

Safety and health risk management in rice and coconut husk mill

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Abstract

Occupational safety and health must be carried out at every work, including in small-scale factories, include rice and coconut husk mill. The risk of there, such as respiratory distress, falling at height, musculoskeletal disorders, finger injury, etc. Therefore, risk management implementation is needed to prevent accidents and occupational diseases. This study aims to determine the management of hazards and risks in the workplace, there are in rice mill and coconut husk mill. This is qualitative research with observation and interview methods. Research subject is all worker in the mill (nine informants). Data analysis use HIRARC (Hazard Identification, Risk Assessment, and Risk Control) with 4M1E (Man, Machine, Material, Method, Environment) approach. The finding of the research is obtained 7 extreme risk, 29 high risk, and 4 medium risks in the rice mill. Then, in the coconut husk mill obtained 4 high risk, and 13 medium risks. The Risk control implementation required to do to reduce the risk level of the work activity. The implication of the research is minimizing of loss, like accidents, property damage, environment pollution, and increasing of production continuity. Then, the risk management programs will be carried out appropriately based on Law 1 of 1970 About Work Safety.

Keyword

HIRARC, Risk management, 4M1E, Rice, Coconut husk

Introduction

Occupational safety and health must be carried out at in all industries, without exception. Not only in the large industries scope, but also in the small factories, like rice and coconut husk mill. Every job or activity in the workplace should the to fulfill safety and health standards. In doing work, workers will interact with a lot of material and equipment, like machine, that will be a source of hazard. Every hazard will pose a risk, which if the risk is not managed, it will cause an accident. Based on data, obtained those 1.9 million workers died each year and 90 million people become disabled because an accident in the workplace [1].

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Rice and coconut husk mill one of factories in agriculture and plantations sector, that still rarely gets attention about health and safety program. In fact, the number of rice and coconut husk mill with specific small scale is more dominates than the number of large-scale rice and coconut husk mill. Hazard in the workplace can identify from the all activity in the mill, both of rice mill and coconut husk. The hazards can be identified from several elements, such as man, machine, material, method, and environment. Hazard classification consist of mechanical, electrical, physical, ergonomic, biological, chemical, and psychosocial hazards. For an example, hazard in the rice mill and coconut husk mill, like dust, noise, awkward, hot work, poor housekeeping, and etc. Hazards in the workplace will pose many risks, if the hazard is not managed properly. The risks of the activity in the milling, like respiratory problems, falling from a height, inhalation of dust, musculoskeletal disorders, cut fingers, and air and soil pollution. Therefore, risk management in the agricultural and plantation sector also needs to be a concern in preventing work accidents and occupational diseases.

The implication of the research is minimizing of loss, like accidents, property damage, environment pollution, and increasing of production continuity, especially for agriculture and plantation sector in Indonesia. Then, the risk management programs will be carried out appropriately based on Law 1 of 1970 About Work Safety. Occupational safety and health must be carried out at in all industries, without exception. Not only in the large industries scope, but also in the small factories, like rice and coconut husk milling. Every job or activity in the workplace should the to fulfill safety and health standards. In doing work, workers will interact with a lot of material and equipment, like machine, that will be a source of hazard. Every hazard will pose a risk, which if the risk is not managed, it will cause an accident. Based on data from the International Labour Organization (ILO) in 2022, obtained those 1.9 million workers died each year and 90 million people become disabled because an accident in the workplace [1].

Methods

The type of research is qualitative with observation and interview methods. Research subject is all worker in the mill, the number of respondents in nine workers. Data analysis use HIRARC method (Hazard Identification, Risk Assessment, and Risk Control) with 4M1E (Man, Machine, Material, Method, Environment) approach. Data collection techniques are carried out by means of primary data and secondary data. Primary data include observations and interviews. Observation is a systematic method to collect primary data directly in the research location with observation checklist. Observation method used to identify the hazards and risk, then assessment the risk, and then determining the risk control in the workplace. While, Interview method used to collect the data by each research subjects to explore all the information directly with depth interview approach. Depth interview expected to dig more possible data e about the what, why, and how about the problems given by the researcher. Secondary data can be obtained through literature study and documents tracing in the milling.

The same previous studies conducted by Irmawati [2], which use the same method to identify the hazard, Assess the risks, and control the risks. HIRARC method with 4M1E elements, there are many, material, machine, method, and environment approach to analyze all the activity in the research location.

Results and Discussion

Result of the research are made in a HIRARC worksheet. HIRARC is a process series which have a lot of process, to identify hazards that can occur in routine or non-routine activities in an agency, then conduct a risk assessment of these hazards and then create a hazard control program in order to minimize the level of risk to a lower one with the aim of preventing accidents [3]. First, Researcher conducted an identify hazard and risk, risk assessment, and risk control in the rice and coconut husk mill. Result of the research are made in a HIRARC worksheet. HIRARC is a process series which have a lot of process, to identify hazards that can occur in routine or non-routine activities in an agency, then conduct a risk assessment of these hazards and then create a hazard control program in order to minimize the level of risk to a lower one with the aim of preventing accidents [3]. First, Researcher conducted an identify hazard and risk, risk assessment, and risk control in the rice and coconut husk mill. Risk analysis is carried out by determining the levels of severity and probability using the AS/NZS 4360:2004 risk matrix as shown below (Figure 1).

Risk Matrix & Risk Impact Scores							
Probability	5 Almost Certain	5	10	15	20	25	Risk Ratings
	4 Likely	4	8	12	16	20	Extreme
	3 Possible	3	6	9	12	15	High
	2 Unlikely	2	4	6	8	10	Medium
	1 Rare	1	2	3	4	5	Low
		Slight	Minor	Moderate	Major	Catastrophic	
		1	2	3	4	5	
Impact							

Figure 1. Risk matrix AS/NZS4360:2004

Results

Work activity in the rice milling is Manual handling of grain transport, grain drying, dry grain manual handling, milling, rice polishing and whitening, rice storage, and rice packaging (Figure 2). The finding of the research is obtained 7 extreme risk, 29 high risk, and 4 medium risks in the rice milling based on Table 1.

Table 1. HIRARC worksheet in the rice milling

No	Activity	Hazard	Risk	Risk Assessment		Risk Level	Recommendation
				P	S		
1	Manual Handling of gain transport	Sun Exposure	Dehydration, sun burn	B	2	M	Substitution: Replacing manual handlers by using carts
		Wrong lifting position	Musculoskeletal Disorders	C	3	H	- Engineering: 1 Provide a roofed space 2 Addition a tarpaulin cover to the roof to reduce the excessive heat
		Excessive lifting load	Low back pain	B	3	H	- Administrative: 1 Implementing of Standard Operating Procedure in the workplace (Manual handling), implementing LFE sign (Learning From Events)
		grain dust	Irritant to the skin, respiration system and eyes	A	2	H	
		Grain dust	Irritant to the skin, respiration system and eyes	A	2	H	2 Socialization of the correct way of manual lifting, risk management in the milling (hazard and risk related to the work activity), 3 Socialization of the importance of using personal protective equipment according to the function - PPE: Using safety shoes, hand gloves, hat, mask, and googles.
3	Grain Storage	Working at height	Fall, the fall object	B	3	H	- Substitution: 1 Replacing a standard stair 2 Replacing uneven floor and no slippery surfaces
		Wrong lifting position,	Musculoskeletal Disorders	A	2	H	- Engineering control: 1 Provide an adequate exhaust local ventilation
		excessive lifting load	Low back pain	B	3	H	2 Equipping the Handrail on the Stairs 3 Install guardrails on the upper side of the grain storage
		non-standard ladder	Fall	B	3	H	- Administrative: 1 Implementing of Standard Operating procedure in the workplace (housekeeping in the grain storage)
		Poor housekeeping	Stumble	A	2	H	2 Make and implementing risk management in the strain storage (hazard and risk related to the hot work activity)
		uneven floor surface	Derailed	B	2	M	3 Socialization of the importance of using personal protective equipment according to the function
		there is no special line for goods	Hit, collision	A	2	H	PPE: Using safety shoes, hand gloves, helmet, mask, and googles.
4	Milling	Milling machine	Finger injury	C	3	H	- Engineering: 1 Redesign the funnel layout on a higher-position milling machine
		Hot work	Heat stress	A	2	H	2 Provide an adequate exhaust local ventilation
		Noise	Decrease hearing function	B	3	H	3 Install guardrails on the upper side of the grain storage
		non-standard ladder	Fall	A	4	E	4 Install safeguard on the milling machine
		Poor housekeeping	Stumble	A	2	H	5 Provide special room which installed noise suppression from the milling machine
		Uneven floor surface	Derailed	A	2	H	- Administrative: 1 Using or implementing Standard Operating Procedure in the workplace (rice milling),
		Rotating engine	Pinched Finger	A	4	E	2 Socialization risk management in the milling (hazard and risk related rice milling)
		Heat engine	machine shuts down, grinding process stops	C	3	H	3 Socialization of the importance of using personal protective equipment according to the function

No	Activity	Hazard	Risk	Risk Assessment		Risk Level	Recommendation
				P	S		
5.	Rice Polishing and whitening	High voltage electricity	electric shock, short circuit, fire	B	5	E	4 Installing sign for the room especially using specific personal protection equipment, danger room, Risk of finger injury near the machine • PPE: Using safety shoes, hand gloves, helmet, mask, and googles, earplug.
		Grain dust	Irritant to the skin, respiration system and eyes	A	2	H	• Substitution: Replacing uneven floor and no slippery surfaces • Engineering control: Provide an adequate exhaust local ventilation • Engineering 1 Designing the layout of polisher machine 2 Provide an adequate exhaust local ventilation 3 Install guardrails on the upper side of the grain storage 4 Install safeguard on the polisher machine 5 Provide special room which installed noise suppression from the polishing machine • Administrative: 1 Using or implementing Standard Operating Procedure in the workplace (polisher \ and whitening of rice), 2 Socialization risk management in the milling (hazard and risk related rice polishing and whitening), the importance of using personal protective equipment based to the function 3 Installing sign for the room especially using specific personal protection equipment, danger room 4 Labelling of chemical hazard, like alcohol (flammable and irritant) • PPE: Using safety shoes, hand gloves, helmet, mask, and googles, earplug.
		Noise Polisher	Decrease hearing function	B	3	H	
		blade on scooping machine	Finger injury	B	3	H	
		Alcohol	Flammable, fire	B	5	E	
6.	Rice Storage		Eye Irritant	A	2	H	
		Poor housekeeping	Stumbled	A	2	H	• Substitution: 1 Replacing a standard stair 2 Replacing uneven floor and no slippery surfaces • Engineering control: 1 Provide an adequate exhaust local ventilation 2 Equipping the Handrail on the Stairs 3 Install guardrails on the upper side of the grain storage • Administrative: 1 Using or implementing Standard Operating Procedure in the workplace (housekeeping in the grain storage), 2 risk management in the milling (hazard and risk related to the hot work activity), the importance of using personal protective equipment according to the function • PPE: Using safety shoes, hand gloves, helmet, mask, and googles.
		cramped workplace	Limited space for movement	A	2	H	
		inadequate lighting	Tired eyes	C	2	M	
		Dust	respiratory tract disorders, eye irritant	A	2	H	
		Working at height	Fall	A	4	E	
		Uneven floor surface	Derailed	A	2	H	
7	Rice packaging	excessive lifting load	Low back pain	B	3	H	
		Rice dust	respiratory tract disorders, eye irritant	A	2	H	• Engineering: 1 Redesign the lay out of the packaging location near the entrance 2 Install an adequate local exhaust ventilation in the area • Administrative:
		Bending position	Musculoskeletal disorder	A	2	H	

No	Activity	Hazard	Risk	Risk Assessment		Risk Level	Recommendation
				P	S		
		excessive lifting load	Low back pain	B	3	H	1 Implementing of Standard Operating Procedure in the workplace (rice packaging)
		cramped work area	Limited space for movement	A	2	H	2 Socialization of the correct way during packaging activity, the correct method if the manual lifting the sacks of rice
							3 Socialization of risk management in the packaging activity
							4 Socialization of the importance of using personal protective equipment based on exposure in the workplace
							• PPE: Using safety shoes, hand gloves, hat, mask, and googles.



Figure 2. Milling machine and condition in the rice milling

Work activity in the coconut husk milling is specified in the loading and unloading activity, there are truck parking activity, loading coconut husk (Figure 3), unloading of coco peat, The finding of the research is obtained 4 high risk, and 13 medium risks based on Table 2.

Table 2. HIRARC worksheet loading and unloading in the coconut husk milling

No	Activity	Hazard	Risk	Risk Assessment		Risk Rank	Recommendation
1	Truck parking	No special path to the loading of coconut husk	Collision	B	4	H	• Elimination: 1 Choose other lane options to avoid slippery roads 2 Redesign of road slopes to avoid water logging
		Driving while smoking,	Unfocused while operating the truck	B	2	M	• Engineering: 1 Repair slippery roads, line paving
		sleepy driver	Collision	C	4	H	2 Create dedicated lanes for trucks/employees in and out
		no speed limit signs on the area	Driving at the standard speed limit, collision	B	4	H	3 Provide speed bumper on the road to reduce the vehicle speed
	Loading coconut	Wrong method while lifting manual	Musculoskeletal disorders, low back pain	B	2	M	• Administrative: 1 Install maximum speed signs 2 Create SOP for smoking prohibitions when driving 3 Put banners or posters prohibiting smoking in the work area 4 Socialization of safety driving, include using a seat belt
							• PPE: Using vest
							• Substitution:

No	Activity	Hazard	Risk	Risk Assessment		Risk Rank	Recommendation
	husk to the dump truck	Excessive lifting load	Stricken	C	2	M	Use the ladder to open the locking lever on the top of the truck (not climbing the side of the truck)
		Dust of coconut husk	Eye irritant, respiratory system disorders	B	1	M	- Engineering: 1 Install a layer of foam on the truck body lock lever 2 Repair slippery roads, line paving - Administrative: 1 Create SOP for loading coconut husk or coco peat activity 2 Socialization about the right position while loading activity to prevent Musculoskeletal disorders 3 Install the warning sign in the loading area - PPE: Wear gloves, Clothes, hat, shoes, mask
		unstable ground surface	Truck mired	B	2	M	
		Sharp coco peat side	Scratched	A	1	M	
		High-position tailgate of locking lever (climbing)	Fall	D	3	M	
		Cover of dump truck is not tight	pinched hands	B	2	M	
		irregular piles of coconut husk	crushed by a pile of coconut husk	C	2	M	
3.	Unloading of coco peat	Awkward	Low back pain	B	2	M	- Engineering: 1 Install a layer of foam on the truck body lock lever 2 Repair slippery roads, line paving - Administrative: 1 Create SOP for unloading coconut husk or coco peat activity 2 Socialization about the right position while unloading activity to prevent musculoskeletal disorders 3 Install the warning sign in the unloading area 4 Create SOP about housekeeping and lay out the work area - PPE: Wear gloves, Wear pack, hat, shoes, mask
		Poor housekeeping	Stumble	B	2	M	
		Coco peat dust	respiratory system disorders, eye irritant	A	1	M	



Figure 3. Loading and unloading activity in coconut husk milling

Discussion

According to [4], Rice mill is where the processing and marketing of grain/rice meets, and becomes an important link in the national rice supply. Rice mill contributes to the supply of rice, both in terms of quantity and quality in order to support national food

security. The rice mill is a process that involves mechanical forces combined with heat, resulting in the release of husks and even bran (bran) from the endosperm (main seed). The process of dehulling serves to produce brown rice, which still contains bran. Furthermore, if whitening and polishing process will make the rice becomes visibly whiter [5]. The result of depth interview obtained all workers already understand the hazard in the milling, although not specifically. Rice mill doesn't have a standard operating procedure, never make hazard identification, risk assessment, and risk control. In this case, all workers do not behave occupational health and safety aspect. There is no supervisor while doing a job, not found of safety signs and PPE equipment is not provided. So, many workers become work unsafely in the milling, like working at height, using nonstandard of stair, bending position, excessive lifting load with wrong method, and etc. Moreover, in the milling seem a lot of unsafe condition because many environmental hazards found, like noise, grain dust, high voltage, uneven floor surface, cramp area, and etc. Grain dust in the workplace is a continuous deposition. It can cause fibrotic changes in the lung parenchyma so that lung elasticity decreases, so that the value of the vital capacity of the lungs is forced and causes restrictive pulmonary disorders. In addition, rice dust which is organic dust can release substances such as histamine and allergens that cause airway obstruction. Business units that only operate one machine dust content ranging from 10.0079-11.4752 mg / m³. The dust content exceeds NAB (>10 mg / m³). The high level of dust exposed in the work environment is dominated by machine activities where rice mill processes always use machine. The results showed that dust exposure after the installation of local exhaust ventilation dropped amounted to 0,5 mg/m³. And 2 mg/m³. The conclusion is the installation of local exhaust ventilation in rice mill Pregolan Desa Jetis Kecamatan Kaliwungu Kabupaten Semarang can reduce the dust exposure.

Use rotating machines without the right procedure can cause injury, like milling machine (Figure 2) and polishing machine. According to concluded that the results of measuring the work environment in rice mills for lighting and noise hazards, the results are not in accordance with Regulation of the Minister of Manpower 5 of 2018 about Working Environment. Environmental factors can potentially cause workers to experience fatigue while working and can even risk workers experiencing occupational diseases such as deafness caused by noise levels that exceed the threshold value. Therefore, adequate personal protective equipment is needed, like mask, earplug, hat or helmet, safety shoes, and clothes that absorb sweat easily [6].

Basic concept of 4M1E (Man, material, machine, method, and environment) is used to analyzed the hazard and risks in the workplace. Observation result showed the man element found smoking while driving a truck, throw the sacks irregularly, doesn't wear Personal Protective Equipment, awkward while doing manual lifting, climbing the side of the truck, and etc. Material element seems from coconut husk and coco peat which have a sharp side, so it becomes finger injury. Machine elements is using an equipment while loading and unloading material, like a cart. Wrong procedure (Method element)

when doing a job can cause many risks, such as musculoskeletal disorders for the worker, hit by sacks, low back pain, stricken, and etc. Environmental hazards that found in the activity by researcher are slippery roads, the absence of special lanes for trucks in and out of the loading and unloading area, the absence of speed signs, the position of the floor of the truck parking lot is uneven and not congested, high tailgate lock lever, corrosion of plates, coco peat dust, and etc. Accidents that occur in the loading and unloading process fluctuate from year to year as a result of 2 factors that cause work accidents in the form of unsafe action and unsafe conditions [8].

Occupational Safety and Health (K3) is an effort to create security and protection from various risks of work accidents and hazards, both physical, biological, chemical and psychological hazards to workers, companies and the community [9]. The Risk control implementation required to do to reduce the risk level of all of activity in the workplace. Risk Control is a way to overcome potential hazards contained in the work environment [12]. Risk control hierarchy is a sequence in the prevention and control of risks that may arise consisting of several levels sequentially. Risk Control in the workplace must be conducted based on hierarchy of control concept, there are from elimination, substitution, engineering, administrative, and personal protective equipment [10]. Both of rice mill and coconut husk mill (loading and unloading activity) be able to provide safety guarantees to workers by controlling hazards in their respective work units. Increase of awareness of Safety and health aspect is needed to know the exposure to hazards in accordance with the work activity. Safety and health programs in the milling must be conducted to prevent an accident and occupational diseases [11]. As a first step, it can be done by approaching the factories regarding the importance of policies and commitments about safety and health in the workplace as a guarantee for workers which is mandatory. In addition, socialization programs about safety and health can be carried out regularly to increase awareness and understanding of safety and health aspect so that workers can cultivate more than safe and health in the workplace. Risk control needed to prevent accidents and occupational diseases in the workplace, both in the rice mill and coconut husk mill.

Conclusion

The implementation of occupational health and safety in both milling is still low. In the rice mill obtained 7 extreme risk, 29 high risk, and 4 medium risks. Then, in the coconut husk mill obtained 4 high risk, and 13 medium risks. The control efforts by the milling is still low, because many hazards and risks are not managed properly in accordance with the expected safety and health aspect standard. Risk control implementation required to do to reduce the risk level of the work activity with hierarchy of control concept, from elimination, substitution, engineering, administrative, and personal protective equipment. The implication of the research is minimizing of loss, like accidents, property damage, environment pollution, and increasing of production continuity. Then, the risk

management programs will be carried out appropriately based on Law 1 of 1970 About Work Safety.

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References

- [1] Intenational Labour Organization, "Press Release International Labour Organization", http://www.ilo.org/global/about-the-ilo/media-centre/pressrelease/WCMS_211627/lang-en/index.html: 27 November 2022, 2022.
- [2] Raya Irmawati, "Assessment of Work Safety Risk in Rice Milling Engineering Work at PT. Belitang Panen Raya Oku Timur Regency", 2017.
- [3] Mariawati, A. U. F. A, "Analysis of Work Safety Application using the Hazard Identification Risk Assessment (HIRA) Method with a Fault Tree Analysis (FTA) Approach. Journal Industrial Serviss, Vol. 3c No. 1, 2017.
- [4] PIPA, "Business Directory/Company of Rice Milling Industry". West Java, 2020.
- [5] Rosiana, U, Yield of Milling and Quality of Rice at a selected Mobile Small Scale Rice Milling Unit in Banyuwangi Regency, Pertanian Bogor Institute, Journal of Food Quality, Vol. 1 No. 1, 2014
- [6] Ade Trisno, "Study on Work Fatigue Rate in Rice Milling Workers, Gunung Pati District", Semarang City, Thesis, Public Health Sciences, Faculty of Sport Science, Semarang University, 2018
- [7] Ministry of Manpower of the Republic of Indonesia, "Occupational Safety and Health Work Environment, 2018
- [8] Sanusi A, Yusdinata Z. Analisis Potensi Bahaya Dan risiko Kegiatan Bogkar Muat Di Pelabuhan PT Sarana Citra Nusa Kabil dengan Metode HIRARC. Jakarta ISSN 2541-2647; 2017.
- [9] Martalina, S., Yetti, H., and Lestari, Y. Identification of Work Safety Hazards and Risks at the Time of Overhaul at Are Kiln PT. X year 2017. Andalas Journal of Health, 7(1), 14-18, 2018.
- [10] Tarwaka, "Occupational Health and Safety Management and Implementation of Occupational Health and Safety in the Workplace, Harapan Press, 2017.
- [11] Reni et al, "The Relationship Between the Use of Personal Protective Equipment (PPE) and the Incidence of Acute Drainage Infection (ARI) in Rice Factory Workers". Public Health Journal, 2, 2020.
- [12] ISO, "International Standard Organization 45001 Occupational Health and Safety Management Systems Migration Guide, 2018.