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Research Article

Hazard Identification and OHS Risk Assessment at Animal Feed Company

Jordan Syah Gustav [1*], Rizqy Kartika Sari[2], Ayu Prima Kartika[3], Nabylla Sharfina Sekar Nurriwanti[4], Warda Yussy Rha[5]

[1] Universitas Sebelas Maret, Indonesia; e-mail : jordansyahgustav@staff.uns.ac.id
[2] Universitas Sebelas Maret, Indonesia; e-mail : rizqykartikasari@staff.uns.ac.id
[3] Universitas Sebelas Maret, Indonesia; e-mail : ayuprimakartika@staff.uns.ac.id
[4] Universitas Sebelas Maret, Indonesia; e-mail : nabyllasharfina@staff.uns.ac.id
[5] Universitas Sebelas Maret, Indonesia; e-mail : warda_yrha@staff.uns.ac.id

***** Corresponding Author : Jordan Syah Gustav

Abstract: This study aims to identify hazards and assess occupational health and safety (OHS) risks in the animal feed production process using the HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method. The feed industry involves various operational stages that pose significant safety risks to workers, particularly due to exposure to dust, noise, chemicals, and physically demanding tasks. A descriptive qualitative approach was employed, utilizing field observations and direct interviews with workers across different departments involved in the production line. The findings reveal a wide range of potential hazards at each stage of the feed manufacturing process. These include respiratory risks caused by airborne particles in confined spaces, noise exposure from machinery, musculoskeletal injuries due to repetitive and manual handling of heavy materials, and exposure to hazardous substances such as cleaning agents and chemical additives. Each identified hazard was assessed based on its likelihood of occurrence and severity of impact, resulting in a risk rating that was then used to prioritize necessary control measures. Risk mitigation strategies were proposed according to the hierarchy of controls, starting with elimination and substitution, followed by engineering controls such as improving ventilation and using noise-reducing equipment. Administrative controls like work rotation schedules, safety training, and the development of standard operating procedures were also emphasized. The use of personal protective equipment (PPE) is recommended as a supplementary measure rather than a primary control. By systematically applying the HIRARC method, this study provides a comprehensive overview of occupational risks in the animal feed industry. The recommended interventions are expected to contribute to a safer working environment, reduce accident rates, and improve the overall well-being and productivity of workers in feed production facilities.

Keywords: Feed Industry, Hazard Identification, HIRARC, OHS, Risk Asassment

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1. Introduction

Occupational Safety and Health (OHS) is an important aspect in the industrial world, including in the animal feed production sector which continues to grow along with the increasing need for animal food. ILO show that accident on animal feed production is one of the most dangerous sector, with approximately 170,000 occupational deaths per year. The production process in the animal feed industry involves a variety of high-risk activities, from receiving raw materials, mixing, grinding, packaging to distributing finished products. In each of these stages, there are potential physical, chemical, biological and ergonomic hazards that can threaten worker safety and disrupt the company's operational continuity. Without an adequate occupational safety system, the potential for accidents such as dust-related fires,

chemical exposure, or injuries caused by heavy equipment is very high. By understanding the importance of occupational safety in this industry, we can see that employee protection efforts encompass not only individual well-being but also directly impact production continuity and product quality. Therefore, strengthening an OHS (Occupational Health and Safety) culture in the animal feed industry is not only a legal obligation but also a smart and sustainable business strategy, hazard identification and risk assessment are crucial first steps in OHS management. By systematically knowing the sources of existing hazards and assessing how likely and impactful they are to workers, companies can develop appropriate control strategies to minimize the potential for occupational accidents and occupational diseases.

In general, the stages in hazard identification and risk assessment start from collecting data on work activities, direct observation in the field, and interviews with workers to identify all potential hazards that may occur. After that, hazard classification is carried out based on the type and source, such as hazards from rotating machinery, explosive feed dust, microorganism contamination, and working conditions that cause physical fatigue. Next, a risk assessment is carried out by estimating the likelihood of an incident occurring and the severity of the impact, using a structured method. The results of the risk assessment are then mapped into a risk matrix to determine control priorities. With this approach, companies can not only respond to risks that have occurred, but also be able to take proactive and sustainable preventive actions in their OHS management system.

In this study, risk assessment is carried out using the HIRARC (Hazard Identification, Risk Assessment and Risk Control) method, which is one of the methods commonly used in OHS management systems in various industrial sectors, including the animal feed sector. HIRARC is a systematic approach consisting of three main stages: hazard identification, risk assessment and risk control [1]. This method emphasizes the importance of thoroughly recognizing each work activity to find potential hazards, then evaluating the level of risk based on two main parameters, namely likelihood and severity, which are then calculated to produce a risk level. Based on these results, the company can determine the appropriate type of control, whether administrative, technical or the use of Personal Protective Equipment (PPE). By consistently applying HIRARC, animal feed companies can create a safe, healthy and productive work environment, while at the same time fulfilling the applicable laws and regulations in the field of occupational safety [2]

2. Literature Review

Occupational Health and Safety (OHS) is part of human resource management that aims to create safe and healthy working conditions. According to Goetsch, OHS is a combination of work programs, safety procedures, and technical controls designed to prevent occupational accidents and occupational diseases[3]. This is supported by Heinrich teory which states that 88% of accidents are caused by unsafe acts, while 10% are due to unsafe conditions, and the

rest are unexpected factors. In the context of animal feed companies, the application of OHS principles is important due to the high risk of production machinery, exposure to dust, and the potential for fire due to flammable materials [4].Unhealthy work environment conditions can reduce productivity, increase fatigue, and increase the risk of accidents [5] . Therefore, a systematic approach through hazard identification and risk assessment is needed so that preventive measures can be taken appropriately.

Hazard identification is the first step in a risk management system. Hazard identification is the process of recognizing and describing potential hazards that may arise in a work activity [6]. Some Teory explains that hazards can be physical (vibration, noise), chemical (exposure to dust or chemicals), biological (microorganisms), ergonomic, and psychosocial [7]. Emphasizes that every accident is always preceded by uncontrolled hazards [8]. Meanwhile, PP 50 2012 emphasizes the importance of worker participation in the hazard identification process in order to obtain comprehensive results [9]. In practice, identification can be done by direct observation, checklists, safety inspections, and job analysis. With comprehensive hazard identification, risks can be minimized from the start[10].

Risk assessment is conducted after the hazards have been identified. Risk assessment is the process of evaluating the likelihood of a hazard occurring and its impact on occupational safety[11]. Risk assessment aims to determine control priorities and establish appropriate management decision not just personal protective equipment [12]. The HIRARC (Hazard Identification, Risk Assessment and Risk Control) method is a widely used approach because it is structured and easy to implement in various industries, including the animal feed industry[13]. HIRARC helps organizations systematically understand the linkages between work activities, potential hazards and control measures[14]. In HIRARC, risks are assessed based on two main parameters, namely likelihood and severity, and then classified in a risk matrix [15]. With this approach, handling of high risks can be immediately prioritized.

The risk control stage is the implementation of the risk assessment results. The hierarchical principle of risk control starts from hazard elimination, substitution, engineering, administration, to the use of personal protective equipment (PPE)[16]. Control must be tailored to the organization's resources and be preventive and corrective[17]. In the context of an animal feed company, engineering could include the installation of an automatic dust ventilation system, while administrative controls include regular training for machine operators. Adyssya Githa Assyahra study mentions that the use of appropriate PPE such as masks, ear protection and gloves is essential in reducing the risk of physical and chemical exposure[18]. The effectiveness of controls must also be evaluated regularly to ensure that risks remain under control and do not cause new unexpected impacts[19].

The implementation of a comprehensive OHS management system in the animal feed industry can also refer to international standards such as ISO 45001:2018. Good OHS management system is able to systematically integrate hazard identification, risk assessment

and control throughout the organization's work cycle[20]. International Labor Organization emphasizes the importance of top management commitment in creating a safe work culture[21]. In addition, Tasha Nabila study emphasizes that training and actively involving workers in OHS activities can increase risk awareness and compliance with procedures[22]. With this approach, not only physical risks are controlled, but also human and organizational factors that are often the root causes of workplace accidents.

Strengthening the OHS culture in the company is an important factor that supports the success of hazard identification and risk assessment programs. Ministry Man power states that a strong safety culture is characterized by collective perceptions, attitudes and behaviors that support safety in the workplace[23]. This is also reinforced by Reason's theory in the "Swiss Cheese Model", which states that accidents occur due to gaps in the layered defense system. By encouraging the involvement of all elements of the company, from leaders to operators, the risk identification and assessment system can run effectively. Suprianto and Evendi study also shows that active involvement of workers in hazard surveillance increases organizational responsiveness in preventing incidents[24]. Therefore, the HIRARC approach is not only technical, but must also be combined with efforts to build a safe and healthy work culture in a sustainable manner [25].

Hazard Identification, Risk Assessment and Risk Control (HIRARC) A technique for identifying hazards, evaluating their risks and controlling their impact on work activities is called Hazard Identification, Risk Assessment and Risk Control (HIRARC). HI (Hazard Identification), RA (Risk Assessment), and RC (Risk Control) are packaged in a format called Hierarc which is intended to be easy to read, understand, and comprehend [26]. HIRARC is a tool to summarize all risk management actions. Meanwhile, HIRARC is a procedure for characterizing the likelihood of hazards, including frequency and severity, to evaluate the consequen ces of potential losses and injuries that may occur [27].

Conducting a risk assessment is the next step after the hazard enhancement process. By considering the many possible scenarios and the severity of the consequences, one can estimate the size of the risk. According to the qualitative research findings, there are four categories of risk: low risk, moderate risk, high risk, and extreme hazard.

Table 1. Risk Saverity

Saverity	Explanation		Score
	Human	Facility / Tools	
Disaster	Fatality on work area	Facility Destroyed	5
High	Fatality, permanent disability	Major damage on facility	4
Medium	Lost time injuries, Medical treatment more than 2 days	Damage on facility	3
Small	Medical treatment case, First aid case	Operational limitations bicause Equipment damage	2
No Impact	No Injuries	No Equipment damage	1

Table 2. Risk Probability

		Saverity				
		1 No Impact	2 Small	3 Medium	4 High	5 Disaster
Probability	5 Almost Certainly	5 Medium	10 Significant	15 High	20 High	25 High
	4 Possible	4 Medium	8 Medium	12 Significant	16 High	20 High
	3 Moderate	3 Low	6 Medium	9 Significant	12 Significant	15 High
	2 Occasionaly	2 Low	4 Medium	6 Medium	8 Significant	10 High
	1 Rare	1 Low	2 Low	3 Medium	4 Medium	5 Significant

Table 3. Risk Matrixs

Probability Event	Explanation	Score
Almost certainly	Almost certainly (daily event)	5
Possible	Possible (Weekly event)	4
Moderate	Moderate (monthly event)	3
Occasionally	Occasionally (yearly event)	2
Rare	Less than 1 year event	1

Table 4. Matrixs Description

Risk Level	Actions and Scales of Time
Low	1. No action required 2. No documentation archive
Medium	1. No additional control / control required 2. Monitoring existing action
Significant	1. Required conntrol, need additional control 2. monitoring existing control and additional controls must be implemented
High	1. action must be taken immediately 2. if necessary, work can be stopped and cannot be started before the risk reduced properly

Risk Control and Risk management is a strategy to avoid potential risks in the workplace. By creating a prioritized scale that can be used for risk control, potential threats can be managed. There is a hierarchy of risk controls used in risk management..

a. Elimination.

By removing the cause, risks can be avoided. The hazard that will develop can be reduced if the source of the hazard is eliminated[28]. Elimination refers to removing any possible hazards, including work objects and work systems, whose presence violates OHS laws, regulations, or standards or whose levels exceed the allowable Threshold Values[29].

b. Substitution.

When the source of danger cannot be completely eliminated, there is an alternative as a prevention to control risk, namely by replacing equipment or machinery that is considered more dangerous with equipment or machinery that is safer in every operation.

c. Engineering Control.

Engineering control is the control of a machine workpiece or machine work equipment by changing its structure so that someone does not come into direct contact with potential hazards, such as by providing machine guards, covering conveyor belts, making concrete cast machine foundation structures, etc.

d. Administrative Control

This strategy lowers the risk of hazards by establishing procedures (SOP), work instructions (WI), installing safety signs, selecting contractors or staff members who participate in certain work processes, establishing and supervising the use of equipment, tools, and machinery, storing and labeling, and having access to evacuation routes. Included are measures to reduce the duration of exposure, health checks, and job rotation[30].

e. Personal Protective Equipment

Equipment used to protect employees from harm or illness caused by exposure to risks in the workplace, including chemical, biological, radioactive, physical, electrical, and mechanical.

3. Research Methods

The research will be conducted at an animal feed company located in Sidoarjo, East Java. The Feedmill area that becomes the research material is the process section of the vat check, hammermill, mixing, pelletizing, to the product packing section. This research uses a qualitative descriptive approach. Data collection was carried out with field observations to review the company environment, storage processes, animal feed manufacturing, as well as worker safety and health, and the condition of raw materials. In addition, interviews were also conducted with managers, supervisors and employees working in the company. The hazard

data in this study focuses on the hazards of work accidents and occupational diseases that arise during work in that section. Data processing is carried out using Hazard Identification, Risk Assessment, and Risk Control (HIRARC). Risk levels are calculated based on ANSI standards as shown in tables 1 to 4 in the literature study, to determine the possible hazards that exist in the production process. The HIRARC technique is defined in many phases, including hazard identification, risk assessment, and risk management. Then the residual risk calculation is carried out which aims to determine how effective the application of risk control is, so that it will be known what kind of continuous improvement will be applied according to the Occupational safety and health standard guidelines. So that recommendations can be given for the company.

4. Results and Discussion

4.1. Hazard Identification

According Rahmawati and friends study Hazard identification and risk control, the area should be identifiy on risk assasmennt on area with jobs that involve high level of occupational risk[30]. And the other study shown that process production is Inadequate work environments are likely to have a risk level 3-4 times worse [14].The results of data collection that has been carried out by observation and interview methods obtained the results of risk identification contained in the production process in the feedmill area consisting of the vat check (storage), premix (multivitamin addition), mixer, hammermill, pellet, and packing. The results of hazard identification in the production process can be seen in Table 5 below.

Table 5. Result of Hazard Identification in Production Process

No.	Description	Location	Hazard
1	Controlling Material	Check Barrel	1. Tripping 2. Squeezed by the door of Drum Check 3. Bumped head, 4. Feed material enters respiratory
2	Milling Feed	Hammermill Machine	1. The machine caught fire and emitted smoke 2. Bearing Roll Loose 3. Pinched
3	Running Pellet Machine	Pellet Machine	1. Exposure to engine heat 2. Noise 3. Bearing friction
4	Manual Pouring of Premix (Multivitamin material)	Premix area	1. Backbone injury 2. Chemical particles enter the respiratory
5	Mixing of raw materials	Mixer	1. Mixer machine on fire 2. Electrical short circuit
6	Packing machine operation	Packing area	1. Stitched finger 2. Backbone injury 3. Foot pinched by conveyor 4. Bag fall

4.2. Risk Asessment

Once a hazard has been identified, the next step is to assess the level of risk by evaluating two main aspects, namely the likelihood of occurrence and the severity of the impact (consequence). This risk level is expressed in the form of a risk rating (RR) that can be seen in the riks matrix, which is the result of multiplying the likelihood and consequence values. This value is used to categorize risks into low, medium, high or extreme categories.

Likelihood assessment uses a scale of 1 to 5. A score of 1 indicates that the event is rare, occurring less than≤ once a year. A score of 2 indicates an event that sometimes occurs once a year (an annual event). A score of 3 indicates a moderate event, which can occur monthly. A score of 4 means the event is likely to occur, for example every week. Meanwhile, a score of 5 indicates a very frequent event that can occur every day.

For the consequence aspect, the assessment also uses a scale of 1 to 5. A score of 1 indicates an insignificant impact (no equipment disruption and no injuries). A score of 2 means there are minor injuries or minor damages that require first aid. A score of 3 indicates moderate harm, such as medical expenses (lost workdays) or financial impact on the facility. A score of 4 indicates a serious impact on one individual, a major loss, or a production stoppage. While a score of 5 indicates a very severe impact, such as the death of several people at once, large losses, and complete disruption of activities to the point of being unusable. This risk assessment is applied to the tofu production process and the results can be seen in Table 6.

Table 6 Risk assessment of the production process

Activity Process	Potential Hazard	Impact/Risk	Risk Assessment		
			P	S	RR
Controlling Materials stored in Check Barrels	Tripping over the door of the check barrel	If they fall, workers could potentially suffer bruises and injuries to their limbs, especially their hands and feet.	3	2	6
	Pinched	Workers' hands and feet could potentially be pinched by the barrel door, causing bruises and injuries.	1	2	2
	Bumped Head	Workers' heads are bumped by machinery and tools, causing bruises to the forehead and head.	3	2	6
	Confined Space	If the process of cleaning barrels for a long duration of time without a break to get out, workers have the potential to experience shortness of breath due to lack of air circulation in the barrels.	3	3	9
	Feed material enters the respiratory / eyes	Workers have the potential respiratory problems, coughing, sneezing, which	3	2	6

Activity Process	Potential Hazard	Impact/Risk	Risk Assessment		
			P	S	RR
		affects the work process and worker performance			
Milling Feed in Hammermill Machine	Imperfect installation of hammermill blades	Machine Burns	4	3	12
		Iron enters the grinding process	3	3	9
	Bearing Roll Loose	Bearing roll wear	2	3	6
		Production is hampered	2	3	6
	Clamped hammermill filter	A worker's bruised hand was pinched by the hammermill door and filter.	2	2	4
Running the Pellet Machine	Exposure to machine heat	Worker experiences heat stress	2	2	4
	Noise	If continuous, it causes a Decrease in workers hearing	2	3	6
	Iron enters the grinding process	Machine catches fire	2	3	6
Pouring Premix (medicine) manually	Workers lift too heavy a load	Workers may experience LBP	4	3	12
	Medicinal dust material enters the respiratory / eyes	Workers have the potential respiratory problems, coughing, sneezing and eye pain, thus affecting the work process and worker performance.	4	3	12
Mixing raw materials in the Mixer	There is a short circuit in the tool	Can potentially cause a fire in the mixer machine	1	3	3
	Overload on the mixer machine	Could potentially cause a fire in the mixer machine	2	3	6
	Noise	If continuous could potentially lead to decreased hearing of workers	5	2	10
Operational packing machine	Movement of packing tools that are semi-automatic (still requires human intervention)	Fingers get stitched if the worker is not focused	3	2	6
		Backbone injury when structuring packing results because it is still manual	3	3	9
		Foot pinched by the conveyor when the arrangement part of the bag is not focused because it steps on the conveyor belt	1	3	3

4.3. Risk Control

Based on the findings of the OHS risk analysis that has been carried out in the production process of animal feed companies using Hazard Identification, Risk Assessment and Risk Control (HIRARC). There are production processes that have the potential to cause work accidents, cause occupational diseases and serious health problems. From the

production process, further risk control is needed in order to reduce the safety and health risks of workers.

From the entire production process, according to the risk matrix, the level of risk that must be carried out additional control or re-monitoring is SIGNIFICANT risk so additional control must be carried out at that risk. The following are the significant risk controls that can be carried out.

4.3.1 Risk of shortness of breath due to working in confined space

The risk of lack of oxygen due to working in a confined space is caused by the barrel check room (raw material storage) the room has minimal air ventilation because it prevents dust from leaving / entering (can cause contamination) the barrel area. However, workers need to enter or see the room whether it is in accordance with the raw materials that are filled in the room, and also workers will enter if there are certain conditions, for example repairs or when cleaning raw materials because they will be used for storage of other raw materials. To reduce the risk of oxygen deficiency, it is necessary to add mechanical ventilation such as a portable blower fan whose tool has a trunk to enter the air into the confined space, also before workers enter the confined space, oxygen levels must be checked. After it is safe, workers can enter and workers in the space, then a decrease in risk can be obtained on the job.

Table 7. Additional Control of Confined Space Risk

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Addition of Mechanical Ventilation Using a Fan Blower 2. Checking Oxygen Level before entering Confined Space 3. Enforcement of Confined Space work permit	3	2	6	Medium

4.3.2 Risk of machine burns in the Hammermill process

The risk of burning the machine occurs as a result of the installation of the hammermill knife is not perfect / the reversal of the knife is not carried out according to schedule, then it can cause the knife to break away from the frame and hit the sieve. Sieve, causing sparks and can burn raw materials because the raw materials are dry. To reduce this risk, it is necessary to take preventive measures such as working in accordance with work instruction and SOP. Monitoring sound and time so that knife reversal is more optimal.

Table 8. Additional control of Hammermill Machine Risk of burning

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Addition of work instructions on tools or machines 2. Rechecking by production supervisor before the machine is run. 3. Enforcement of work permits for starting machines that must be attended by Supervisor, Safety, and Head of Sift / Production Manager	4	2	8	Medium

4.3.3 Risk of Iron entering into the Hammermill machine grinding process

The risk of iron can enter the hammermill machine and this can damage the hammermill as a whole because the iron can damage the filters in the hammermill. So that this needs to be done risk control, risk control that can be done is the installation of a magnetic trap in the production flow before the raw material enters the hammermill machine. After the magnet is installed, of course, periodic checks must be carried out on the cargo / iron that is stuck to the magnet regularly because if cleaning is not carried out regularly, it will affect the existing magnetic power and cause iron particles to escape from the magnetic trap.

Table 9. Additional control of the Risk of Iron Entering the Hammermill Machine

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Addition of Trap Magnet in the process flow before entering HM machine 2. Provision of SOP and Work Instruction for cleaning Trap Magnet	3	2	6	Medium

4.3.4 Risk of workers experiencing LBP pouring Premix and Packing

The risk of Low Back Pain in the process of pouring premix and packing drugs is due to the work process carried out manually, so this must have a high potential to cause the risk of Low Back Pain to workers. The work process or risk can be carried out additional risk control in the form of using automatic tools in the process of pouring premix and packing drugs, and providing / implementing a shorter division of working hours (implementing a rolling work system every time), providing PPE that can be used by workers such as back support, and troley to facilitate lifting.

Table 10. Additional Controls on LBP of Premix and Packing

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Use of automatic tools for pouring medicine and packing	2	2	4	Medium
2. Implementation of Rolling work / division of shorter working hours 3. Use of PPE back support belt to prevent Low Back Pain	4	2	8	Medium

#probability can decrease due to applying substitution and engineering control, by changing the process from manual to machine automation.

4.3.5 Risk of workers experiencing ARI (Acute Respiratory Tract Infection) in the Premix area

The risk of workers experiencing ARI is very high because it is related to chemicals / mixed drugs from raw materials for animal feed, so it can cause serious side effects if the risk is not reduced. Workers can experience Occupational Disease which can be suffered by workers in the period after work / retirement. Where this can burden workers because they experience Occupational Disease after working at the company. Risk controls that can be added include periodic checks (Medical Check Up) on workers who work in the area, the use of PPE in the form of respirators to reduce chemical exposure.

Table 11. Additional control of respiratory risk

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Routine scheduling for medical checkups and work rotation if there are indications of respiratory disorders 2. Provision of PPE Chemical respirators	4	2	6	Medium

4.3.6 Risk of hearing loss in the mixer area

The risk of hearing loss occurs in the mixer area due to the condition of the machine sound which is quite noisy, which is 89 db when the machine is operating. Workers who work in the mixer area have the potential to experience hearing loss which can affect workers' health in their daily lives. This Occupational Disease must be controlled by the company because it can become a nuisance to workers even after the worker retires. Additional controls that can be carried out by the company include a shorter division of working time, the addition of noise reduction devices on the machine, and the provision of PPE in the form of earmuffs to workers.

Table 12. Additional control of hearing loss risk

Additional Control Recommendations	Residual risk			Category
	P	S	RR	
1. Routine Medical Checkup for workers and removal if hearing loss is indicated. 2. Schedule maximum working hours when around the machine 3. Addition of noise absorbers to the machine 4. Addition of PPE in the form of Earmuffs	3	2	6	Medium

The decrease in probability can occur because engineering control is carried out so that machine noise decreases.

Based on the existing OHS risk control in the animal feed company, the production process has been carried out as follows:

a. Risk control is based on the existing risk level, risk control carried out based on the risk matrix is only carried out for significant risks.
b. Risk control is carried out based on the control hierarchy, which must be in order from elimination, substitution, engineering control, administrative, and PPE. Where the emphasis on reducing risk probability can only be done if the control is substitution and engineering control, or a combination method of these 2 things.
c. Health hazard control also needs to be done considering the contact of chemicals and production workers, especially the premix section. It is very necessary to do more in-depth monitoring because it is related to the health of workers.
d. Controls that on PPE are less effective because they are the last step in the risk control hierarchy. Control in the form of PPE can only reduce the impact on existing risks, the impact is also still in the range of significant - extreme danger.

5. Conclusions and Suggestion

Comparison This study shows that the production process at an animal feed company has a number of potential hazards that are significant to occupational safety and health (OHS). Through the application of the HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method, the identification of hazard sources has been carried out systematically in various stages of production, starting from barrel check, premix, mixer, hammermill, pelletizing, to packing. The risk assessment results show that most of the hazards are in the moderate to significant risk category, and significant risks require immediate and continuous control measures.

Some of the significant risks found include shortness of breath due to work in confined spaces, potential burns on hammermill machines, respiratory problems due to exposure to chemical dust, and low back pain due to manual work. Risk control efforts have been formulated based on the control hierarchy, starting from elimination to the use of personal protective equipment (PPE). The most effective control is proven to come from engineering control and substitution, such as the installation of mechanical ventilation, magnetic traps, automation of work tools, and the addition of noise suppression systems. Meanwhile, the use of PPE such as respirators and earmuffs is positioned as the last layer of complementary protection.

These findings emphasize the importance of implementing a comprehensive OHS system, including worker training, the development of appropriate work SOP, and regular monitoring of working conditions and workforce health. Management awareness and active involvement of all elements of the organization are the main keys in creating a safe and healthy working environment. With the implementation of structured risk controls and regular

evaluation of their effectiveness, it is expected that the company will be able to significantly reduce the level of risk and prevent accidents and occupational diseases in the future.

Suggestion based on the study's findings and the importance of implementing hazard identification and OHS risk assessment in the animal feed industry, stakeholders including company management, government regulators, industry associations, and academics are encouraged to take concrete steps to build a strong and systematic safety culture. Animal feed company management must actively implement risk identification and assessment methods such as HIRARC in every work activity and make them an integral part of the operational management system. Relying solely on written procedures is not sufficient; regular training, internal OHS audits, and the involvement of all workers in daily safety discussions are essential.

Government regulators, such as the Ministry and relevant regional agencies, are expected to strengthen oversight and provide technical assistance to small and medium-sized companies in this industry. The development of OHS technical guidelines specifically for the animal feed industry, based on local risks, is also urgently needed. Furthermore, animal feed industry associations can play an active role in disseminating OHS best practices through seminars, training, and communication forums among business actors. Safety campaigns aimed at raising OHS awareness in the field need to be enhanced with a more communicative and evidence-based approach.

For future research, it is recommended that the focus be expanded beyond the technical aspects of occupational hazards to include behavioral and cultural factors that influence OHS compliance. A study of the effectiveness of automation technology in reducing occupational risks in animal feed production lines is also an important area to explore. Furthermore, longitudinal research on the impact of HIRARC system implementation on workplace accident rates over the long term could provide stronger empirical data for policymaking. Collaboration between academia and industry needs to be strengthened so that research findings can be truly implemented in the workplace and provide direct benefits for worker protection and business continuity.

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