



Identification of implementation and understanding of health and work safety with hazard and operability study (Hazop) method at SMG Mulya Factory

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ABSTRACT

The micro, small and medium enterprises sector has a major contribution to economic development in Indonesia. One of the micro, small, and medium enterprises (UMKM) is the SMG Mulya Factory, which produces snacks, and complimentary crackers. The work area certainly has risks and hazards that may arise. The reason makes MSME owners implement occupational safety and health for both owners and workers. This study aims to identify the application and understanding of occupational health and safety at the SMG Mulya Factory. This research uses the hazard and operability study (HAZOP) method. The results showed that the potential for extreme work hazards was 8.33%, high and medium risk hazards were 25%, and low risk was 41.83%. There is an extreme risk when frying crackers is not accompanied by personal protective equipment (PPE), so it is feared that it will be splashed by heat from the oil used when frying. There is a high risk when the dough-making machine does not use a lid, so it is feared that when washing the tool, there will be puddles of water on the floor so that it is slippery and causes injuries to workers.

ABSTRAK

Sektor usaha mikro, kecil dan menengah memiliki kontribusi yang besar dalam pembangunan ekonomi di Indonesia. Salah satu pengembangan Unit Usaha Mikro kecil dan Menengah (UMKM) adalah adanya Pabrik SMG Mulya yang memproduksi krupuk yang notabeneanya adalah makanan ringan, cemilan dan pelengkap. Area kerja tentunya memiliki resiko dan bahaya yang dimungkinkan muncul. Hal tersebut membuat pemilik UMKM menerapkan adanya keselamatan dan kesehatan kerja baik bagi pemilik maupun bagi pekerja. Penelitian ini bertujuan untuk mengidentifikasi penerapan dan pemahaman kesehatan dan keselamatan kerja pada Pabrik SMG Mulya. Penelitian ini menggunakan metode hazard and operability study (HAZOP). Hasil penelitian dapat menunjukkan bahwa potensi bahaya kerja ekstrim sebesar 8,33%, potensi bahaya risiko tinggi dan sedang sebesar 25% dan risiko rendah sebesar 41,83%. Resiko ekstrim terdapat pada saat penggorengan krupuk tidak disertai penggunaan alat pelindung diri (APD) sehingga dikhawatirkan terkena cipratan panas dari minyak yang digunakan saat penggorengan. Resiko tinggi terdapat pada saat pembuatan adonan mesin tidak menggunakan tutup sehingga dikhawatirkan ketika mencuci alat tersebut menjadikan adanya genangan air pada lantai sehingga licin dan mengakibatkan luka pada pekerja.

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1. Introduction

The existing era of industrialization and globalization has brought national development into it, marked by the development of the industrial sector. The development should be balanced with human resources that increase quality and consistently implement a good occupational safety and health system. Occupational Safety and Health (OSH) exists in employment and cannot be separated from the aspect of human resources. The importance of maintaining



consistency in occupational safety and health makes social security and workers prosperous so that it is far from unwanted impacts, indirectly will increase work productivity and other positive impacts. Currently, OSH is an important and an obligation that must be considered by workers and the work system so that later it will become a requirement that must be met by workers who work in certain industrial units [1].

Furthermore, occupational health that is not maintained properly will impact work accidents. Work accidents are not expected and are not wanted to happen so that they lead to material and nonmaterial losses [2], factors that cause work accidents, such as humans, work equipment, and the work environment [3]. The increase in the workforce working in the industrial sector in Indonesia has increased from time to time. The development of the number of workers comes from formal and informal industries. The purpose of the information sector is to be a household-scale company with maximum use of 20 people. The informal sector has different characteristics from the formal sector, such as working on oneself by using labor in the family, irregular salaries, different working hours, work done at home, no assistance from the government, and no legal entity. Some workers work in the informal sector, whether organized or not. Groups classified as organized are workers who work in groups with management in a group of informal workers [4]. An important aspect that must be considered and maintained in improving the industrial sector, especially households, is the workplace. The contents of the workplace are people, processes, and places used to support humans and their work environment. A growing and the increasingly innovative workplace has an impact on optimal business performance. Indirectly, these conditions will affect employees' social, mental, and physical lives so that the work environment needs improvement, especially in working conditions on a household scale [5].

Of course, there is a potential hazard in every job. If this is not cared for and controlled properly and thoroughly, it will lead to fatigue, complaints, injuries, and even the potential for work accidents. Thus, hazard control must be put forward by finding potential hazards that may appear in the workplace and then taking further steps in the form of hazard identification [6]. The next step, if the identification of possible sources of danger has been successfully carried out, then an evaluation of the risks of the workers is also carried out. It is necessary to anticipate things that are not desirable based on the potential for workplace accidents that can be prevented. All parties, from the leadership to the lowest structural workers, must follow the steps mentioned above to participate in implementing safety and health in the work area. The culture that has been formed must always be carried out to shape the attitudes and perceptions of workers not to be indifferent to work safety. These efforts will later describe the pattern of work behavior in complying with OSH rules and procedures by suppressing potential sources of hazards that exist and are possible to emerge [7].

An important function of management that is implemented properly will trigger an increase in the safety and health of workers in the work area. The increase will become a habit so that it becomes a normal function. Application techniques must also accompany the effectiveness of these efforts. Many companies view that a work accident as a natural and accidental thing that happens unexpectedly so that some companies seem to be less serious in dealing with the problem. Even finding the background of the cause and calculating the loss is rarely done. Public facilities are also not free from dangers to health, damage to buildings, loss of assets, and effects on the environment. Moreover, in applying the diagnostic sampling technique of safety, hazard analysis and safety audits are rarely carried out comprehensively and planned. Even though these efforts can prevent it by providing equipment support and so on [8], the anticipation must be made of the bad consequences of potential dangers that may arise from a place [9].

The effects of hazards in the workplace can provide physical harm to workers both directly and over some time. In addition to physical hazards, mechanical hazards originate from industrial equipment and mechanical equipment used by workers. Hazards that may arise other than mechanical and physical are chemical hazards that arise due to materials derived from chemical substances. In addition to these three things, the danger of electricity can also cause work accidents such as fires and short circuits due to electric shock. Risk is the embodiment of a profession that results in the possibility of greater losses [10]. Companies or industries have the main point of maintaining the work environment because the work environment greatly affects the work process. If the work environment is not maintained properly, the resulting output will be less than optimal. Work cannot be done and run well if the problem is not resolved. These problems can be anticipated using the 5S method. These methods include Seiri, Seiton, Seiso, Seiketsu, and Shitsuke (5S), which is a philosophy and a way for an organization to organize and manage workspaces and workflows with the aim of efficiency by reducing waste, both in terms of goods or equipment and time. Siri distinguishes between what is needed and what is not needed and discards what is not needed. Seiton defines a neatly organized layout so that we always find what we need. Seiso is about removing trash, dirt, and foreign matter for a cleaner workplace. Seiketsu keeps things orderly, neat, clean, and in the personal aspect and about pollution or doing something right as a habit. Seiketsu becomes the basis for improving the mentality of employees and improvements that will impact the quality of work. This approach is based on setting the work environment to minimize waste so that the created work environment will be neat, effective, efficient, and productive [11].

Businesses that are established by utilizing the home area as a workplace are the definition of what is often referred to as micro, small, medium enterprises or commonly called MSMEs [12]. Most of these businesses produce their goods, so the system is very flexible and adapts to market conditions that may change rapidly compared to large companies. Micro, small, medium enterprises or commonly called MSMEs, also have a large share in a country's economy [13]. Micro, small, medium enterprises or commonly called MSMEs, also have the potential for accidents and work hazards in their areas even though they are small, so that these are often ignored by workers [14]. The attitude of workers who often ignore this will lead to a bad impact for workers and the business sector. Potential hazards often ignored when working will make the business suffer losses in terms of materials, production quality, time, and workers [15].

Indonesian people are famous for consuming snacks and snacks, and they have become a trend. One of these snacks is crackers. The impact of this has triggered the rapid development of food entrepreneurs, for example, the SMG Mulya Factory in Sukoharjo Regency [16]. The factory produces snacks in the form of prawn crackers. Because SMG Mulya is a small and medium-sized business, this business usually requires workers from the area around the business area. The workers in question usually do not have sufficient competence and knowledge about OSH. The work area in the Mulya SMG Factory also allows for potential hazards, so this study aims to determine the potential hazards and the impact of work accidents at the Mulya SMG Factory. This research contributes to making workers more aware of the hazards that may arise in the work area.

2. Research Methodology

This research uses descriptive-analytic. Direct disclosure of the situation and facts in the field accompanied by solutions to existing problems. Of course, this research has a scope regarding the study of OSH (occupational safety and health). This study uses primary data taken directly in the field. This research took place at the SMG Mulya Krupuk Factory in Sukoharjo Regency. The location selection was done intentionally or purposively because the factory had marketed its products in several restaurants in Sukoharjo Regency so that the product was already well known in the Sukoharjo Regency community. The data analysis method used in this study used the Hazard and Operability Study (HAZOP) method. The main step in this research is to collect data using a site survey, which is useful for seeing the workplace from making cracker dough, mixing machines, drying crackers, frying pans, and

knowing whether workers use personal protective equipment in the SMG Mulya Factory. The next step that needs to be done is to conduct in-depth interviews with owners and workers using a questionnaire related to the problem of the OSH study (occupational safety and health). The third stage is to conduct a literature study to strengthen theory and science adapted to the problem under study. The literature obtained was sourced from books, journals, and other sources deemed relevant by the researcher.

The next step is to identify problems in the workplace, which is done by identifying where it is possible for work accident problems to arise and the source of the problem. If the identification has been completed, formulate a problem to determine what hazards may occur in the area or work field as the object of research. In the end, if everything is known, it is arranged according to the HAZOP method and its criteria, also supported by hazard description data at each stage of making crackers. Kemudian mengidentifikasi bahaya yang telah dirumuskan, membuat parameter acuan untuk penelitian pada objek yang diamati seperti suhu, tekanan, dan aliran, merumuskan penyebab dan akibat serta mengurutkan potensi bahaya yang terlibat. Semua proses telah dirumuskan pada lembar kerja HAZOP sesuai dengan klasifikasi silang atau perhitungan kemungkinan dan konsekuensi. After the value is obtained, use the risk matrix to find out more about the potential hazards that will later appear and then identify improvements. This process must also be added to the analysis, discussion, and recommendations for improvement at points where there may be gaps in work accidents. The criteria in the HAZOP worksheet are listed in Table 1 and Table 2.

Table 1. Likelihood criteria [6].

Level	Criteria	Description	
		Qualitative	Quantitative
1	Rarely happening	Thinkable but not only in extreme circumstances	Less than once per 10 years
2	Small chance	It has not happened yet but could appear/happen at some time	It happens once per 10 years
3	Possible	It should have happened and may have happened/appeared here or somewhere else	Once per 5 years to once per year
4	Most likely	It can happen easily, may appear in most circumstances	More than once per year to once per month
5	Almost sure	It happens frequently, is expected to appear in the most frequent circumstances	More than once per month

One of the criteria used in assessing a risk is the likelihood criterion. Table 1 is a quantitative calculation of the frequency based on factory interviews at certain times. The level used on the likelihood criterion scale has a ranking level from 1 to 5. The advanced criteria used are the Consequences/Severity criteria listed in Table 2. Table 2 is a table regarding the Consequences Criteria (severity). These criteria are used to see the consequences received by workers by describing qualitatively the lost working days. The score used in this criterion has a scale of 1 to 5. The next step is to assess the existing risk by defining the criteria in table 1 and table 2. The ranking of hazards uses identification on the HAZOP worksheet by taking into account the criteria in tables 1 and 2 according to the following figure.

Table 2. Consequences/severity criteria [6].

Level	Description	Injury severity	Working days
1	Not significant	The incident did not cause harm or injury to humans	Does not cause lost workdays
2	Small	The incident did not cause harm or injury to humans	Can still work on the same day/shift
3	Currently	Serious injury and hospitalized, no permanent disability, moderate financial loss	Lost workdays under 3 days
4	Heavy	Cause serious injury and permanent disability and large financial losses and have a serious impact on business continuity	Lost workdays 3 days or more
5	Disaster	Resulting in death and serious losses can even stop business activities forever	Lost workdays forever

Scale		Consequences				
		1	2	3	4	5
Likelihood	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

	1. Extreme
	2. High risk
	3. Moderate risk
	4. Low risk

Figure 1. Risk matrix [10].

3. Result and Discussion

The marshall test of the HRS-WC asphalt mixture was carried out using a Marshall tool. The test results include stability, flow, marshall quotient, volumetric values, and the optimum asphalt content value (KAO) in the mixture with the percentage of gypsum filler combination. The KAO value ranged from 6% to 8% in the HRS-WC mixture, as shown in Figure 2. The test results showed that the addition of gypsum filler gave a smaller KAO value than the mixture without using gypsum filler. Snacks are favored by the community are crackers. The snacks are light and dry and made from starchy ingredients. Krupuk is often used by the people of Indonesia, especially in Sukoharjo Regency. This food is often associated with foods that expand in volume with porous and low density when fried. SMG Mulya factory is one of the well-known crackers producers in the Sukoharjo Regency. This factory can produce crackers with many results, which are then deposited in several restaurants in Sukoharjo Regency and even up to Surakarta and other areas. The stages in making crackers at this factory consist of the dough-making process, dough molding, drying and drying cracker dough, and frying crackers.

Workers are always faced with stress arising from the workplace because workers are under pressure to do their work. Besides that, they also have to think about unfinished homework. That way, workers experience fatigue working with stress. Based on the research results in Italy, more women experience work stress than men [17]. In addition to gender factors that determine stress is workers' level of education [18]. With the stress spread to the negligence of work, there is a work accident, making supervision an important thing for employees [19]. In addition to employee performance, occupational health and safety is also an important part [20].

The first step in producing crackers at the SMG Mulya Factory is making cracker dough. This dough is a mixture of several ingredients such as shallots, garlic, wheat flour, salt, sugar, chili, flavoring, and shrimp juice. After the cracker dough is finished, the second stage is to print the cracker dough into a uniform and fitting shape and size. Crackers that have been fried will produce a uniform color and shape. The third stage after printing the dough is drying and drying the dough. The SMG Mulya factory uses two types of drying, namely natural and oven drying. The water concentration in the crackers will, of course, impact the quality of the crackers created and their development when fried. This technique is vital, particularly in terms of shape consistency, so that during frying, the heat source may be penetrated equally, and the crackers expand as they reach the frying phase. The moisture content of the crackers must be on a certain scale so that it produces maximum steam pressure and expands well when fried. The last step in producing crackers is frying. The frying of crackers carried out at the SMG Mulya factory using palm oil uses a special temperature. These efforts are made to produce crispy, tasty, and savory crackers. Frying is done using a tool to maximize the capacity of the crackers that are quite large. Based on research conducted at the Mulya SMG Factory using the HAZOP method, several potential hazards were found, as shown in Table 3.

Table 3. Potential hazards (risk level)

No	Study	Hazard's findings	Risk	Source hazard	L	C	S	Risk level
1	Cracker dough making	Ceramic floor	Slippery, stumbles on the floor	Working environment condition	2	3	6	Currently
		Puddles that may appear when washing the machine	Slips, Sprains, Minor Elbow and Knee injuries	Working environment condition	3	2	6	Currently
		No v-Belt Cover	Severely Injured Hand	Working environment condition	3	3	9	High
		Workers are not equipped with PPE	Sneeze	Worker attitude	2	1	2	Low
2	Dough printer	Low ventilation space	Tired quickly, sweating, stuffy	Working environment condition	2	1	2	Low
		Hot temperature	High temperature, Workers experience dizziness	Working environment condition	2	2	4	Low
		Factory Layout	Standing position, the location of the groove is not right	Worker attitude	2	1	2	Low
3	Dough Drying and Drying	Hot temperature	High temperature, Workers experience dizziness	Working environment condition	3	3	9	High
		Factory Layout	The position of the worker cannot sit, the location of the groove is not right	Worker attitude	2	2	4	Low
4	Crackers frying	Minimal air vent	Workers get tired and sweat	Working Environment Condition and Worker Attitude	3	2	6	Currently
		Hot Temperature	Workers experience headaches	Working environment condition	3	3	9	High
		Workers are not equipped with PPE	Exposed to heat or splashes of oil	Worker attitude	3	4	12	Extreme

Source: Processed primary data analysis (2021).

Table 3 regarding the potential hazards that may arise in the work area of the SMG Mulya Factory can be categorized into four risks, namely extreme, medium, high and low. The study results show that the potential for extreme work hazards is 8.33%, high and moderate risk potential hazards are 25%, and low risk is 41.83%. The risk of extreme danger arises when frying crackers because workers do not use PPE, so they are feared to be splashed by hot oil from frying. Potential danger or high risk is possible at several stages of making crackers, such as in the manufacture of cracker dough, the machine does not have a cover, the course can endanger the hands of workers when checking or when starting the machine. There is also high risk in the factory, especially in the lack of ventilation in the existing room so that hot temperatures are possible to occur frequently, making workers sweat and allowing work fatigue and headaches. Medium and low risk is found in the layout of the crackers factory because the position of each cracker-making process is not well organized, so workers have to mobilize quite a lot. In addition, the floor is also possible to be a bit slippery in the ceramic area. Wet clothes due to high enough temperatures make workers vulnerable to colds. Of course, workers who do not use PPE must know the possible dangers, even if they are minimal. Recommendations can be improved promptly by applying the right SOP and using the correct PPE. It is necessary to provide OSH training for owners and workers, and a machine cover is needed for dough printing. Water disposal and water absorption also need to be improved to minimize the

hazards that occur. However, from the overall assessment of the risk aspects that may arise at the SMG Mulya Factory, it is quite good because the low-risk level still has a greater value when compared to the extreme, high or moderate risk.

4. Conclusion

Based on data processing and data analysis that has been carried out in this study, it can be concluded that the stages of making crackers go through four stages, namely making cracker dough, molding dough, drying and drying crackers, and frying crackers. The four stages mentioned certainly have their level of risk. Based on the potential hazards, it can be seen that the potential for extreme work hazards is 8.33%, the potential hazards are high and moderate risk is 25%, and low risk is 41.83%. Based on these results, low risk dominates at the stage of making crackers so that the MSME sector does contain a lower risk of danger than other industrial sectors. However, factories should still pay attention to workers to remain orderly in compliance with work safety regulations. Additional use of PPE is recommended, such as the use of boots. Care must be taken by workers while working so that the implementation of K3 is well implemented and extreme and high risks can be minimized as much as possible. Inspection of the existing tools at the SMG Mulya factory must also be carried out periodically to minimize zero accidents while working.

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