

Application of the Hirarc Method at the XYZ Factory to Analyze Occupational Health and Safety Risk

Alvi Octavianto¹; Andriyas Sugiarto²; Syafrian Eko Nugroho³; Yudi Prastyo⁴
 Industrial Engineering Program, Faculty of Engineering, Pelita Bangsa University

Abstract:- XYZ Tofu Factory is a factory engaged in food production, namely making tofu. The XYZ Tofu Factory produces 21,000 to 28,000 tofu in a day. It is undeniable that various types of hazards can occur, starting from the initial process to the final production. Some of the causes are due to the lack of awareness of employers on occupational health and safety. Currently, the implementation of good occupational safety and health has not been widely applied at many companies. For this reason, it is necessary to identify occupational safety and health hazards (K3) to determine potential hazard risks, hazard assessments, and worker risk control. This type of research is qualitative using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method as a research method. Based on the results of the risk assessment that has been carried out, the risk categories in the XYZ Tofu Factory are 7 moderate risk categories with a percentage of 27%, high-risk categories of 16 with a percentage of 62% and very high-risk categories of 3 with a percentage of 11%. Based on the results of the research, it was found that jobs with a very high level of risk are in the activities of grinding, boiling, and screening, controls that can be taken to reduce these risks are cleaning the work area of stagnant water and scattered soybeans, replacing all equipment and cables on the better production processes that are no longer suitable for use, provide K3 signs in the production area as well as carry out regular monitoring and checking of worker conditions, room conditions, tools or machines to prevent unwanted things from happening.

Keywords:- Risk Analysis, Occupational Safety and Health, HIRARC.

I. INTRODUCTION

Occupational Safety and Health (OSH), developed collaboratively by workers and employers, aims to proactively prevent workplace accidents and illnesses. The program addresses potential hazards arising from the nature of the production process, such as the risk of explosions, fires, pollution, and occupational diseases. This involves identifying potential factors that may lead to work-related incidents and diseases and taking preventive measures, it is mandatory to implement Occupational Safety and Health (K3). The XYZ tofu factory is a small industry that was founded in 2007. This factory is one of the largest suppliers

of tofu for markets in the Bekasi, Cibitung, and Cikarang areas. Since its founding until now, the XYZ tofu factory has continued to improve, even though it has experienced ups and downs from year to year. The XYZ tofactory starts production at 08.00 - 17.00 WIB. However, the rest time given to workers is uncertain due to the alternating rest system and there is no time fixed for each worker. Everyday the average production capacity is 3 to 4 quintals A quintal of soybeans can produce 21,000 to 28,000 tofu per day, but this could increase due to adjusting the number of orders received during big holidays such as New Year or Eid. Therefore, workers often have overtime if the number of orders increases. There are various types of tofu sold, namely Chinese tofu, yellow tofu, and also fried tofu.

The XYZ tofu factory has 10 employees and it cannot be denied that there are various types of dangers that can occur from the initial process to the final production process, some of which are caused by a lack of employee awareness of Occupational Safety and Health. You can see cases of work accidents that occurred in the vulnerable months of January-August 2022 in Table 1.1 below:

Table 1 Data on Work Accident cases for the period January-August 2022

No	Type of work accident	Number of events
1	Slip	6
2	Electrocuted	1
3	Scalded	9
4	Scalded with hot oil	5
5	Exposed to burning flames	4
6	Skin irritation	3
7	Exposed to combustion fumes	7
8	Wrong working posture	4
TOTAL		39

Based on Table 1.1, it can be seen that 39 work accidents occurred at the XYZ tofu factory. The impact of work accidents results in workers being slightly injured and unable to work for a certain period. Workers who are unable to work within a certain period also result in the factory not being able to complete the work on time so the factory suffers losses due to this. Apart from that, absent workers result in the factory having a shortage of workers who cannot be backed up by other workers at that time. simultaneously.

The conducted research seeks to prevent and diminish the likelihood of workplace accidents while avoiding and minimizing risks. This is achieved by implementing suitable hazard controls to enhance the overall safety of the process. It is hoped that this research can prevent the possibility of accidents occurring which will cause losses to the company so that the level of work accidents in the factory can be reduced to a minimum.

II. RESEARCH METHODS

The HIRARC method involves identifying hazards (Hazard Identification) in all company activities, conducting risk assessments (Risk Assessment), and establishing controls (Risk Control) to minimize the likelihood of accidents.

HIRARC involves a sequence of procedures aimed at recognizing potential hazards arising from both regular and irregular activities within a company. Subsequently, a comprehensive risk assessment of these hazards is conducted, followed by the development of a program designed to manage and mitigate these risks. The ultimate goal is to reduce the risk level to a minimum, thereby preventing the occurrence of accidents.

III. DISCUSSION AND RESULTS

➤ *Hazard Identification*

Table 2 Identification of Hazards and Risks

No	Activity/Process Work	Potential hazard	Risk
1	Soaking soybeans	1. Slippery floor	1. Slipped
		2. Waste water remaining from soaking	2. Skin Disorders
		3. Storage of raw materials and tools is messy	3. Falling on raw materials or tools
2	Soybean grinding	1. Engine noise	1. Hearing loss
		2. Electrical voltage	2. Electrocutation
		3. Exposed to a grinding machine	3. Serious injury
3	Boiling ground soybeans	1. Slippery floor	1. Slipped
		2. Exposure to hot water	2. Blisters, Burns
		3. Exposure to boiler drum combustion flames	3. Burns
		4. 4. Boiler drum explosion	4. Fire, death
4	filtering soybean slurry	1. Electrical voltage 2. Lifting is not ergonomic	1. Electrocutation 2. Aches, muscle injuries
5	Coagulation with a coagulating agent	1. Exposure to chemicals	1. Skin irritation
		2. Exposure to hot water	2. Blisters, Burns
		3. Slippery Floor	3. Slipped

6	Tofu Printing	1. Exposure to Heat 2. Storage of raw materials and tools is messy 3. Workers smoke in the work area	1. Blisters, Burns 2. Hit by boards and tools 3. Respiratory and health problems, fire
7	Cutting Know	1. Cut by cutting tool	1 Minor injuries
8	Boiling tofu coloring	1. Exposure to hot water	1. Blisters, Burns
		2. Exposure to combustion smoke	2. Shortness of breath
		3. Exposure to Fire burning	3. Burns
9	Frying	1. Exposure to hot oil	1. Blisters, Burns
		2. Exposure to combustion smoke	2. Shortness of breath
		3. Exposure to Fire burning	3. Burns
10	Packaging	1. Incorrect working posture	1. Muscle injury

➤ *Risk Assessment*

After identifying the hazards, the possible hazards will be assessed according to the likelihood and severity of each hazard. The following is a table for risk assessment at the XYZ tofu factory.

Table Risk Control 3

No	Work Activities/Processes	Potential hazard	Risk	Risk Assessment		
				Severity	Likelihood	Mark Risk
1.	Soaking soybeans	1. Floor Slippery	1. Slipped	2	5	10 High
		2. Wastewater Remaining Marinade	2. Skin Disorders	2	3	6 Moderate
		3. Storage of raw materials and tools is messy	3. Falling under raw materials or tools	3	4	12 High
2.	Soybean grinding	1. engine noise	1. Hearing loss	4	3	12 High
		2. Electrical voltage	2. Electrocutation	5	4	20 Extreme
		3. Caught Grinding Machine	3. Serious injury	5	1	5 Moderate
3.	Boiling ground soybeans	1. Slippery floor	1. Slip	2	5	10 High
		2. Exposure to hot water	2. Blisters, Burns	4	3	12 High
		3. Exposure to burning fire boiler drums	3. Burns	4	3	12 High

		4. Boiler drum explosion	4. Fire, Death	5	4	20 Extreme
4.	Soybean Slurry Filtering	1. Voltage Electricity	1. Electrocuted	5	4	20 Extreme
		2. Lifter it's not ergonomic	2. Aches, muscle injuries	3	5	15 High
5.	Coagulation with a coagulating agent	1. Exposure to materials Chemistry	1. Skin irritation	2	4	8 Moderate
		2. Exposure to hot water	2. Blisters, burns	2	5	10 High
		3. Slippery floor	3. Slip	2	5	10 High
6.	Tofu printing	1. Exposed Hot	1. Blister, Burns	1	5	5 Moderate
		2. Storage of raw materials and tools is messy	2. Overwritten boards and tools	3	4	12 High
		3. Worker's smoke in the work area	3. respiratory and health problems, fire	4	4	16 High
7.	Tofu Cutting	1. Cut cutting tool	1. Wound Light	3	2	6 Moderate
8.	Boiling tofu coloring	1. Exposure to hot water	1. Blisters, Burns	2	5	10 High
		2. Exposed burning smoke	2. Out of breath	1	5	5 Moderate
		3. Exposed to fire burning	3. Burns	2	4	8 Moderate
9.	Frying	1. Exposed hot oil	1. Blisters, Burns	3	4	12 High
		2. Exposure to smoke burning	2. Out of breath	2	5	10 High
		3. Exposed to Fire burning	3. Burns	3	4	12 High
10.	Packaging	1. Incorrect working posture	1. Muscle injury	3	5	15 High

Table 4 Risk Control

NO	Activity/ Work process	Potential hazard	Risk	Risk Value	Risk Level	Risk control
1.	Soaking soybeans	1. Floor Slippery	1. Slip	10	High	Cleaning residual water from soaking, providing floor wipers, adding K3 signs, Using safety shoes
		2. Water Leftover Soaking Waste	2. Skin Disorders	6	Moderate	Washing hands, & use rubber gloves
		3. Storage of raw materials and tools is not neatly arranged	3. Falling on raw materials or tools	12	High	Implement the 5S program by arranging raw materials and tools in their proper place neatly.
2.	Soybean grinding	1. Voice Machine Noise	1. Hearing disorders	12	High	Turn off the machine if not used, Added engine sound dampening device, used earplugs.
		2. Electrical Voltage	2. Electrocuted	20	Extreme	Tidy up the cable arrangement with clips or cable wrap, carry out periodic checks on condition cable
		3. Exposed to Grinding Machine	3. Serious injury	5	Moderate	Turn off the machine when performing
						soybean pouring process, Addition of K3 signs, wear gloves
3.	Boiling ground soybeans	1. Floor Slippery	1. Slip	10	High	Cleaning boiling stagnant water, providing floor wipers, adding K3 signs, Using safety shoes
		2. Exposure to hot water	2. Blisters, Burns	12	High	Use wearpack (Long Clothes), gloves and safety shoes
		3. Exposure to boiler drum combustion flames	3. Burns	12	High	Providing fire extinguishers, Using wearpack (Long Clothes), gloves and safety shoes
		4. Boiler drum explosion	4. Fire, Death	20	Extreme	Carrying out monitoring water level in the drum, Safety valve, Perform routine checking schedules on Use safety shoes
4.	Tofu Printing	1. Exposure to Heat	1. Blisters, Burns	5	Moderate	Use disorders, health (Long clothes), gloves and safety shoes

		2. Storage of raw materials and tools is not neatly arranged	2. Crushed by boards and tools	12	High	Apply 5R program by arranging raw materials and tools in their proper place neatly.
		3. Workers smoke in the work area	3. Respiratory disorders, health and Fire	16	High	Nothing is may smoke during the production process, provide a special smoking area, Addition of K3 signs
5.	Soybean slurry filtering	1. Electrical voltage	1. Electrocuted	20	Extreme	Tidy up the cable arrangement with clips or cable wrap, carry out an inspection periodically check the condition of the cable
		2. The lift is not ergonomic	2. Aches, muscle injuries	15	High	Create work procedures regarding safe and comfortable working attitudes at work as well as additional transportation equipment (Trolley)
6.	Coagulation with a coagulating agent	1. Exposure to chemicals	3. Skin irritation	8	Moderate	Wash your hands, replace the fermented ingredients with vinegar and acid wearing a sarong rubber hands
		2. Exposure to hot water	2. Blisters, burns	10	High	Use wearpack (long clothes), gloves and safety shoes
		3. Slippery floor	3. Slip	10	High	Cleaning standing water, providing floor wipers, adding K3 signs, Use safety shoes
7.	Tofu Cutting tool	1. Cut by cutting	1. Minor injuries	6	Moderate	Use gloves
8.	Boiling tofu coloring	1. Exposure to hot water	1. Blisters, Burns	10	High	Use wearpack (long clothes), gloves and safety shoes
		2. Exposure to burning smoke	2. Out of breath	5	Moderate	Increase your intake of mineral water, and use it Face mask
		3. Exposed to burning fire	3. Burns	8	Moderate	Provide fire extinguisher, Use wearpack (long clothes), gloves and safety shoes
9.	Frying	2. Exposure to hot oil	1. Blisters, Burns	12	High	Use wearpack (long clothes), gloves and safety shoes

		2. Exposure to burning smoke	2. Out of breath	10	High	Increase your intake of mineral water, and use a mask
		3. Exposed to burning fire	3. Burns	12	High	Providing fire extinguishers, using wearpack (long clothes), gloves and safety shoes
10.	Packaging	1. Incorrect working posture	1. Muscle injury	15	High	Provide special packaging area with ergonomic chairs, & adds transportation aids (Trolley)

➤ Risk Control

Risk control is the final stage of HIRARC, after knowing the risk value for each activity at the XYZ tofu factory, risk control is then carried out so that the risks that occur can be minimized or eliminated. The following is the risk control carried out at the XYZ tofu factory.

➤ Dangers Discovered

- The activity of lifting buckets or other heavy objects that can cause soreness or muscle injury for workers.



Fig 1 XYZ Tofu Factory

- Water or other materials often spill and cause slippery floors, raising the risk of workers slipping and getting injured.



Fig 2 XYZ Tofu Factory

- Smoke from milling machines and filtering machines as well as steam produced from boiling has the potential to cause vision problems and respiratory problems.



Fig 3 XYZ Tofu Factory

- Placing buckets or other items that could potentially cause workers to trip and get injured.



Fig 4 XYZ Tofu Factory

- Noise from milling machines which has the potential to cause hearing problems can be minimized by placing the machine as far away from workers as possible.



Fig 5 XYZ Tofu Factory

IV. CONCLUSION

Based on the results of research conducted using the HIRADC (Hazard Identification, Risk Assessment, and Determining Control) method at the XYZ tofu factory, the following conclusions can be drawn:

- The results of the hazard identification carried out obtained 26 potential hazards from 10 activities/activities, some activities have a high risk of danger, namely in milling, boiling, and filtering activities there is a danger of exposure to fire, boiler drum explosion, electrocution, and fire. This job is a job that has a high category because it can result in serious injury or death to the victim.
- Based on the results of the risk assessment carried out by the author, the risk assessment was classified into low, medium, high, and very high-risk levels. There are 26 risks which are then classified based on risk assessment and 3 risk categories are obtained, namely medium, high, and very high, and obtained scores based on risk assessment for risk levels with a moderate risk category of 7 with a percentage of 27%, a high-risk category of 16 with a percentage of 62%, and a very high-risk category of 3 with a percentage of 11%.
- Based on the results of the data processing and analysis that has been carried out, the researchers carried out risk control at the XYZ tofu factory to minimize the occurrence of accidents or health problems for workers. Risk control is carried out using a control hierarchy. Where elimination is carried out by cleaning the work area of puddles of water and scattered soybeans and turning off noisy machines when they are no longer in use, substitution is carried out by replacing all equipment and cables in the production process that is no longer suitable for use with better ones, and replacing the process of lifting materials or tools manually using a transport tool (Trolley), technical control is carried out by adding facilities such as creating a special non-smoking

area, creating a special packaging area with ergonomic chairs and providing engine sound dampening equipment, the administration carried out in determining the hours' clear breaks to maintain the health of employees, providing K3 signs in the production area as well as carrying out regular supervision and checking of workers' conditions, room conditions, tools or machines, and finally PPE (personal protective equipment) which employees are required to use. PPE appropriate to the work being performed.

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