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Occupational Health and Safety (OHS) Risk Control Analysis at a Tofu Factory Using the Job Safety Analysis (JSA) Method

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ABSTRACT

Tahu Bintang Salma Factory is a company engaged in the tofu manufacturing industry. The factory continuously faces occupational accident issues in the form of blistered skin, itchy skin, eye irritation, and sprained feet, all of which disrupt the production process. This study identifies work accidents occurring at Tahu Bintang Salma Factory and proposes occupational health and safety (OHS) control methods to address these problems. Data were collected and processed using the Job Safety Analysis (JSA) method. Results revealed eleven potential hazards: spinal pain, bruised hands, bruised feet, sprained feet, tailbone injury, blistered skin, eye irritation, reddened skin, skin irritation (itching), bruised fingers, and hand lacerations. These risks were categorized into four levels: six low-risk, three moderate-risk, and two high-risk incidents. Control measures, including administrative controls, personal protective equipment (PPE), and substitution, were proposed to mitigate or reduce the potential for workplace accidents.

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INTRODUCTION

The manufacturing industry is one of the sectors that absorbs a considerable number of workers and reduces unemployment [1]. Human resources are one of the most important assets in an organization; without qualified human resources, an organization cannot function properly [2]. Human resources serve as the driving factor in a company to achieve its goals through professional, effective, efficient, and competent performance [3]. Safety and health factors in the workplace require special attention. Every worker faces risks of occupational accidents and health hazards that may occur if the company lacks adequate risk management controls.

According to Gani et al. [4], risk is the possibility of an event occurring that can affect an organization's mission, highlighting the need for vigilance and preventive action to protect the company from losses by determining the best approach to addressing risks.

Problems in the occupational health and safety (OHS) sector are often associated with incidents or accidents occurring within companies, causing financial, material, or productivity losses [5]. Workplace accidents are unexpected and unintentional events that impact company productivity [6], [7]. Although OHS has been strictly regulated by law, the rate of workplace accidents remains high, requiring companies to seriously implement OHS management [8]. In addition to workplace accidents, occupational diseases can arise from work involving exposure to chemical substances, pollution, or other risk factors [9].

Based on Indonesian Health Law No. 9 of 1960, Chapter I, Article 2, worker health encompasses not only physical aspects but also mental, emotional, and working environment conditions. Maintaining worker health is therefore an obligation for companies to ensure safe and conducive working conditions, which in turn improves employee performance and enables the company to achieve its goals effectively [10]. Several factors contribute to workplace accidents, including unsafe worker behavior, lack of knowledge, and fatigue. Identifying the factors that cause or can potentially cause workplace accidents is crucial for companies to prevent occupational accidents and diseases, and also helps companies formulate effective prevention strategies [11], [12].

Tahu Bintang Salma Factory has not been immune to occupational accidents and health problems. Based on preliminary observations, several types of accidents were identified: splashed by boiling soybean water on the face and hands, slipping due to slippery factory floors, back pain when lifting raw materials, bruised wrists when carrying soybeans on the shoulders, and skin irritation.

Occupational accident data at Tahu Bintang Salma Factory for the period October 2023 to April 2024 totaled 17 workplace accidents. These incidents occurred primarily due to a lack of self-awareness and minimal attention to occupational health and safety (OHS) management.

One method that can be used in OHS analysis is the Job Safety Analysis (JSA) method. JSA is a method comprising sequential steps aimed at identifying and analyzing potential hazards in the workplace [10], [13]. JSA is also known as an inspection procedure to determine whether work activities comply with established standard operating procedures (SOPs) [14], [15].

The purpose of the JSA method is to identify potential hazards in each work activity so that worker safety and health at the workplace can be ensured. The JSA method can help Tahu Bintang Salma Factory prevent potential workplace accidents. Accordingly, this study aims to identify what accident risks occur at Tahu Bintang Salma Factory and to propose OHS control measures to prevent potential workplace accidents.

RESEARCH METHODS

Risk is an unpleasant, harmful, or dangerous consequence resulting from an activity or work process. Risk is a combination of the probability or frequency of an accident and the severity of its consequences, including injuries and health impairments. According to Prayogi and Siswoyo [16], [17], [18], the main elements in categorizing a risk are: uncertainty, events, future and interests and objectives.

A risk must be comprehensively, extensively, and intensively identified in order to formulate appropriate control actions [16]. Risk control is an effort to reduce the likelihood of hazards so that workers performing tasks or operating designated machinery are not exposed to risk [19]. Risk control should refer to the Hierarchy of Controls approach, which serves as an outline of the stages used to prevent and control existing and future risks. Elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE) are the stages in sequential order.

Fig. 2. Hierarchy of Controls

Elimination aims to remove the possibility of human error when working. Substitution refers to replacing materials, processes, or activities that may cause accidents. Engineering controls involve separating the hazard source from workers to prevent human error. Administrative controls involve creating safe and efficient work procedures. PPE (Personal Protective Equipment) refers to safety equipment used during work.

This study was conducted at Tahu Bintang Salma Factory located on Jalan Dworowati KM 12, Sorong Timur District, Southwest Papua Province, Indonesia. The study focused on assisting the company in identifying risks and proposing preventive actions using the JSA method. The research subjects consisted of 7 workers at the factory. Data were collected through preliminary observation, interviews, and questionnaires directed at the research subjects.

In this study, Job Safety Analysis (JSA) was used to identify hazard sources and potential risks, which were then evaluated to formulate appropriate controls. JSA also serves as a monitoring or assessment tool to determine whether work activities comply with the standard operating procedures (SOPs) established by the company [20]. The stages of the JSA method are as follows: (1) Determine the work to be analyzed. The first step involves identifying critical jobs by classifying tasks with significant impact. (2) Describe the work tasks. The analyzed work is broken down into more specific steps through direct observation and discussion with company supervisors. (3) Identify hazards. This step involves identifying potential hazards present in each work activity. (4) Develop solutions and hazard controls. The final step is to develop safe work procedures to be recommended to the company. These recommendations are designed to help the company prevent workplace accidents and avoid potential hazards.

RESULTS AND DISCUSSION

Based on preliminary observations, occupational accident data from Tahu Bintang Salma Factory were collected. Several potential hazards that could cause injury or workplace accidents were also identified. Following JSA methodology, the first step was to determine the work activities to be analyzed. This study focused on analyzing the tofu production process, which was divided into three activities: the initial production process, the production process, and the finishing process.

The next step was to describe work tasks and identify hazards in each work activity. Hazard identification was based on interview data and observations consistent with actual incidents previously recorded at Tahu Bintang Salma Factory in Sorong City.

Table 1. Hazard Identification

No	Activity Description	Work Step	Hazard	Risk
1.	Initial Production Process	Preparation of soybean raw material	Incorrect lifting technique	Spinal pain
		Soaking soybeans	Pinched by soaking basin	Bruised hand
		Washing soybeans	Slipping on wet floor	Sprained foot
			Falling bucket of soybeans	Bruised foot
		Grinding soybeans	Slipping on wet floor	Sprained foot / Tailbone injury
2.	Production Process	Boiling soybeans	Splashed by boiling water	Blistered skin
		Filtering soy extract	Exposed to hot steam	Eye irritation
			Splashed by soy extract	Reddened skin
		Soy sedimentation	Continuous contact with the coagulant	Skin irritation (itching)
		Molding and pressing	Hand caught in press tool	Bruised finger
	Finishing Process	Cutting tofu	Hand grazed by knife	Hand laceration

Based on Table 1, there are 13 types of risks identified across the 3 tofu production activities. The next step is to conduct a risk assessment obtained through questionnaire distribution. Table 2 presents the risk matrix for each type of risk, and the values of Likelihood and Severity.

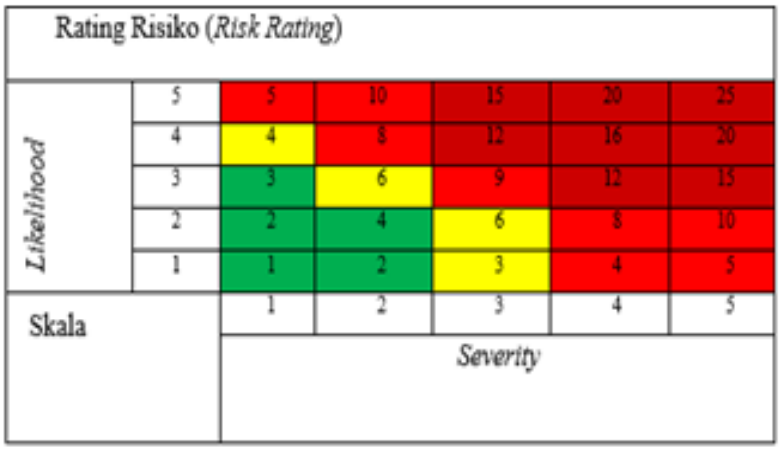

Fig. 3. Risk Matrix

Table 2. Risk Assessment

No	Risk	Likelihood (L)	Severity (S)	Risk Rating (RR)
1	Spinal pain	3	1	Low Risk
2	Bruised hand	1	1	Low Risk
3	Sprained foot	3	2	Moderate Risk
4	Bruised foot	1	1	Low Risk
5	Tailbone injury	1	4	High Risk
6	Blistered skin	3	2	Moderate Risk
7	Eye irritation	3	2	Moderate Risk
8	Reddened skin	3	1	Low Risk
9	Skin irritation (itching)	4	2	High Risk
10	Bruised finger	2	1	Low Risk
11	Hand laceration	1	1	Low Risk

After determining the Likelihood and Severity values, the next step was to conduct analysis using the JSA form for each type of work activity. The Risk Rating (RR) is calculated as Likelihood (L) x Severity (S). From the 11 identified risks: 6 are Low Risk (L), 3 are Moderate Risk (M), and 2 are High Risk (H).

Table 3. Job Safety Analysis Form – Initial Production Process

Activity	Work Description	Risk	Risk Rating	Control Measures
1. Initial Production Process	Preparation of raw material	Spinal pain	L	Administrative
	Soaking soybeans	Bruised hand	L	PPE
	Washing soybeans	Sprained foot	M	Administrative / PPE

Table 4. Job Safety Analysis Form – Production Process

Activity	Work Description	Risk	Risk Rating	Control Measures
2. Production Process	Grinding soybeans	Bruised foot	**L**	PPE
	Grinding soybeans	Tailbone injury	**H**	Administrative / PPE
	Boiling soybeans	Blistered skin	**M**	PPE / Substitution
	Filtering soy extract	Eye irritation	**M**	PPE
	Filtering soy extract	Reddened skin	**L**	Administrative / PPE
	Soy sedimentation	Skin irritation (itching)	**H**	Substitution
	Molding & pressing	Bruised finger	**L**	Administrative / PPE

Table 5. Job Safety Analysis Form – Finishing Process

Activity	Work Description	Risk	Risk Rating	Control Measures
3. Finishing Process	Cutting tofu	Hand laceration	**L**	PPE

Based on the JSA forms, the following risk control recommendations were developed for the company to prevent workplace accidents or hazards to workers. These control measures can also help the company improve productivity by avoiding risks that could cause company losses.

1. **Substitution Control Recommendations**

Adding a stainless steel ladle and waterproof gloves to reduce direct contact with the boiling basin, thereby minimizing burns from soybean boiling water splashes and reducing continuous contact with the tofu coagulant liquid that causes skin itching.

2. **Administrative Control Recommendations**

Providing instructions for correct material handling techniques, including: (a) keep feet close to the load; (b) bend knees and hips (squat position); (c) grip load firmly; (d) keep load close to the body; (e) lift using the leg muscles; (f) keep the back straight; (g) use smooth movements; and (h) avoid jerking motions. Guiding correct pressing procedures to prevent hand entrapment in the press tool. Installing warning signs for slippery floors and hot surfaces to prevent slipping accidents and scalding water splash injuries.

3. **Personal Protective Equipment (PPE) Recommendations**

Workers are required to use personal protective equipment during production activities, namely: safety shoes, safety gloves, safety goggles, and masks. These are intended to reduce or prevent workplace accidents such as burns from hot water splashes, slipping on wet floors, eye exposure to hot steam, and hand lacerations when cutting tofu.

CONCLUSION

Risk refers to events that may occur; therefore, research is essential to prevent undesirable outcomes. This study was conducted to identify potential accident risks, determine the risk rating for each type of accident, and propose risk control measures for the production process at Tahu Bintang Salma Factory. The objective of this study is to prevent or minimize the potential for workplace accidents through risk control. The Job Safety Analysis (JSA) method was employed to identify potential workplace accidents using Severity (S) and Likelihood (L) assessments. The product of S x L yields the Risk Rating (RR), which determines the highest probability hazard and guides the selection of controls based on the Hierarchy of Controls theory. Based on JSA analysis, 11 types of accidents were identified: spinal pain, bruised hands, bruised feet, sprained feet, tailbone injury, blistered skin, eye irritation, reddened skin, skin irritation (itching), bruised fingers, and hand lacerations. These 11 risk types were analyzed and control measures were formulated based on the hierarchy of controls, yielding three types of controls: (1) Substitution control: adding a stainless steel ladle to reduce direct contact with the boiling basin, thereby reducing burns from soybean boiling water splashes; (2) Administrative control: installing warning signs for hot surfaces and slippery floors, and providing guidelines for soybean sack handling and processing activities; (3) PPE: protective gloves, safety shoes, safety goggles, waterproof gloves, and masks.

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