International Journal Of Latest Technology In Engineering & Management (IJLTEM)
Volume 9 - Issue 4 {July-August 2024} {Page: 01-07}

Improvement Proposal for Occupational Health and Safety Management System (OHSMS) Using Hazard Identification and Risk Assessment (HIRA) Method (Case Study: Bearing Company)

Totok Setiyawan[1], Yerikho Alexander[2], Mulyadi[3], Heriyanto[4], Yudi Prastyo[5]
Department of Industrial Engineering, Pelita Bangsa University, Indonesia

ABSTRACT : *In current occupational health and safety practices in the industry, the primary concern of every responsible organization is the identification and elimination of hazards that threaten the life or health of workers, as well as hazards that can cause damage to facilities, equipment, property, products, or the environment. The Occupational Health and Safety Management System (OHSMS) is a global market demand as indicated by the International Labor Organization (ILO). Based on observations conducted at a bearing company, there are still unsafe actions/activities being carried out in daily work activities in the tool storage area. Therefore, research was conducted to identify hazards using the HIRA method. The results of the research identified three types of activities in the tool storage room that have potential hazards: "Lifting Heavy Spare Parts, Pick up heavy spare parts on the top shelf, Ride the Lift Table (assistive device) for the process of picking up spare parts" with risk rating numbers of 8, 8, and 6 respectively.Risk priority is an intermediate priority/significant risk with the hazard risk index being 3D, 3D and 2D.2D hazard risk index for which corrective action must be taken.If these potential hazards are not controlled, the company will face significant impacts in the event of an accident.*

Keywords: *HIRA, Occupational Health and Safety Management System (OHSMS)*

INTRODUCTION

In current industrial occupational health and safety practices, the primary concern of every responsible organization is the identification and elimination of hazards that threaten the life or health of workers, as well as hazards that can cause damage to facilities, equipment, property, products, or the environment. When such risks cannot be completely eliminated, as is often the case, the fundamental function of safety professionals is to provide recommendations to control these hazards in an effort to reduce the associated risks to the lowest acceptable level[1]. The Occupational Health and Safety Management System (OHSMS) is a global market demand as indicated by the International Labor Organization (ILO). A well-organized occupational health and safety management system can minimize the risk of work accidents resulting in death, illness, disability, and physical or mental disturbances for workers[2]. Based on observations conducted at a bearing manufacturing company, there are unsafe actions in daily work activities in the tool storage area. Therefore, the company will face significant impacts in the event of a work accident. The impact of work accidents on the company includes lost worker hours, which will disrupt the production process, and direct and indirect losses for the company. Therefore, a measurement of work accident risks is needed using the hazard identification and risk assessment (HIRA) method, which can analyze and identify the occupational health and safety management system in the company[3].

Based on the definition, safety means a condition where a person is free from accidents and near-miss incidents. Health not only means being free from disease but also being physically, mentally, and socially well. Thus, occupational health and safety (OHS) means being free from accidents and near-misses wherever one is, and being healthy physically, mentally, and socially[4]. According to A.S Munir, occupational health is an effort to create a safe and healthy state in the workplace, both for the workforce and the environment itself. A work accident is a sudden, unwanted event that can cause losses (injuries, disabilities, death, property damage, time loss, etc.). Occupational health and safety relate to safety involving machinery, equipment, work tools, materials and their processing, work foundations and environment, and work methods[5].

The occupational health and safety management system (OHSMS) is a component in building a systematic safety culture within an entity. According to Government Regulation No. 50 of 2012, Chapter I, Article 1, an OHSMS is part of the overall management system of a company aimed at controlling risks associated with work activities to create a safe, efficient, and productive workplace. The purpose of an OHSMS is to maintain workplace health and safety[6]. OHSMS also protects coworkers, workers' families, consumers, and others who might be affected by workplace conditions[7]. It seeks to prevent and reduce work accidents and occupational diseases by involving management, workers/laborers, and/or worker unions, and to create a safe, comfortable, and efficient workplace to boost productivity[8].
Hazard Identification and Risk Assessment (HIRA) is a method for identifying work accidents with risk assessment as a key point to implementing an OHSMS[9]. HIRA aims to identify potential hazards in a company and assess the likelihood of

accidents or losses. Hazard identification and risk assessment, along with their control, must cover all company activities, including routine and non-routine activities, whether conducted by direct employees, contract workers, suppliers, contractors, or any personnel entering the workplace[10]. Hazard identification is carried out by identifying all processes/areas involved in activities, recognizing as many OHS aspects as possible in each identified process/area. Then, OHS identification is conducted for each work process under normal, abnormal, emergency, and maintenance conditions[11].

RESEARCH METHODOLOGY

This research focuses on the occupational health and safety management system using the HIRA (Hazard Identification and Risk Assessment) method. The type of research used is descriptive research. Descriptive research describes a set of data that is then analyzed and compared based on the prevailing reality. The steps undertaken in this research are:

1. Job Breakdown: Types of activities are described based on the nature and activities performed in the job. Job descriptions are carried out by observing several activities.
2. Hazard Identification: Potential hazards can be identified by direct observation at the workplace. Observations are made for all activities conducted at the worksite.
3. Severity Assessment: The risk assessment process considers important aspects of severity. The severity assessment is divided into four categories: catastrophic, critical, marginal, and negligible. Severity is measured based on the impact of the accident[12]. The severity assessment uses a hazard severity classification table, as shown in table 1.
4. Frequency Assessment: This stage involves assessing the frequency of accidents or the likelihood of hazards occurring, using the hazard exposure classification table, as shown in table 2.
5. Calculating Risk Rating Number (RRN): The risk value resulting from the hazard source is calculated by determining the Risk Rating Number (RRN). The calculation of the Risk Rating Number uses the formula:

$$RISK\ RATING\ NUMBER = LO \times DPH$$

Explanation:
LO = Likelihood of occurrence or contact with hazard (frequency)
DPH = Degree of possible harm (severity)

Table 1.Severity Classification

Description	Category	Score	Mishap Definition
Catastrophic	I	4	Death or loss of system
Critical	II	3	Serious injuries that cause permanent disability
			Severe occupational disease
			Severe system damage
Marginal	III	2	Moderate injury, only requires medical treatment
			Mild occupational disease
			Partial system damage
Negicable	IV	1	Minor injuries that only require first aid

Tabel 2.Hazard Exposure Classification

Description	Level	Score	Specific Individual Item
Frequent	A	5	Occurs frequently, repeatedly within the system
Protable	B	4	Occurs several times within the system cycle
Occasional	C	3	Occurs occasionally within the system cycle
Remote	D	2	Unlikely, but possible to occur within the system cycle
Improbable	E	1	Extremely unlikely to occur

6. Hazard risk index, the assessment of risks is given a certain value by combining the level of emergency that can occur as well as the level of frequency of hazards occurring and the risks posed using the proposed criteria which can be seen in table 3.

Tabel 3.Risk Index

Risk Index	Proposed Criteria
1A, 1B, 1C, 2A, 2B, 3A	Unacceptable
1D, 2C, 2D, 3B, 3C	Undesirable (requires management decision)

1E, 2E, 3D, 3E, 4A, 4B	Acceptable with management review
4C, 4D, 4E	Acceptable without management review

7. Prioritize risks using the risk priority map table which can be seen in table 4.

Tabel 4.Risk Priority Map

RRN	PRIORITY
0.1 s/d 0.3	Lowest priority
0.4 s/d 4	Low priority / low risk
6 s/d 9	Medium priority / significant risk
10<	Main priority / immediate action required

8. Once the resulting risk level is known, a HIRA table can be created.

DATA COLLECTION AND PROCESSING

3.1 Activity Description

At this stage, the process of decomposing activities in the work area is carried out, especially in the tool storage room. The order of work obtained is as follows:

1. Find a spare parts storage location.
2. The process of picking up spare parts.
3. The process of recording the collection of spare parts.

From some of the sequences of activities above in the process of picking spare parts on high shelves there are unsafe actions, these unsafe actions can be seen in the picture below.

Fig. 1. Unsafe actions when picking up spare parts

The following are the types of activities in picking up spare parts in the storage room:

1. Lift and raise the storage box into the shelf.
2. Lower the storage box from the shelf.
3. Climb the Lift Tableto pick up the storage box on the top levels shelf.

3.2 Identify Potential Hazards

At this stage, a potential hazard analysis process is carried out for each activity in the process of picking up spare parts. The following is a table of potential hazards in the process of picking up spare parts, which can be seen in table 5.

Table 5. Potential Hazards Based onSpare Parts Retrieval Activities

No.	Types of Activities	Potential Hazards
1	Lifting Heavy Spare Parts	Sprain due to improper lifting position
2	Picking up heavy spare parts on the top shelf	Falling objects

3	Ride the Lift Table (assistive device) for the process of picking up spare parts	Fell because there was no safety fence in the Lift Table aid

3.3 Severity Assessment

Risk assessment based on potential hazards that can occur based on the classification of hazard severity. In this table, there is a category of severe injury or Critical with a level II definition, namely a severe injury that causes permanent disability, and a level III category, which is marginalwith a definition of moderate injury, requiring only medical treatment.The severity assessment is carried out by looking at the potential hazards as well as the categories and scores of the severity that occurs. The severity assessment of the process of picking spare parts in the tool room can be seen in table 6.

Table 6. Hazard Severity Value of Handling Spare Parts Activities

No.	Types of Activities	Potential Hazards	Hazard Description	Severity	
				Category	Score
1	Manual heavy lifting	Muscle injury	Moderate wounds, requiring only medical attention	III	2
2	Manual lowering of heavy objects	Falling objects	Moderate wounds, requiring only medical attention	III	2
3	Climb the Lift Tableto pick up the storage box	Fall	Severe injuries that cause permanent disability	II	3

3.4 Frequency Value

Frequency assessment is by looking at data from the company about the frequency of a work accident that occurs by looking at the hazard exposure classification reference. The frequency assessment in the process of picking spare parts in the tool room can be seen in table 7.

Table 7. Hazard Frequency inSpare Parts Picking Activities

No.	Types of Activities	Potential Hazards	Frequency of Occurrence/3 years	Frequency	
				Level	Score
1	Manual heavy lifting	Muscle injury	6times	B	4
2	Manual lowering of heavy objects	Falling objects	3times	B	4
3	Climb the Lift Tableto pick up the storage box	Fall	0	D	2

3.5 Risk Rating Number(RRN)

The higher the risk value, the greater the attention that must be given by the company's management, which is related to what control measures are worth giving. This quantitative calculation can be obtained by calculating the Risk Rating Number (RRN) value where this value can be obtained by considering the severity value ofthe hazard frequency data received by the worker. The calculation of the Risk Rating Number in the activity of picking up spare parts in the tool room can be seen in table 8.

Table 8. Calculation of Risk Rating NumberonSpare Parts Picking Activities

No.	Types of Activities	Severity Score	Frequency Score	Risk Rating Number
1	Manual heavy lifting	2	4	8
2	Manual lowering of heavy objects	2	4	8
3	Climb the Lift Table to pick up the storage box	3	2	6

3.6 Hazard Risk Index

After grouping the assessment of the risks that occur based on ranking, the overall hazard exposure can be determined using a risk matrix. The determination of the risk index in the process of picking spare partscan be seen in table 9.

Table 9. Hazard Risk Index in the Process of Picking Up Spare Parts

No.	Types of Activities	Category Severity	Level Frequency	Hazard Risk Index
1	Lifting & placing boxes onto shelves	III	B	3B
2	Lowering the box from the shelf	III	B	3B
3	Climb the Lift Tableto pick up the storage box	II	D	2D

3.7 Risk Priority

The results of the calculation of the Risk Rating Numbercan determine the priority of the risks produced. Each potential hazard that occurs can be determined by prioritizing risks by looking at the risk priority map. Risk prioritization in the process of picking up spare parts can be seen in table 10.

Table 10. Risk Priority on Spare Parts Retrieval Activities

No.	Types of Activities	Risk Rating Number	Risk Level
1	Lifting & placing boxes onto shelves	8	Medium priority/significant risk
2	Lowering the box from the shelf	8	Medium priority/significant risk
3	Climb the Lift Tableto pick up the storage box	6	Medium priority/significant risk

3.8 Hazzard Identification and Risk Assessment(HIRA)

Based on the entire series of hazard identification, the HIRA table is then made as an identification of hazards in bearing companies, especially in the activity of picking up spare parts in the tool room. The HIRA table on the process of picking up spare parts at the tool storage area can be seen in table 11.

Table 11.HIRA Table of Observation Results

No.	Type of Activity	Potential Hazards	Severity		Frequency		RRN	Hazard Risk Index	Risk Priority
			Category	Score	Level	Score			
1	Lifting & placing boxes onto shelves	Muscle injury	III	2	B	4	8	3D	Medium priority/significant risk
2	Lowering the box from the shelf	Muscle injury, Falling objects	III	2	B	4	8	3D	Medium priority/significant risk
3	Climb the Lift Tableto pick up the storage box	Fall	II	3	D	2	6	2D	Medium priority/significant risk

RESEARCH RESULTS

Based on the results of the identification of potential hazards using the Hazzard Identification Risk Assessmentmethod found in bearing companies, it can be seen that there are still potential hazards that have a moderate level of Risk Ratting Number (RRN)and medium priority / significant risk with a hazard risk index of 2Dwhich means "Unwanted (requires a decision on management activities)" and 3D which means “acceptable with management review”. So that the conditions of

activities that occur in these potential hazards can be analyzed. The following is an analysis of the activity of picking up spare parts in the tools room.

Table 12. Analysis of Hazard Identification in Spare Parts Retrieval Activities

No.	Types of Activities	Potential Hazards	RRN	Risk Priority	Explanation
1	Lifting & placing boxes onto shelves	Muscle injury	8	Medium priority/significant risk	Incorrect body position when lifting heavy weights
2	Lowering the box from the shelf	Muscle injury, Falling objects	8	Medium priority/significant risk	Incorrect body position when lowering heavy weights
3	Climb the Lift Tableto pick up the storage box	Fall	6	Medium priority/significant risk	The Lift Table has no railings so there is a risk of falling from the top

From the results of the analysis, recommendations for improving the risk of accidents to the main potential of spare parts in the tool storage room are recommended. Recommendations based on top priority in this case can be seen in table 13.

Table 13. Top Priority Recommendations

No.	Types of Activities	Recommendations
1	Manual heavy lifting	Using the back support equipment
2	Manual lowering of heavy objects	Using the back support equipment
3	Climb the Lift Tableto pick up the storage box	Installing a safety frame on the lift table

Recommendations for back support tools and safety frames on lift tables to reduce the risk of work-related illnesses in these cases can be seen in the following picture:

Fig. 2 Back Support tools

Fig. 3 Installation of safety frame on lift table

Conclusion

To identify the risk of danger in a job where there are still unsafe actions and conditions that can cause work accidents and occupational illnesses using the HIRA method, it is necessary to approach the system that is currently running, then collect hazard risk data to be classified into HIRA tabeh. In this observation there are 3 types of activities in the work in the tool storage room that have potential dangers, these activities are "Lifting Heavy Spare Parts, Picking up heavy spare parts on the top shelf, Ride the Lift Table (assistive device) for the process of picking up spare parts" for the risk rating number of each of these activities is 8, 8 and 6. Risk priority is an intermediate priority / significant risk with the hazard risk index being 3D, 3D, which means “acceptable with management review”and 2D which means undesirable (requires a decision on management activities). The author's advice for controlling the existing risks is: using back support and making new SOP (standard operating process) for heavy spare parts picking activities on the top shelf,Use back support during lifting activities and modifying the Lift Table to be safe when used by adding a frame cover on each side. The results of this observation are expected to be used as a reference for future studies. I hope that the next research can provide a clearer picture of the implementation of HIRA (Hazzar Identificaation Risk Assessment).

Acknowledgements

We offer all praise and gratitude to the presence of God Almighty, because with His mercy and grace, this research can be completed successfully. This research would not have been possible without support, assistance and contributions from various parties. Therefore, allow me to express my deepest gratitude to:

- Mr Yudi Prastyo, as the main supervisor, for the guidance, advice and motivation that was provided during this research process. Your knowledge and experience are invaluable in improving this research.
- Fellow authors who have worked well in their respective tasks in completing this research.
- This research discusses various aspects of occupational safety and health which are very important to apply at work. I hope that the results of this research can make a significant contribution to increasing safety awareness and application in various fields.

Finally, I realize that this research is still far from perfect. Therefore, I really hope for constructive criticism and suggestions for future improvements.

REFERENCES

[1] *J. W. Vincoli, Basic guide to system safety, Third Edition. John Wiley & Sonc, Inc., Hoboken, New Jersey, 2014.*

[2] *P. Jurnal, K. Masyarakat, W. Afnella, and T. N. Utami, "HAZARD IDENTIFICATION AND RISK ASSESSMENT METHOD OF WORK ACCIDENT RISK ANALYSIS AT PT. X," vol. 5, no. 2, 2021.*

[3] *S. Sari, H. Hayati, A. Dzaki, W. Juliansyah, and A. R. Safaat, "ANALYSIS OF OCCUPATIONAL HEALTH AND SAFETY RISKS AT MR. PAIMIN'S TOFU FACTORY USING THE HIRA METHOD," JISI: Journal of Industrial System Integration, Vol. 10, No. 1, P. 1, Mar. 2023, Doi: 10.24853/GC.10.1.1.1-8.*

[4] *S. Larasati, B. Widjasena, P. H. Occupational Safety and Health, Faculty of Public Health, Diponegoro University, Jl Soedarto, and B. H. Occupational Safety and Health, Faculty of Public Health, Diponegoro University, Jl Soedarto, "ANALYSIS OF POTENTIAL HAZARDS USING THE HIRA (HAZARD IDENTIFICATION AND RISK ASSESSMENT) METHOD AT THE X BOYOLALI WHITE BREAD FACTORY," vol. 9, no. 6, 2021, [Online]. Available: http://ejournal3.undip.ac.id/index.php/jkm*

[5] *R. F. Daulay and M. Nuruddin, "K3 ANALYSIS AT THE DWI JAYA MOTOR WORKSHOP USING THE HIRA METHOD INTEGRATED WITH THE FTA METHOD," vol. 2, no. 4, 2021.*

[6] *D. Agustin, "Analysis of the Dangers of Unsafe Behavior using the JSA Method and Risk Control using the Hirarc Method ANALYSIS OF THE DANGERS OF UNSAFE BEHAVIOR USING THE JSA METHOD AND RISK CONTROL USING THE HIRARC METHOD (Case Study of Warehouse PT. Heinz ABC Indonesia)."*

[7] *D. Syfa Urrohmah and D. Riandadari, "HAZARD IDENTIFICATION WITH HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC) METHOD IN AN EFFORT TO MINIMIZE THE RISK OF WORK ACCIDENTS AT PT. PAL INDONESIA," 2019.*

[8] *A. P. Nurieta, D. M. Safitri, and I. W. Utami, "Minimizing Unsafe Action in the Mass Rapid Transit (MRT) Phase II Construction Project Using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) Method," Journal of Industrial Systems Engineering, vol. 12, no. 1, pp. 81–94, Apr. 2023, doi: 10.26593/jrsi.v12i1.6088.81-94.*

[9] *A. Rizki Syachputra and A. Wasiur Rizqi, "Implementation of the HIRA Method in Minimizing the Risk of Work Accidents in CV.XYZ".*

[10] *M. Fakhriansyah, L. D. Fathimahhayati, and S. Gunawan, "Occupational Safety and Health Risk Analysis Using Hazard Identification and Risk Assessment (HIRA) and Job Safety Analysis (JSA) Methods (Case Study: Arjuna Interior)," G-Tech: Journal of Applied Technology, vol. 6, no. 2, pp. 295–305, Sep. 2022, doi: 10.33379/gtech.v6i2.1706.*

[11] *A. Saputra Ismy, "OCCUPATIONAL SAFETY AND HEALTH (K3) PLANNING USING THE WEBSITE-BASED HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) METHOD (Case Study on PT. Amarta Karya (PERSERO))".*

[12] *S. A. Arumningtyas and W. Putro, “MENGELOLA POTENSI RISIKO BAHAYA DALAM PROSES PRODUKSI KAPAS MELALUI PENDEKATAN HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) MANAGING HAZARD RISK POTENTIAL IN COTTON PRODUCTION PROCESSES USING HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) METHOD.”*