



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 smallscale 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 gualitative 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

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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].

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 one with the aim of preventing accidents [3]. First, Researcher one with the aim of preventing accidents [3]. First, Researcher conduct a number of these 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).



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.

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Non-standardFailA4E4 install safeguard on the milling machineladder			and the standard	F -11	•		-	the grain storage
Indeer For index in the interview of provide special room which installed Poor Stumble A Provide special room which installed housekeepin machine noise suppression from the milling g			non-standard	Fall	A	4	E	4 Install safeguard on the milling
Poor Stumble A 2 H noise suppression from the milling machine housekeepin g - Administrative: 1 Using or implementing Standard Uneven floor Derailed A 2 H Operating Procedure in the workplace (rice milling), surface - - - - 2 Socialization risk management in the milling Rotating Pinched Finger A 4 E milling (hazard and risk related rice milling) - - - - - - - Heat engine machine shuts C 3 H using personal protective equipment according to the function process stops - - 3 - - -			ladder					machine 5. Provide special room which installed
housekeepin g Administrative: uneven floor uneven floo			Poor	Stumble	Δ	2	н	noise suppression from the milling
g · Administrative: 1 Using or implementing Standard Operating Procedure in the workplace (rice milling), 2 Socialization risk management in the Rotating Pinched Finger A 4 E milling (hazard and risk related rice engine			housekeepin	Stamble	~	2		machine
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3 Socialization of the importance of Heat engine machine shuts C 3 H using personal protective equipment down, grinding according to the function process stops			engine					milling)
near engine machine source c 3 H using personal protective equipment down, grinding according to the function process stops				machina	C	-		3 Socialization of the importance of
process stops			neat engine	down grinding	C	3	п	asing personal protective equipment
				process stops				

				Ri	isk		
No	Activity	Hazard	Risk	Asses	sment	Risk	Recommendation
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			D	ç	Level	
		Utali i Urani	a ha a ha ha ha a h	P	3		-
		High voltage electricity	electric shock, short circuit, fire	В	5	E	4 Installing sign for the room especially using specific personal protection
		Crain duct	Irritant to the	۸	~	ц	finder injury poor the machine
		Grain dust		A	2	п	
			skin, respiration				 PPE: Using safety shoes, hand gloves,
			system and eyes				helmet, mask, and googles, earplug.
5.	Rice	High voltage	electric shock,	В	5	E	Substitution:
	Polishing	electricity	short circuit, fire				Replacing uneven floor and no slippery
	and		, -				surfaces
	whitening	Crain dust	Irritant to the	C	r	м	Engineering control:
	whitehing	drain dust	skin respiration	C	2	141	Browide an adequate exhaust local
			skin, respiration				Flovide all adequate exhaust local
			system and eyes				ventilation
							Engineering
		Noise	Decrease hearing	В	3	Н	1 Designing the layout of polisher
		Polisher	function				machine
							2 Provide an adequate exhaust local
		blade on	Finger injury	В	з	н	ventilation
		scooping		_)		2 Install guardrails on the upper side of
		scooping					the grain starage
		machine					the grain storage
							4 Install safeguard on the polisher
		Alcohol	Flammable, fire	В	5	E	machine
							5 Provide special room which installed
			Eve Irritant	А	2	Н	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
							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 shops, hand gloves
							• FFE. Using safety shoes, hand gloves,
							neimet, mask, and googles, earplug.
6.	Rice	Poor	Stumbled	A	2	Н	• Substitution:
	Storage	housekeepin					1 Replacing a standard stair
		g					2 Replacing uneven floor and no
		0					slipperv surfaces
		cramped	Limited space for	Δ	r	н	Engineering control:
		workplace		~	2		Lingineering control. Drovide an adequate exhaust local
		workplace	movement				1 Provide all adequate exhaust local
							ventilation
		inadequate	Tired eyes	C	2	М	2 Equipping the Handrail on the Stairs
		lighting					3 Install guardrails on the upper side of
							the grain storage
		Dust	respiratory tract	А	2	н	Administrative:
			disorders eve				1 Using or implementing Standard
			irritant				Operating Presedure in the workplace
			Innant				
							(housekeeping in the grain storage),
		Working at	Fall	A	4	E	2 risk management in the milling
		height					(hazard and risk related to the hot
							work activity), the importance of using
		Uneven floor	Derailed	А	2	Н	personal protective equipment
		surface					according to the function
		Junace					PDE: Using cofaty choose hand gloves
				-			• FFE. USINg Salety Shoes, nand gloves,
		excessive	Low back pain	В	3	Н	neimet, mask, and googles.
		litting load					
7	Rice	Rice dust	respiratory tract	A	2	Н	Engineering:
	packaging		disorders, eve				1 Redesign the lay out of the packaging
	1		irritant				location near the entrance
			anneant				a Install an adequate local exhaust
		Pondia -	Mucculock-l-+-l	^	-		2 mistan an aucquate fold exildust
		вenaing	wusculoskeletal	А	2	н	ventilation in the area
		position	disorder				 Administrative:

No	Activity	Hazard	Risk	Risk Assessment		Risk	Recommendation
				Р	S	Level	
		excessive lifting load	Low back pain	В	3	Н	 1 Implementing of Standard Operating Procedure in the workplace (rice packaging) 2 Socialization of the correct way during
		cramped work area	Limited space for movement	A	2	Н	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.

			Ŭ	R	Risk Assessment		Recommendation
No	Activity	Hazard	Risk	Asses			
1	Truck parking	No special path to the loading of coconut husk	Collision	В	4	Н	 Elimination: Choose other lane options to avoid slippery roads Redesign of road slopes to avoid
		Driving while smoking,	Unfocused while operating the truck	В	2	М	water logging • Engineering: 1 Repair slippery roads, line paving
		sleepy driver	Collision	C	4	Н	 Create dedicated lanes for trucks/employees in and out
		no speed limit signs on the area	Driving at the standard speed limit, collision	В	4	Н	 3 Provide speed bumper on the road to reduce the vehicle speed 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
2	Loading coconut	Wrong method while lifting manual	Musculoskeletal disorders, low back pain	В	2	М	Substitution:

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

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

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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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