Operating the Sterilizer Panel	- Fire due to electrical short circuit - Electrocuted by a damaged panel - Explosion due to excessive steam pressure - The packing of the sterilizer broke	- Causing death, burns, serious injuries to the operator, hearing impairment, and loss of work focus.	
2	Opening and Closing the Upper Sterilizer Door	- Electric shock from the damaged panel - Hot steam exposure when opening the top door. - Exposed to loud noise while operating the machine - Tripped while going up and down the stairs	- Causing burns on the operator, blisters on the skin, hearing disturbances, and sprains or even fractures.	
3	Lacing fresh fruit bunches (TBS) into the Sterilizer	- Electric shock from the damaged panel - Exposed to residual low-intensity steam in the inactive sterilizer chamber - Exposed to noise while operating machinery	- Causes burns and mild blistering skin injuries, hearing impairment.	
4	Opening and closing the lower Sterilizer door	- Electric shock from the damaged panel - Exposed to residual steam when opening the lower door of the sterilizer - Exposure to noise while operating the machine	- Causes burns, blisters, and hearing impairment in the operator.	
5	Cleaning and Maintenance of Machines and Sterilizer Area/Station	- Slippery floor causes falls and slips - Exposed to dust during machine and area cleaning causing sprains, even serious injuries, and respiratory disturbances	- Causing sprains, even serious injuries, and respiratory disturbances.	
6	Pulling fruit in the Sterilizer using Gala Pipe Tool	- Fell during the fruit pulling process - Hit by the fruit pulling too	- Causes sprains or injuries to the operator, and results in skin bruising.	

The results of the hazard identification are reinforced by the main informant's statement about the hazards present at the sterilizer station, as follows:

"When we operate the panel, we might get electrocuted, opening and closing the boiling door

might also expose us to hot steam because there is always steam, and during boiling, there are also steam bursts which can be dangerous, and noise often occurs." (IU1)

Risk Assessment

To calculate and determine the risk value, a risk management strategy is required through several stages, including work activity stages, hazard identification, potential hazards, likelihood, severity, and risk assessment (score). The risk assessment at the sterilizer station at PT Kharisma Iskandar Muda can be seen in table 6.

Table 6. Risk Assessment at the Sterilizer Station

No	Work Activity	Hazard Identification	Health Risk/Impact	L	S	score	Risk Level
1	Operating the Sterilizer Panel	- Fire due to electrical short circuit - Electrocuted by a damaged panel - Explosion due to excessive steam pressure - The packing of the sterilizer broke	- Causing death, burns, serious injuries to the operator, hearing impairment, and loss of work focus.	5	5	25	Unacceptable
2	Opening and Closing the Upper Sterilizer Door	- lectric shock from the damaged panel - Hot steam exposure when opening the top door of the sterilizer - Exposed to loud noise while operating the machine - Tripped while going up and down the stairs	- Causing burns on the operator, blisters on the skin, hearing disturbances, and sprains or even fractures.	3	5	15	Substansial
3	Lacing fresh fruit bunches (TBS) into the Sterilizer	- Electric shock from the damaged panel - Exposed to residual low-intensity steam in the inactive sterilizer chamber - Exposed to noise while operating machinery	- Causes burns and mild blistering skin injuries, hearing impairment.	2	5	10	Substansial
4	Opening and closing the lower Sterilizer door	- Electric shock from the damaged panel - Exposed to residual steam when opening the lower door of the sterilizer - Exposure to noise while operating the machine	- Causes burns, blisters, and hearing impairment in the operator. -	3	5	15	Substansial
5	Cleaning and Maintenance of	- Slippery floor causes falls and slips	- Causing sprains, even serious	3	2	6	Moderate

	Machines and Sterilizer Area/Station	- Exposed to dust during machine and area cleaning	injuries, and respiratory disturbances.					
6	Pulling fruit in the Sterilizer using Gala Pipe Tool	- Fell during the fruit pulling process - Hit by the fruit pulling too	- Causes sprains or injuries to the operator, and results in skin bruising.	2	2	4	Acceptable	

The results of the risk assessment above are in line with the in-depth interviews conducted with the sterilizer station operators, who stated that:

> "The most fatal danger at the sterilizer station, as I mentioned earlier, is that we carry out the boiling operation starting from the first, second, and also third steps. Perhaps negligence in working could have fatal consequences, as exceeding the pressure could cause the boiling to explode." (IU3)

Risk Control

Risk control is a stage carried out before the identified hazards cause workplace accidents or health disturbances to workers. The goal is to minimize the risks that may arise from a work activity. The controls that have been determined to address the potential hazards present at the sterilizer station of PT Kharisma Iskandar Muda can be seen in Table 7.

Table 7. Risk Control at the Sterilizer Station

No	Work Activity	Hazard Identification	Health Risk/Impact	Control
1	Operating the Sterilizer Panel	- Fire due to electrical short circuit - Electrocuted by a damaged panel - Explosion due to excessive steam pressure - The packing of the sterilizer broke	- Causing death, burns, serious injuries to the operator, hearing impairment, and loss of work focus.	- Performing work according to SOP and adding hazard signs, using PPE correctly, daily monitoring, ensuring the electrical panel functions normally, and staying focused.
2	Opening and Closing the Upper Sterilizer Door	- lectric shock from the damaged panel - Hot steam exposure when opening the top door of the sterilizer - Exposed to loud noise while operating the machine - Tripped while going up and down the stairs	- Causing burns on the operator, blisters on the skin, hearing disturbances, and sprains or even fractures.	- Performing work according to SOP, using PPE correctly such as safety shoes, safety helmets, gloves, protective suits, masks, ear plugs/earmuffs, daily monitoring, and ensuring the ladders are clean and safe.
3	Lacing fresh fruit bunches (TBS) into the Sterilizer	- Electric shock from the damaged panel - Exposed to residual low-intensity steam in the inactive sterilizer chamber - Exposed to noise while operating machinery	- Causes burns and mild blistering skin injuries, hearing impairment.	- Performing work according to SOP, using PPE correctly such as gloves, protective suits, and ear plugs/earmuffs.

4	Opening and closing the lower Sterilizer door	- Electric shock from the damaged panel - Exposed to residual steam when opening the lower door of the sterilizer - Exposure to noise while operating the machine	- Causes burns, blisters, and hearing impairment in the operator.	- Performing work according to SOP, using PPE correctly such as safety shoes, safety helmets, safety gloves, protective suits, masks, and ear plugs/earmuffs, and maintaining concentration.
5	Cleaning and Maintenance of Machines and Sterilizer Area/Station	- Slippery floor causes falls and slips - Exposed to dust during machine and area cleaning	- Causing sprains, even serious injuries, and respiratory disturbances.	- Perform work according to SOP, wearing PPE such as masks, safety shoes, safety helmets, and other protective equipment.
6	Pulling fruit in the Sterilizer using Gala Pipe Tool	- Fell during the fruit pulling process - Hit by the fruit pulling too	- Causes sprains or injuries to the operator, and results in skin bruising.	- Performing work according to SOP, using PPE such as safety gloves, safety shoes, safety helmets, and other protective equipment, and staying focused.

Control efforts in this study are supported by interviews with key informants and supporting informants, stating that:

"For the prevention measures we have implemented, we conduct safety briefings in the morning safety talk, where every worker is given education or understanding about how to work safely. First, the second measure is socialization using pamphlets or posters that we put up at the station. As for the PPE required at the sterilizer station, the first is shoes because the area is slippery, the second is gloves, then safety glasses, and long-sleeved shirts are recommended." (IK)

"For control or prevention measures that we have implemented here, we provide education to the boiling station operators to ensure they work according to the applicable SOPs so that they operate the boiling process according to the rules. We also provide education related to occupational safety for them and we provide personal protective equipment." (IP1).

Discussion

This research has presented data on the analysis of Occupational Health and Safety (OHS) risk levels at the sterilizer station using the HIRARC method at PT Kharisma Iskandar Muda Nagan Raya. The researcher first discusses the findings regarding the hazards identified related to work activities at the sterilizer station. From this research, the researchers identified 6 work activities that pose potential hazards, namely operating the sterilizer panel, opening and closing the upper sterilizer door, inserting fresh fruit bunches (TBS) into the sterilizer, opening and closing the lower sterilizer door, cleaning and maintaining the sterilizer area/station, and removing fruit from the sterilizer using a gala pipe tool.

The First Finding relates to the identification of hazards in work activities at the sterilizer station when operating the sterilizer panel, which is the initial stage in the boiling of palm fruit, where the operator will ensure that the supply of steam, water, and electricity is in normal condition and also ensure that the safety valve functions properly before operation. Based on the identification results, the hazards that can occur are fires due to electrical short circuits, electric shocks from damaged panels,

explosions due to excessive steam pressure, and ruptured cooking packings, which pose risks of death, burns, serious injuries to operators, and hearing health issues that can disrupt focus while working. The research is in line with the study conducted by [13] that in the work process of operating the sterilizer control room, the danger of electrical panel contact and the explosion of the sterilizer tank falls into the high-risk level.

The next activity is opening and closing the top door of the sterilizer, which is an important step that must be performed to ensure the TBS boiling process runs optimally. The hazards that may occur during this activity include electric shock from a damaged panel, exposure to hot steam when opening the boiling door, exposure to loud noise when operating the machine, and falling when going up and down the stairs, which can lead to risks such as burns to the operator, skin blisters, hearing impairment, sprains, or even broken bones. This research is supported by research [14] stating that the process of opening and closing the top door of the sterilizer can result in hazards such as exposure to hot steam, falling, and prolonged exposure to machine noise.

After the process of opening the sterilizer door is complete, the next activity is to insert the fresh fruit bunches (TBS) into the sterilizer tube. At this stage, there are potential hazards such as electric shock from a damaged panel, exposure to residual low-intensity steam in the inactive sterilizer tube, and exposure to loud machine noise. The resulting risks include burns and minor skin blister injuries to the operator, as well as hearing impairment in the operator. This can occur due to a lack of maintenance on the equipment and insufficient use of PPE by workers during the process. This research is in line with [14] which the activity of inserting TBS into the sterilizer tube has the potential danger of exposing the operator to hot steam.

In addition to the upper door, the activity of opening and closing the lower sterilizer door is also an important part of the processing at this station. This is done not only to remove the residual steam inside the sterilizer chamber but also to simultaneously release the cooked TBS that has finished boiling. From this activity, hazards were identified such as electric shock from a damaged panel, exposure to residual steam when opening the sterilizer door, and exposure to the loud noise of the operating machine, resulting in risks such as burns, blistered skin, and hearing impairment for the operator. This is in line with [15] in the process of opening the sterilizer door after boiling, there is a risk of being exposed to hot steam and inhaling hot steam when opening the door.

Cleaning and maintenance activities for machines and work areas are also routine activities that are carried out. This activity is carried out to maintain the cleanliness of the work environment and ensure that the machinery is in optimal condition to minimize the risk of workplace accidents. The potential hazards identified are slippery floors causing slips and falls, exposure to dust while cleaning the sterilizer area leading to the risk of sprains or even serious injuries, and health risks to operators such as respiratory issues. This research is in line with previous studies [15] stating that the floor cleaning activity in the sterilizer area poses a slippery floor hazard due to water and oil drips, which can lead to slipping and falling.

And the last activity performed was the extraction of fruit from the sterilizer tube. This process uses a gala pipe as a pulling aid to remove fruit that is stuck inside the sterilizer tube. Although it seems simple, this activity can also pose dangers because it involves physical strength and the direct use of tools in the extraction process. Hazards were found such as falling during the fruit pulling process and colliding with the fruit pulling tool, resulting in the risk of sprains or injuries to the operator, and experiencing skin bruising. This is supported by research [16] stating that the workers' activity of pulling sticky fruit is at risk of steam exposure and contact with tojok, which is a tool for pulling fruit.

Then, the researchers conducted a risk assessment to determine the level of danger risk that had been previously identified. To determine the average result of the risk assessment, there are 5 levels of likelihood. Level 5 (Almost Certain) indicates that an event occurs under all conditions, level 4

(Likely) indicates the possibility of an event occurring under almost all conditions. Level 3 (Possible) indicates an event that has the potential to occur under certain conditions/occurs occasionally, level 2 (Unlikely) indicates an event that may occur under some specific conditions but is unlikely/rarely occurs, and level 1 indicates an event that occurs under special conditions or almost never occurs (Rarely) [17].

Meanwhile, severity also has 5 levels. Level 1 (Insignificant) indicates a state of no injury and no loss, allowing the person to continue working (no lost time injury). Level 2 (Minor) involves a light injury/illness requiring medical treatment (first aid) but no loss of work time. Level 3 (Moderate) indicates a moderate injury/illness requiring special treatment, resulting in loss of work time and causing damage. Level 4 (Major) indicates a permanent injury/severe illness causing permanent physical disability and significant loss. Level 5 (Catastrophic) indicates a fatal condition causing death/permanent physical disability of more than one person and significant financial loss [18].

The average risk assessment results show that the processing area of the sterilizer station at PT Kharisma Iskandar Muda is at a hazardous level. It is shown in Table 5 that these 6 work activities have the potential to cause accidents. These activities are categorized into four categories: 1 low risk (Acceptable), 1 moderate risk (Moderate), 3 high risk (Substantial), and 1 unacceptable/extreme risk (Unacceptable).

The activity of operating the sterilizer panel poses an unacceptable/extreme level of risk (Unacceptable) with a score of 25. Next, the activity of opening and closing the upper and lower doors of the sterilizer falls into the heavy risk level (Substantial) with a score of 15. Placing fresh fruit bunches (TBS) into the sterilizer also poses a heavy risk level (Substantial) with a score of 10. Additionally, the activity of cleaning the station area and fruit retrieval with a score of 6 poses a moderate risk level, and the activity of fruit retrieval in the sterilizer using a gala pipe with a score of 4 poses a light risk level.

This research is supported by previous research by [19] which states that the sterilizer station has potential hazards, namely electrical shock, sterilizer explosion, hot steam spray, slipping, tripping, and falling, with a harmful/dangerous level. This research is also supported by observations and interviews with maintenance members while performing repairs at the sterilizer station of PT Kharisma Iskandar Muda, who have experienced accidents while cleaning clogged steam pipes and were sprayed with residual steam/hot vapor from the flange gaps. These accidents fall into the moderate risk category, requiring special care and resulting in loss of work time.

The next step is to determine risk control or risk management. The goal of risk control is to reduce the amount of risk by providing risk control recommendations. After identifying potential hazards, the next step is to implement risk control measures for all identified hazards, considering the risk assessment to determine their control priorities [20].

Based on the risk assessment results, the control measures used to address light hazard risk (acceptable), moderate hazard risk (moderate), heavy hazard risk (substantial), and unacceptable/extreme hazard risk (unacceptable) in this study are the hierarchy of OSH control starting from elimination, substitution, engineering controls, administration, and Personal Protective Equipment (PPE). The control measures that can be implemented include daily monitoring, ensuring the electrical panel functions normally, concentrating while performing tasks, adding hazard warning signs, checking the condition and state of machines before operation, performing tasks according to Standard Operating Procedures (SOP), and using complete Personal Protective Equipment (PPE) such as safety helmets, safety shoes, safety gloves, masks, earplugs, and face shields.

This research is in line with the study conducted by [21] stating that risk control measures implemented include using PPE in the factory environment, engineering controls to minimize hazards, and administration such as applying SOPs to every work process. Other research was conducted by [22] that hazard risk control is carried out by using PPE according to the needs of workers and routine

control of sterilizer tools and machines.

Conclusion

Based on the research conducted, it can be concluded that at the sterilizer station of PT Kharisma Iskandar Muda, there are 6 work activities that can pose accident risks. The accident risks are divided into 4 categories: 1 light risk (acceptable), 1 moderate risk (moderate), 3 heavy risks (substantial), and 1 unacceptable/extreme risk (unacceptable). Mitigation or control measures that can be implemented are based on the hierarchy of OSH control, including daily monitoring and ensuring the electrical panel functions normally, concentrating while performing tasks, adding hazard signs, checking the condition and state of machines before operation, performing tasks according to Standard Operating Procedures (SOP), and using Personal Protective Equipment (PPE) completely (safety helmet, safety shoes, safety gloves, mask, earplug, and face shield).

The company needs to increase attention to the implementation of Occupational Health and Safety (OSH), especially for workers who are still undisciplined in following safety procedures. This is important to prevent potential risks that could cause workplace accidents. The steps that can be taken are to strengthen supervision and conduct regular evaluations of employee compliance with Standard Operating Procedures (SOP) using technology such as CCTV, as well as the implementation of a checklist system for the use of Personal Protective Equipment (PPE) with a punishment and reward approach to improve compliance. In addition, regular K3 training and the addition of safety signs are also necessary to enhance workers' understanding and awareness of potential hazards in the work area. It is hoped that the implementation of the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) standards can continue to be applied and become a common practice to reduce or eliminate hazards in the company's work environment.

References

[1] D. Aulya and B. Hasibuan, “Analisis Perbedaan Tingkat Kematangan Budaya Keselamatan Pada Pekerjaan Konstruksi Gedung Bertingkat Dan Bendungan PT X,” *J. Ind. Hyg. Occup. Heal.*, vol. 8, no. 2, pp. 154–165, 2024.

[2] R. P. Sholekhah, *Evaluasi Penerapan Keselamatan Dan Kesehatan Kerja Pada Divisi Produksi Kelapa Sawit*. 2022.

[3] A. Fajriah Hasanah and N. Diandra, “Analisis Penerapan Keselamatan dan Kesehatan Kerja (K3) Sebagai Pengendalian Terhadap Kinerja Pada Proyek Konstruksi,” *J. Tek. SIPIL CENDEKIA*, vol. 5, no. 1, pp. 863–872, 2024, doi: 10.51988/jtsc.v5i1.195.

[4] D. P. Sari, Y. Hariani, and N. Muhammad, “Dampak Pengetahuan, Sikap dan Masa Kerja dengan Kejadian Kecelakaan Kerja di PT X Palembang Tahun 2024,” *J. Kesehat. Terap.*, vol. 11, no. 2, pp. 148–155, 2024, doi: 10.54816/jk.v11i2.798.

[5] A. Yuli *et al.*, *Profil Keselamatan dan Kesehatan Kerja Nasional Indonesia Tahun 2022*. 2022.

[6] E. Y. P. Siboro, Darmawan, D. Nabela, J. M. Is, and S. Sriwahyuni, “Identifikasi Bahaya dan Penilaian Resiko di Stasiun Boiler Menggunakan Metode HIRARC Hazard Identification and Risk Assessment at Boiler Station Using by HIRARC Methods,” vol. 4, no. 03, pp. 153–160, 2024.

[7] E. R. Tarigan, D. Adelaila, and B. Pardede, “Analisis Potensi Bahaya Dan Pengendaliannya Pada Area Produksi Kelapa Sawit Menggunakan Metode Hazard Identification Risk Assessment and Risk Control Di PT Mora Niaga Jaya PKS Gedong Biara,” *J. AGROTRISTEK*, vol. 2, no. 2, pp. 20–26, 2023.

[8] Triswandana and Armaeni, “Penilaian Risiko K3 Kontruksi Dengan Metode Hirarc.,” *J. Univ.*

Kadiri Ris. Tek. Sipil, vol. 4, no. 1, p. 13, 2020.

[9] S. F. Pakpahan, H. P. L. Simangunsong, D. M. S. Siregar, and S. Ramadhani, "Analisis Implementasi Pengendalian Potensi Bahaya dengan Metode Hazard Control with The Hirarc pada Stasiun Kernel Di PKS PT. Kresna Duta Agroindo Pelakar-Mill Tahun 2020," *J. Pembaruan Kesehat. Indones.*, vol. 1, no. 5, pp. 239–249, 2024.

[10] M. Sahri, F. Ayu, N. M. N. Syufi, and R. W. Safitri, "Penilaian Risiko Kuantitatif Paparan Toluen Melalui Inhalasi Pada Pekerja Di Industri Percetakan," *J. Ind. Hyg. Occup. Heal.*, vol. 5, no. 2, p. 1, 2021, doi: 10.21111/jihoh.v5i2.4630.

[11] M. A. Purwanto, A. W. Rizqi, and & Hidayat, "Analisis Kecelakaan Kerja Menggunakan Metode Hirarc (Hazard Identification, Risk Assessment Dan Risk Control) Di Divisi Maintenance Cv. Dira Utama Sejahtera," *J. Teknovasi*, vol. 09, no. January, pp. 20–30, 2022.

[12] A. A. Syarif, U. N. Harahap, S. J. Sinaga, and M. Z. Siregar, "Analisis Sistem Kesehatan Dan Keselamatan Kerja Di Pt Sumber Sawit Makmur Dengan Metode Hazard Identification Risk Assessment and Risk Control (Hirarc) Dan Fault Tree Analysis (Fta)," *J. Al Ulum LPPM Univ. Al Washliyah Medan*, vol. 11, no. 1, pp. 7–15, 2023, doi: 10.47662/alulum.v11i1.432.

[13] N. O. Maliza and C. W. A. Putri, "Evaluasi Kesehatan dan Keselamatan Kerja pada Stasiun Sterilizer dengan Metode HIRARC di PT . Beurata Subur Peusada," *J. Ind. Inov.*, vol. 1, pp. 38–45, 2024.

[14] A. Sudarma and D. Suastiyanti, "Analisis Risiko Bahaya Pada Stasiun Loading Ramp Dan Perebusan Pada Industri Pengolahan Kelapa Sawit Dengan Metode Job Safety Analysis (Jsa)," *J. Ind. Eng. Technol.*, vol. 4, no. 1, pp. 74–80, 2023, doi: 10.24176/jointech.v4i1.11302.

[15] Dewiyana, R. Pramanda, Nurmalawati, and H. A. F. Saragih, "Analisis Potensi Bahaya Pada Stasiun Sterilizer Di Ptpn Iv Pks Tanjung Seumantoh Menggunakan Metode Job Safety Analysis (JSA)," vol. 3, no. 1, pp. 219–228, 2024.

[16] C. Zefanya, A. Ginting, and R. A. Widyowanti, "Identifikasi Bahaya serta Penilaian Risikonya di Pabrik Kelapa Sawit menggunakan Metode Job Safety Analysis (JSA)," vol. 2, pp. 1826–1832, 2024.

[17] M. E. Albar, L. Parinduri, and S. R. Sibuea, "Analisis Potensi Kecelakaan Menggunakan Metode Hazard Identification and Risk Assessment (Hira)," *Bul. Utama Tek.*, vol. 17, no. 3, pp. 241–245, 2022, doi: 10.30743/but.v17i3.5366.

[18] G. Putra and O. Saputra, "Analisis Potensi Bahaya di Area Produksi Kelapa Sawit Menggunakan Metode HIRARC di PT. Beurata Subur Persada," *J. Serambi Eng.*, vol. 7, no. 2, pp. 2913–2921, 2022, doi: 10.32672/jse.v7i2.3896.

[19] W. Afnella and T. N. Utami, "Analisis Risiko Kecelakaan Kerja Metode Hira (Hazard Identification And Risk Assessment) Di PT . X," *PREPOTIF J. Kesehat. Masy.*, vol. 5, no. 2, pp. 1004–1012, 2021.

[20] R. Ameliawati, "Penerapan Keselamatan dan Kesehatan Kerja dengan Metode HIRADC (Hazard Identification, Risk Assessment and Determining Control) di Area Plant-Warehouse," *Rang Tek. J.*, vol. 6, no. 1, pp. 51–64, 2022, [Online]. Available: https://scholar.googleusercontent.com/scholar?q=cache:Trq8QTUWD1EJ:scholar.google.com/+ameliawati+penerapan+k3&hl=id&as_sdt=0,5

[21] G. Samarandana, A. Momon, and J. Arifin, "Penilaian Risiko K3 pada Proses Pabrikasi Menggunakan Metode Hazard Identification, Risk Assesment and Risk Control (HIRARC)," *J. INTECH Tek. Ind. Univ. Serang Raya*, vol. 7, no. 1, pp. 56–62, 2021.

[22] R. Narandreswara, Priyambada, and P. L. Pamardi, "Evaluasi Sistem Keselamatan dan Kesehatan Kerja K3 pada Stasiun Sterilizer menggunakan Metode Hirarc," *Agroforetech*, vol. 1, no. 3, pp. 2032–2039, 2023.