

Analysis of the Application of the Hirarc Method (Hazard Identification Risk Assessment and Risk Control) in Potential Hazard Identification Activities in the Healthy Stevia Sugar Making Process at PT Tri Arga Makmur Sentosa

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ABSTRACT

The still high level of work accidents requires companies to implement work safety and health programs to prevent work accidents. HIRADC (Hazard Identification, Risk Assessment, And Determining Control) is one of the K3 programs which consists of a series of activities to identify potential hazards and risks and provide appropriate control efforts according to the level of hazard risk. Based on the results of determining the risk level, there are 7 process activities with 2 types of risk. In each process activity, 5 (71%) hazard risks are included in the moderate category, and 2 (29%) hazard risks are included in the acceptable category.

Keywords: high level; accidents; K3; activities; acceptable.

INTRODUCTION

According to the Ministry of Manpower, work accidents are accidents that occur in connection with work, including illnesses that arise due to work relations, and accidents that occur on the way to work or returning home along the usual route (Ministry of Manpower, 2021). According to data from (BPJS Employment, 2017) work accident cases in Indonesia are still relatively high, in Indonesia up to June 2020 there have been 108,573 work accident cases, this number has increased by 42.20% compared to the previous year. Likewise, claims payments by BPJS Employment increased by 17.73% to around 747.68 billion rupiah. The manufacturing and construction sector contributed the largest number of work accidents with a percentage of 63.6%. Based on data from the East Java Provincial Government, in 2016 there were 95 work accident victims who died; 37 people were disabled; 670 people were unable to work, and 6,215 people were hospitalized.

The occupational safety and health program implemented by each company as a workplace is an effort to prevent work accidents. SMK3 is part of the company system which is used to implement, manage risks and develop K3 policies in the company (Saputro and Lombardo, 2021). One method for implementing and managing risk in the workplace is HIRADC. The HIRADC (Hazard Identification, Risk Assessment and Determining Control) method is a series of processes for identifying hazards in activities or work processes carried out both routinely and non-routinely (Ramadhan, 2017).

The HIRADC method is also an important element in creating a safe and comfortable workplace. Risk assessment and control is part of SMK3 which consists of hazard identification, risk assessment and risk control activities.

PT. Tri Arga Makmur Sentosa is a manufacturing company that produces sugar made from stevia leaves, where stevia leaves are a natural ingredient that can produce sugar crystal extracts that are naturally sweet and healthier. Thus the manufacturing company PT. Tri Arga Makmur Sentosa is able to reduce the level of diabetes in Indonesia, and also helps make people aware of the importance of maintaining health.

A work management system for a company is a framework that regulates how work is planned, implemented and evaluated to achieve organizational goals. This system includes several core components: planning, implementation, monitoring, and evaluation. Planning involves setting goals, creating schedules, and allocating resources. Implementation is the stage where tasks and projects are carried out according to plan. Supervision focuses on monitoring performance and ensuring that work is progressing according to established standards and targets. Evaluation involves assessing work results to determine successes and areas requiring improvement (Syaiful S, Marsauli T, 2021).

RESEARCH METHODS

This research is cross sectional in nature based on the research time, data collection process and observation of research variables carried out at a certain time. This research is observational research by conducting observations and interviews with K3 parties in the company. This research is descriptive research because it does not contain comparisons or look for relationships between variables but rather provides an objective description of the situation.

The data used in this research is primary data obtained through observations and interviews with the company's K3 regarding work processes in the weighing, mixing and packing work areas. Secondary data obtained is in the form of a company description, work procedures in the weighing, mixing and packing work area and accident control carried out.

Data processing and analysis techniques are guided by the results of interviews and observations by the company's K3. Based on the results of interviews and observations, potential hazards along with likelihood and severity values can be identified in the weighing, mixing and packing work area work processes. Next, the likelihood and severity values for each potential hazard are recorded and then analyzed using a risk assessment matrix table. The results of this analysis will reveal the risk level of potential hazards and whether the hazards are trivial, acceptable, moderate, substantial and unacceptable. The following is a risk assessment matrix table and the risk categories used:

Table 1. Risk Assessment Matrix

Severity (S)	Likelihood (L)				
	1 Unlikely	2 Rarely	3 Possible	4 Probable	5 Regular
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Table 2. Risk Categories

Trivial	1 – 2
Acceptable	3 – 5
Moderate	6 – 9
Substantial	10 – 15
Unacceptable	20 – 25

RESULTS AND DISCUSSION

Hazard Identification, Risk Assessment and Determining Control (HIRADC)

HIRADC (Hazard identification, Risk Assessment and Determining Control) is an important element in SMK3 (Occupational Health and Safety management system) because it is directly related to efforts to prevent and control hazards which are used to determine occupational safety and health objectives and plans. HIRADC is one part of the OHSAS standard 18001;2007 clause 4.3.1. This clause states that companies must establish, create, implement and maintain procedures, namely by identifying hazards, assessing risks and determining the necessary hazard and risk controls.

Research conducted in the weighing, mixing and packing work area at the PT stevia sugar factory. Tri Arga Makmur Sentosa, using the HIRADC method, explains that the importance of implementing an K3 management system in a company can be implemented using the HIRADC method.

Hazard Identification

PT. Tri Arga Makmur Sentosa is a manufacturing company that produces sugar made from stevia leaves, where stevia leaves are a natural ingredient that can produce sugar crystal extracts that are naturally sweet and healthier. Thus the manufacturing company PT. Tri Arga Makmur Sentosa is able to reduce the level of diabetes in Indonesia, and also helps make people aware of the importance of maintaining health.

Identification of hazards carried out in each work process in the PT weighing, mixing and packing work area. Tri Arga Makmur Sentosa obtained results that potential hazards included physical, chemical and mechanical hazards. The physical dangers posed include exposure to raw material dust, while the mechanical dangers include falls, slips, being hit, being hit by loads, equipment failure when using tools. The use of trolleys in industry aims for operational effectiveness and efficiency. Even though trolleys have many benefits such as increasing productivity, trolleys can also pose occupational hazards (Khasanah and Nawawinetu, 2018). Cleaning, fumigation and stock taking as well as silo maintenance activities can cause workers to be exposed to chemicals (gas and spray) which are considered chemical hazards.

In the process of removing the main raw materials from the warehouse there are mechanical and physical hazards. The mechanical dangers that occur include cargo falling, being hit, being pinched and failure of lifting and transport equipment.

Risk Assessment and Control

Risk is a form of potential danger that is likely to cause loss, the level of risk consists of the lightest or lowest risk, and severe or high risk depending on how it is handled (Karundeng, V Doda and AT Tucunan, 2018). Risk assessment is carried out by finding the value from multiplying the likelihood by the severity of each potential hazard. The category levels of likelihood (opportunity) and severity (severity) were obtained from the results of interviews and observations of the work environment carried out by the company's K3 for workers in the weighing, mixing and packing work areas. The likelihood and severity scale is 1 – 5 with different value descriptions. The following is a table for determining likelihood and severity.

Table 3. Determination of Likelihood

Levels	Description
1	An incident may occur in special or extraordinary circumstances or after many years
2	An event may occur under certain conditions, but the probability of it occurring is small
3	An event will occur under certain conditions
4	An event may occur in almost any condition
5	An event will occur under all conditions

Table 4. Severity Determination

Levels	Description
1	Minor injury/illness, has little impact on K3, requires first aid but the worker can return to work. No lost time injuries.
2	Moderate injury/illness, requires medical treatment. Workers can return to work but there is a decline in performance. No lost time injuries.
3	Injuries/illnesses that require special treatment resulting in lost work time.
4	Death or permanent physical disability due to work
5	Death of more than one person or permanent disability of more than one person due to work

After knowing the relative risk value obtained from multiplying the likelihood and severity, it is analyzed using a risk assessment table so that you can determine the risk level of the potential hazard. Risks included in the trivial category are risks with a relative risk value of 1 – 2, the acceptable category with a relative risk value of 3 – 5, the moderate category with a relative risk value of 6 – 9, the substantial category with a relative risk value of 10 – 15, and the unacceptable category with relative risk value 16 – 25. The following is a table of the results of hazard identification and risk assessment in the weighing, mixing and packing work area.

Table 5. Results of Hazard Identification and Risk Assessment in the Work Area in the Weighing, Mixing and Packing Work Area

No	Activity	Hazards	Potential risks	Residual risk (Ixs)	Risk level
1	Entering goods into the warehouse using trolleys	- Slip - Stumble - Pinched	- Injury - Injury - Injury	5	Acceptable
2	Pushing goods using a trolley for the weighing process	- Pinched - Stumble - Aches	- Injury - Injury - Injury	8	Moderate
3	Carry out the process of weighing goods	- Being hit by an object being lifted	- Injured	9	Moderate
4	Carrying out radiation and metal detection processes on goods	- Exposure to radiation - Exposure to dust	- Skin Irritation - Out of breath	8	Moderate
5	Mix sugar with extracted stevia	- Exposure to dust - Pinched	- Out of breath - Injury	6	Moderate

6	Goods Packaging	- Pinched	- Injury	5	Acceptable
7	Storing goods	- Exposure to dust - Overwritten	- Out of breath - Injury	6	Moderate

Based on the results of determining the risk level, there are 7 process activities with 2 types of risk. In each process activity, 5 (71%) hazard risks are included in the moderate category, and 2 (29%) hazard risks are included in the acceptable category. This research is in line with research which states that from using the HIRADC method to determine work-related accidents and illnesses, it was found that there were potential dangers with medium and low risks, as well as high risks during observations in the workshop area (Ikrar Pramadi, Suprpto and Rahma Yanti, 2020). The HIRADC method used in research in the fabrication department of PT. Unindo Pacific obtained risk assessment results, namely 3 types of danger risks in the extreme category, 10 types of danger risks in the high category, 8 types of danger risks in the moderate category, and 2 types of danger risks in the low category (Poniman and Mandati, 2020). After obtaining the risks that occur due to potential hazards, risk control is then carried out for all types of hazards found by considering the risk ranking to determine the priority of how to control them (Ramadhan, 2017). From the results of the risk assessment above, it can be seen that potential hazards have trivial, acceptable, moderate, substantial and unacceptable risks which can then be used as a reference for providing risk control efforts. The following are risk control efforts that have been implemented by the company: After obtaining the risks that occur due to potential hazards, risk control is then carried out for all types of hazards found by considering the risk ranking to determine the priority of how to control them (Ramadhan, 2017). From the results of the risk assessment above, it can be seen that potential hazards have trivial, acceptable, moderate, substantial and unacceptable risks which can then be used as a reference for providing risk control efforts. The following are risk control efforts that have been implemented by the company: After obtaining the risks that occur due to potential hazards, risk control is then carried out for all types of hazards found by considering the risk ranking to determine the priority of how to control them (Ramadhan, 2017). From the results of the risk assessment above, it can be seen that potential hazards have trivial, acceptable, moderate, substantial and unacceptable risks which can then be used as a reference for providing risk control efforts. The following are risk control efforts that have been implemented by the company: and unacceptable which are then used as a reference for providing risk control efforts. The following are risk control efforts that have been implemented by the company: and unacceptable which are then used as a reference for providing risk control efforts.

1. The following are risk control efforts that have been implemented by the company:
Administrative control, administrative control of potential hazards carried out by the company including procurement of K3 signs, supervision of work processes, work instructions, safety talks and safety briefings, room temperature checks, work environment dust checks, initial and periodic health checks, K3 training basics and outreach regarding occupational diseases to workers.
2. Personal protective equipment, namely the use of masks, safety glasses and gloves

CONCLUSIONS

There are 7 process activities with 2 types of risk. In each process activity, 5 (71%) hazard risks are included in the moderate category, and 2 (29%) hazard risks are included in the acceptable category. Administrative control of potential hazards carried out by the company includes procurement of K3 signs, supervision of work processes, work instructions, safety talks and safety briefings, room temperature checks, work environment dust checks, initial and periodic health checks, basic K3 training and socialization regarding diseases. the impact of work on workers and the use of PPE that is adapted to the type of work

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REFERENCES

Alexander, H., Nengsih, S. and Guspari, O. (2019) 'Study of Occupational Safety and Health (K3) Beam Construction in Building Construction', *Poly Engineering Scientific Journal*, 15(1), p. 39. doi:10.30630/jipr.15.1.140.

Ambarani, AY and Tualeka, AR (2017) 'Hazard Identification and Risk Assessment (Hira) in the Plate Tank Fabrication Process 42-T-501a Pt Pertamina (Persero) Ru Vi Balongan', *The Indonesian Journal of Occupational Safety and Health*, 5(2), p. 192. doi: 10.20473/ijosh.v5i2.2016.192-203.

BPJS Employment (2017) 'BPJS Employment Strengthens Capabilities in Supporting Expansion of Membership 2017 Annual Report', *BPJS Employment*, p. 20.

Edwin, T. et al. (2019) 'Risk Analysis in the Production Section of a Rubber Processing Factory Using the Hirarc Method (Case Study of PT X Padang City)', *Journal of Science and Technology*, 18(1), p. 21. doi:10.31258/jst.v18.n1.p21-26.

Handoko, JC, & Rahardjo, J. (2017). Hazard Identification, Risk Assessment, and Determining Control (HIRADC) Design at Schneider Electric Cikarang. *Titra Journal*, 5(2), 159-164

Hartono, H. (2017). Implementation of an Occupational Safety and Health Management System Using the Hiradc Method in Wood Processing Companies. *Journal of Industrial Manufacturing*.

Ihsan, T., Safitri, A. and Dharossa, DP (2020) 'Risk Analysis of Potential Hazards and Control Using the HIRADC Method at PT. IGASAR Padang City, West Sumatra', *Serambi Engineering Journal*, 5(2), pp.1063–1069. doi: 10.32672/jse.v5i2.1957.

Karundeng, I., V Doda, D. and AT Tucunan, A. (2018) 'Hazard and Risk Analysis Using the Hirarc Method in the Production Department of Pt.Samudera Mulia Abadi Mining Contractor Likupang, North Minahasa', *Public Health*, 7(4).

Ministry of Manpower (2021) 'Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2021 concerning Procedures for Implementing Work Accident Insurance, Death Insurance and Old Age Security Programs', pp.1–90. Available at:https://jdih.kemnaker.go.id/data_puu/Permenaker_5_2021.pdf.

Mohammad Ikrar Pramadi, Hadi Suprpto and Ria Rahma Yanti (2020) 'Prevention of Work Accidents Using the Hiradc Method in Fabrication and Machining Companies', *JENIUS: Journal of Applied Industrial Engineering*, 1(2), pp. 98–108. doi: 10.37373/jenius.v1i2.60.

Poniman and Mandati, SA (2020) 'Criteria for Hazard Identification, Risk Assessment and Control for the Fabrication Department of PT. Unindo Pacific', *Journal of Scientific Engineering and...*, 4(1), pp. 28–39.

Ramadhan, F. (2017) 'Occupational Health and Safety (K3) analysis using the Hazard Identification Risk Assessment and Risk Control (HIRARC) method', *National Seminar on Applied Research*, (November), pp. 164–169. Available at: <https://ejournal.lppmunsera.org/index.php/senasset/article/view/443>.

Saputro, T. and Lombardo, D. (2021) 'Assessment and Determining Control Risk Control Method Using Hazard Identification, Risk', *Journal of Bolting and Manufacturing*, 03(1), pp. 23–29. Available at: <https://uia.e-journal.id/bautdanmanufaktur/article/view/1316>.

S, AY, Fachrin, SA and Baharuddin, A. (2021) 'Heat Stress Measurement and Risk Assessment in PT Workers. Maruki International Indonesia', *Window of Public Health Journal*, 01(05), pp. 482–492.

Syamsiar, H. et al. (2018) 'Identification of the Hazards of Wheat Silo Cone Cleaning Work Using the Hiradc Method (Case Study: Flour Producing Company)', *Proceedings of the 2nd Conference*

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on Safety Engineering and Its Application, (2581), pp. 785–790. Available at: <http://journal.ppns.ac.id/index.php/seminarK3PPNS/article/view/792>

S Syaiful, T Marsauli. (2021). Kajian Penerapan Sistem Manajemen Keselamatan dan Kesehatan (SMK3) Konstruksi di Era COVID-19. Abdi Dosen: Jurnal Pengabdian Pada Masyarakat 5 (3), 334-341.