

Conference Paper

Occupational Accident Analysis in CV. Purnama Workshop Using HAZOP (Hazard and Operability) Method

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CV. Purnama's workshop is a welding workshop with appropriate technology. The workshop covers an area of 600 m², with a total of seven workers. The workshop manufactures a cracker-making machine, a cutting machine, a dough mixer, etc. A preliminary study on the manufacturing process of the workshop conducted in 2014 reported a work accident in which the workers' feet were exposed to iron. Also, in 2019, workers fell into a boiler-machine pulley, which hit the head of one of the workers. Thus, this study aims to determine the risks and hazards involved in the work process at the Purnama workshop. This study used a qualitative research method and collected data through observation in each machine-building process and interviews with all workshop employees and workshop owners. The results of this study highlighted that the process of making a chopping machine had six hazards, while that of a dough mixer had five. The levels of hazards in the processes of making a chopping machine and a dough mixer were "high" at 58% and 56%, respectively. It is concluded that since a higher level of danger was found in each machine-building process in the workshop, risk control is necessary to avoid work accidents or occupational diseases. The workshop owners and workers are recommended to apply K3 in the workplace.

Keywords: HAZOP, risk assessment, work accidents

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1. Introduction

Occupational safety and health is an activity to guarantee and protect the safety and health of workers so as to prevent work or occupational disease prevention. The aim of occupational safety and health is to reduce or eliminate the risk of loss, damage or work accidents. during the production process so that the health and safety of workers runs as much as possible [2]. A work accident is a condition or event that is unexpected and unhappy. Work accidents that occur in Industry are divided into two categories, namely

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[1] industrial accidents, namely uncontrollable accidents that occur in the workplace; [2] Accidents on the way to work-related accidents that occur outside the workplace [6]. In 2017, there were 2.78 occupational accidents and occupational diseases in the world [11]. Meanwhile, in Indonesia, that in 2017 the number of work accidents reported was 173,015 cases [7], work accidents in East Java according to 2017 the number of work accidents reported were 21,631 cases. Accident work caused by one's knowledge of work safety, one's practice of working with safe actions [8]. Work accidents must be able to guarantee risks so that work accidents can be stopped [1]. Human factor is the factor that most influences the incidence of work accidents [12].

Purnama's workshop is one of the lathe welding machine workshops in Malang. This workshop operates to make efficient technology machines. Purnama workshop is located on Jalan Raya Ki Ageng Gribig, No. 260, Lesanpuro, Kec. Kedungkandang, Malang City, East Java, with a building area of 600 m² and was founded in 1995. There are eight [8] workers at the Purnama Workshop. Some of the machines produced by Bengkel Purnama are kneading machines, cracker making machines, chopping machines, and other industrial machines. The machines that have been produced will be sold and shipped to various parts of the Indonesian archipelago, namely in Java, Kalimantan, Sulawesi, Sumatra and Papua.

Based on the results of research conducted by researchers, several dangers were found, namely the tools used when making machines were scattered, this was because there was no cupboard to store unused tools besides the awareness of workers to tidy up the tools that had been use, this obedience is not resolved immediately, so workers can trip over and fall due to work tools scattered on the floor. The next danger is that there is a rotating engine [fan] that is not given approval by the wind so that no cover is immediately given to the rotating fan blade so that it can cause worker hazards if you touch the propeller, so the advice given is to cover the propeller the fan. The next danger is that workers do not use PPE, a recommendation that can provide PPE to workers and explain to workers the importance of using PPE in the work environment. The last resort made for harm is the use of PPE [14].

In addition, the dangers that can be found during welding are workers who are exposed to ultraviolet and infrared impacts, immediately welding workers are inhaled, electrocuted, burnt to the body of the worker [exposed to welding sparks], hands that are exposed to hot metal, and hands are pinched [13]. The gases produced in the welding process are carbon monoxide [CO], carbon dioxide [CO₂], ozone [CO₃], and nitrogen dioxide [NO₂] gas [20]. The next danger is that there is no worktable which can cause MSDS to be done repeatedly, with the wrong way of working, such as squatting, and so

on [15]. Based on other research, the manufacturing of the packaging industry yielded 38% of the hazards associated with equipment and 5% related to the environment and personnel. In addition, great dangers occur to the extruding and rotating machinery of the packaging industry. These hazards can be prevented by providing training to employees [19].

Work accidents that occur in the workshop are that workers are often exposed to iron bram splashes during the turning and milling process, besides that in 2014 there was a work accident, namely the worker's feet were torn due to exposure to iron while making one of the machines, and in 2019 there was an accident work namely workers falling pulleys to lift boiler tubes, and my workers

2. Material and Method

This type of research is descriptive observational with the HAZOP method. The type of data used in this research is qualitative data. Descriptive research is a study that is used to determine a phenomenon that exists in society by describing or by way of [16]. Qualitative research is research conducted to determine phenomena in social life which is carried out naturally by prioritizing the process of communication interaction between researchers and events that are studied in depth [10]. In this study, researchers conducted research using primary data, primary data is data obtained directly by researchers [21]. Primary data in this study were obtained by means of interviews and observations. The results of the observations obtained are recorded on the observation sheet, then transcribed on the HAZOP worksheet, then assess the risk by looking at the consequence table and likelihood table to determine the level of likelihood and severity. Then do the analysis by multiplying the likelihood risk value and severity, then the multiplication results obtained can be seen in the risk matrix to see and find out the level of risk and danger in the activities carried out by workers. The results of the interviews were used to strengthen the observation data. Data collection in this study was carried out by interview and observation. Interviews in this study aimed to obtain information about the application of occupational health and safety in the research site. Respondents of this interview were workshop owners and workers in the workshop. The tools used at the time of the interview were interview sheets and a recording device. While the observation tools in this study used observation sheets, and documents [photos] which were taken directly by the researcher. After conducting the interview, the next stage is filling in the HAZOP worksheet by entering the results of the interview findings and observations in the HAZOP worksheet, after which the

likelihood and severity level analysis is carried out by looking at the likelihood table and consequence table. After that an analysis is carried out by categorizing or giving a score for each severity and possibility of the hazard occurring, after that to find out whether the hazard has a risk of “E” [category of very high risk or extreme risk], “H” [category of low risk or high risk], “M” [moderate risk category], “L” [low risk category or low risk]. This value is obtained by multiplying the severity and likelihood [severity x probability].

3. Results

3.1. Chopping machine

The chopping machine is one of the production machines made by Bengkel Purnama, in making a chopping machine several processes are carried out, namely:

1. Frame making
2. Making a chopping place
3. Installation of transmission
4. Disc making knife
5. Combining components

The following is the result of the level of risk assessment for each hazard in the manufacture of chopping machines.

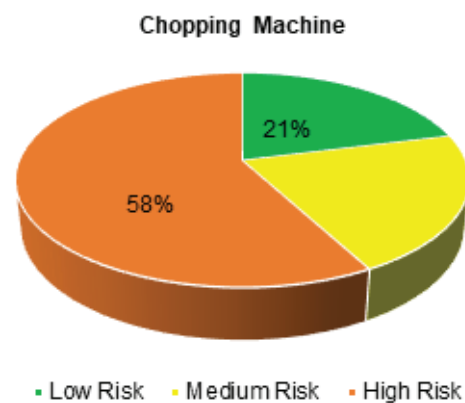


Figure 1: Risk diagram for making chopping machines. (Source: Author's own work.)

In the manufacture of chopping machines the percentage of hazards obtained is 21% moderate risk, 21% low risk, and 58% high risk.

3.2. Dough mixer machine

Apart from chopping machines there are also several machines produced at the Purnama Workshop, one of which is the dough mixer machine.

1. Frame making
2. Dough tube making
3. Transmission installation
4. Mixing shaft manufacture
5. Joining of component

The following is the result of the level of risk assessment for each hazard in the manufacture of chopping machines.

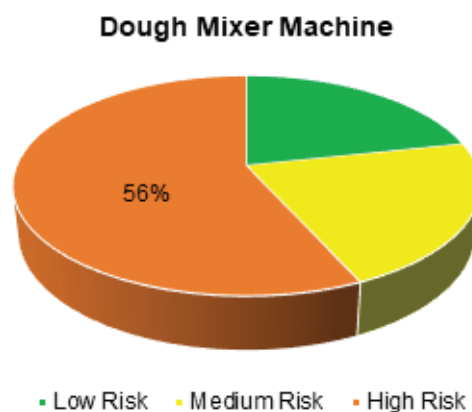


Figure 2: Risk diagram for making dough mixer machine. (Source: Author's own work)

In the manufacture of chopping machines the percentage of hazards obtained is 22% moderate risk, 22% low risk, and 56% high risk.

4. Discussion

From the results of observations made at the Purnama Workshop, the following are the results and discussion of the research that has been carried out.

4.1. Chopping machine

The chopping machine is one of the production machines made by Bengkel Purnama, in making a chopping machine several processes are carried out, namely:

a. Making a body or frame

The initial stage carried out in making a chopping machine is by making a body or machine frame, in making a frame or body of a chopping machine, which is cutting parts or parts of iron [long iron] using a welding machine.

b. Making a chopping place

After the frame or machine body has been completed, the next step is to make a chopping place on the chopper machine, in making the chopping place there are several steps that must be done, namely cutting the plate iron according to the specified size

c. Installation and manufacture of transmissions

The transmission is a system of transferring engine power to the differential after heading to the differential then heading to the shaft so that the pulley can rotate or work and the engine can work according to its function [3].

d. Making a knife disc

The next step in making the chopping machine at the Purnama Workshop is making a knife disc. The disc of the knife serves to cut the ingredients that are chopped.

e. Painting

At this stage, what is done is painting every component of the machine.

f. Combination of components

After painting, the next step is to combine each of the engine components.

g. Machine storage

Here is the final stage, namely storing the engine that has been made.

Some of the hazards found when making chopping machines are as follows: 1) the position of the worker is not ergonomic; 2) workers do not use PPE; 3) the fan is not covered; 4) workers smoke during the welding process; 5) the material tools scatter; and 6) workers are exposed to bram from turning and milling.

The following is a control for each hazard that has been found, namely as follows:

1. The position of workers is not ergonomic, the workshop provides a worktable during the welding and grinding process, and conducts stretching training for workers so that workers do not experience back pain.

2. Workers do not use PPE, the workshop is obliged to provide PPE to workers, and provide socialization about the importance of PPE.

3. The fan has no cover; the workshop must provide a cover on the fan so that it is not dangerous and can cause work accidents.

4. Workers smoke, give pearutan prohibited smoking, and give sanctions if they find workers who smoke.

5. Material tools scattered, providing a cupboard for storing unused material tools

6. Workers are exposed to bram when turning and milling, making regulations, namely cleaning lathes and milling machines when they are used, and workers wearing long sleeves [not loose] so they can protect their hands.

4.2. Dough mixer machine

Apart from chopping machines there are also several machines produced at the Purnama Workshop, one of which is the dough mixer machine. In making the dough mixer machine, there are several steps that are carried out, namely as follows:

- a. Making the body or frame of the kneading machine
- b. Making dough tubes
- c. Installation and manufacture of transmissions
- d. Make a mixing shaft
- e. Painting
- f. Combination of components
- g. Machine storage.

Here are some of the dangers found during the process of making a dough mixer:

1. The position of the worker is not ergonomic
2. Workers do not use PPE
3. The fan is not covered
4. The material tools scatter
5. Workers are exposed to bram from turning and milling

The following is a hazard control that can be done, namely as follows:

1. The position of workers is not ergonomic, the workshop provides a worktable during the welding and grinding process, and conducts stretching training for workers so that workers do not experience back pain.

2. Workers do not use PPE, the workshop is obliged to provide PPE to workers, and provide socialization about the importance of PPE.

3. The fan has no cover; the workshop must provide a cover on the fan so that it is not dangerous and can cause work accidents.

4. Material tools scattered, providing a cupboard for storing unused material tools

5. Workers are exposed to bram when turning and milling, making regulations, namely cleaning lathes and milling machines when they are used, and workers wearing long sleeves [not loose] so they can protect their hands.

5. Conclusion

Based on the calculation of the hazard risk in each machine manufacture, the following is the level of hazard risk in the chopping machine, namely the “high” risk in the chopping machine manufacturing process is 58%, the “medium” hazard risk is 21%, and the “low” hazard risk is 21%. So it can be stated that the hazard risk in the chopping machine maker has a “high” hazard risk with a value of 58%. Meanwhile, for the level of risk in the manufacture of a dough mixer machine, the risk of “high” hazard is 56%, the risk of “moderate” hazard is 22%, and the “low” risk is 22%. Based on the explanation above, it can be said that the risk of danger when making a dough mixer is a “high” risk with a value of 56%. So it can be said that the high level of risk in each of the existing machine building workshops.

Acknowledgement

None

Conflict of Interest

The authors declare that there is no conflict of interest.

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