

Hazard Analysis and Occupational Safety and Health Risk (K3) with Hazard Identification Risk Assessment and Determining Control (HIRADC) in the Canopy Making Process at the Arivlas Workshop, Bantul Regency.

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ARTICLE INFO

ABSTRACT

Article history

Received February 07, 2024

Revised June 25, 2024

Accepted July 23, 2024

Keywords

HIRADC

Danger

Risk

Canopy Making,

K3

Background: Most workers have not complied with the standard operating procedures in the use of personal protective equipment (PPE), apart from the lack of awareness of workers about the importance of using PPE, there are other factors, namely the Arivlas Workshop in Bantul Regency does not have occupational safety and health risk management so that the existing risks cannot be controlled which will cause the risk of work accidents when using machines, equipment and during the installation process. **Method:** This study is descriptive with a qualitative type of research that aims to obtain an overview of the analysis of safety and health risks in the canopy making process at the Arivlas Workshop in Bantul Regency. The research subjects were taken by purposive sampling, using HIRADC tools with data collection techniques through observation and interviews. The respondents in this study were 3 workers as the main informants, and workshop owners as key informants. **Result:** In the canopy making activity, a risk assessment of 20 risks included in the moderate risk category was still tolerable but action or handling was needed so that the risk could be reduced, and 15 high risks were unacceptable so attention was needed to take action or handle as soon as possible. **Conclusion:** The process of making canopies at the Arivlas Workshop in Bantul Regency has a high potential for hazards and risks to occupational safety and health, the dangers contained in canopy making activities are the dangers of movement, gravity, mechanics, electricity, chemicals, noise, and radiation. With the risk of hearing loss, feet hit by iron, scratches, electric shocks and the risk of inhaling chemicals such as paint and dust from polishing results.

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How to Cite: Cahyadi, N., Arianto, M. E. (2024). Hazard Analysis and Occupational Safety and Health (K3) Hazard Identification Risk Assessment and Determining Control (HIRADC) in the Canopy Making Process at the Arivlas Workshop, Bantul Regency. *Periodicals of Occupational Safety and Health*, 1(2), 1-8.

1. Introduction

The rapid growth of the industry in today's modern era demands optimal work performance and productivity in tight work time management. All the energy exerted by the body without sufficient work time management certainly has an impact on the onset of work fatigue in the form of physical, cognitive and psychological work fatigue (Priyohadi & Achmadiansyah, 2021). Potential dangers are found in the workplace and result in losses both from the company, employees and the surrounding community. An effort to prevent this is to implement an Occupational Safety and Health (K3) concept (Efvandi et al, 2022).

In 2020, almost 32% of work accident cases occurred in the construction sector which includes all types of building projects, roads, bridges, tunnels, dam irrigation and the like). Industrial accidents in general are caused by 2 main things, namely dangerous work behavior (*Unsafe Human Act*) and unsafe conditions (*unsafe condition*) (Priyohadi & Achmadiansyah, 2021). Based on the annual report of the Directorate General and the Ministry of Agriculture in 2020, there were a total of 6,037 cases of work accidents, including 81 due to occupational diseases, 1 case of poisoning, 1,486 cases due to being hit by sharp or hard objects, 399 cases due to hits, 581 cases due to being pinched, 414 cases due to exposure to radiation or light and 28 cases due to being touched by electricity. Meanwhile, in 2021 the number of work accidents that occurred was 7,928, 6 cases due to work-related diseases, 33 cases due to poisoning, 2,097 cases due to impact, 485 cases due to hits, 1,116 cases due to pinching, 455 cases due to exposure to radiation or light, and 24 cases due to being touched by electricity (Kemnaker, 2022).

Based on statistical data of Bantul Regency (BPS, 2023) in the informal sector in Bantul Regency, it is known that the most frequent work accidents from 2018-2020 are eye irritation with a total of 55 cases. Then the second is shortness of breath with a total of 46 cases, the third is burns and injuries due to machinery with a total of 38 cases, and the last is a hammer hit as many as 22 cases. The high number of occupational accidents is caused by the lack of Occupational Safety and Health risk management, so efforts to manage occupational safety and health risks are needed. An analysis of occupational safety and health risks in the canopy manufacturing process at the Arivlas Workshop in Bantul Regency is important to ensure that the process is safe and not dangerous for the workers involved. This risk assessment aims to identify potential hazards that arise during the manufacture of the canopy and determine the steps that need to be taken to reduce those risks.

Based on the results of a preliminary study conducted at the Arivlas Workshop in Bantul Regency, there are several risks in the Arivlas Workshop in Bantul Regency during the canopy making process due to the lack of awareness of workers, such as when measuring iron without using gloves and *safety* shoes which can cause scratches, when cutting iron does not use a welding mask which can cause fragments of the piece to be exposed to the face and eyes, then when welding does not use gloves which can cause minor burns around the hand area, in the painting process only use ordinary masks so that exposure to chemical substances can still be inhaled and at the time of installation the canopy workers stand directly on the iron frame of the canopy which can result in fell from a height because it was not equipped with a *safety belt*. Most workers have not complied with the standard operating procedures in the use of personal protective equipment (PPE), apart from the lack of awareness of workers about the importance of using PPE, there are other factors, namely the Arivlas Workshop of Bantul Regency does not have occupational safety and health risk management so that the existing risks cannot be controlled which will cause the risk of work accidents when using machines, equipment and during the installation process. For work accidents that have occurred at the Arivlas Workshop in Bantul Regency in the process of making canopies, namely scratches due to being cut by iron or tools because they do not use *safety* shoes, minor burns to the hands because they do not use welding gloves when cutting iron and eye irritation due to being exposed to iron chips when cutting iron because they do not use welding masks or welding glasses.

2. Materials and Method

This research is descriptive with a qualitative type of research that aims to obtain an overview of the analysis of occupational safety and health risks in the process of making canopies at the Arivlas Workshop in Bantul Regency. The purpose of this study is to obtain an overview of the

analysis of occupational safety and health risk management with *Hazard Identification Risk Assessment and Determining Control (HIRADC)* in canopy making activities in the Arivlas workshop in Bantul Regency. The research subjects were taken by purposive sampling, using HIRADC tools with data collection techniques through observation and interviews. The respondents in this study are 3 workers as the main informants, and workshop owners as key informants with the research object, namely the process of making canopies.

3. Results and Discussion

3.1. Results

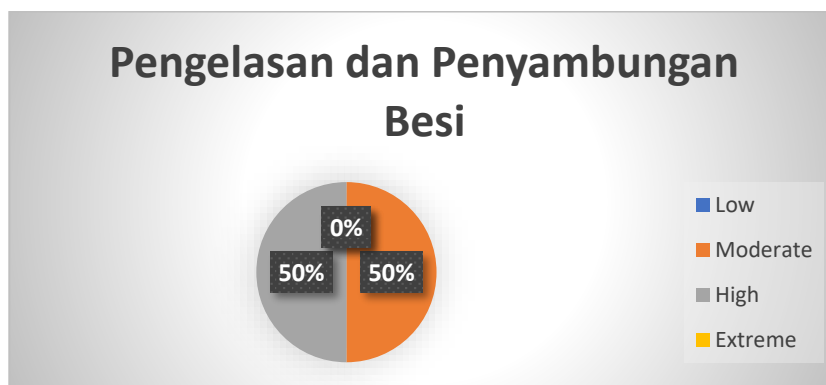
Based on the results of the assessment carried out by the researcher on the iron cutting process as follows:



Picture 1 Iron Cutting Diagram

Based on the risk level assessment, the *level of risk* can be determined which is the next to determine the priority of handling. In iron cutting activities, 70% of the risk is medium so that an action or treatment is needed so that the risk can be reduced, and 30% of the risk is high so that attention is needed to take action or handle it as soon as possible. 2 high risk or intolerable, and 5 medium risk or tolerable.

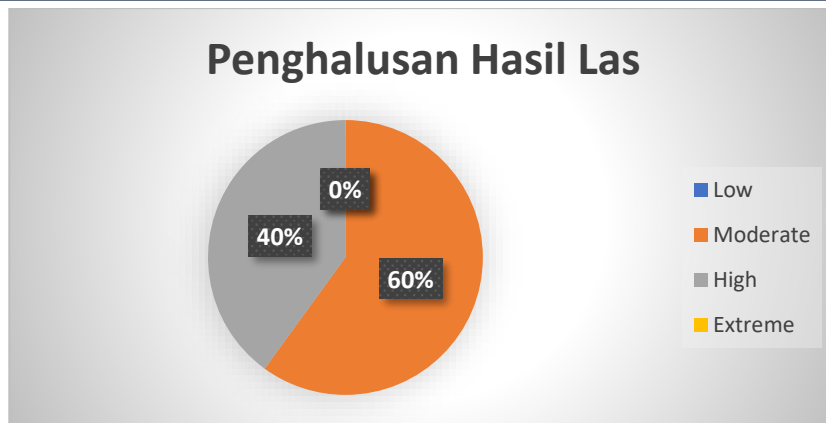
Based on the results of the assessment carried out by the researcher on the welding process as follows:



Picture 2 Welding Diagram

Based on the risk level assessment, the *level of risk* can be determined which is the next to determine the priority of handling. In iron welding activities, 50% of the risk is medium so that an action or treatment is needed so that the risk can be reduced, and 50% of the risk is high so that attention is needed to take action or treatment as soon as possible. 4 high risk or intolerable, and 4 medium risk tolerable.

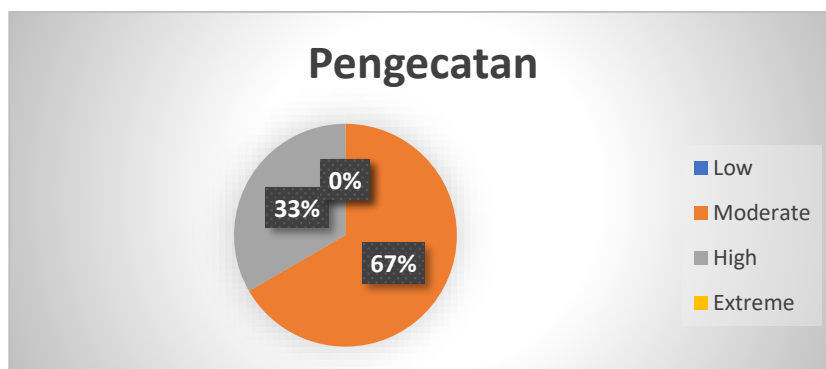
Based on the results of the assessment carried out by the researcher on the process of smoothing the welding results as follows:



Picture 3 Smoothing Diagram

Based on the risk level assessment, the *level of risk* can be determined which is the next to determine the priority of handling. In iron refining activities, 60% risk is moderate so that an action or treatment is needed so that the risk can be reduced, and 40% risk is high so attention is needed to take action or treatment as soon as possible. 2 high *risk* or intolerable, and 3. Moderate risk can be tolerated

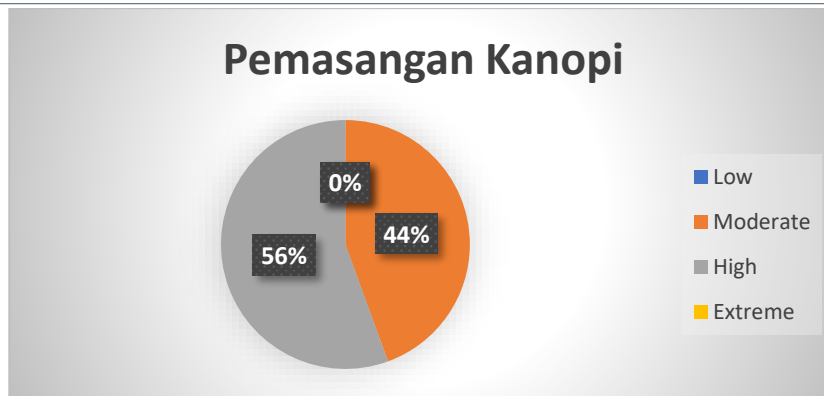
Based on the results of the assessment carried out by the researcher in the painting process as follows:



Picture 4 Painting Diagram

Based on the risk level assessment, the *level of risk* can be determined which is the next to determine the priority of handling. In the iron checking activity, 67% of the risk is medium so that an action or treatment is needed so that the risk can be reduced, and 33% of the risk is high so that attention is needed to take action or handle it as soon as possible. 2 high risk or intolerable, and 4 moderate *risk* tolerable

Based on the results of the assessment carried out by the researcher on the canopy installation process as follows:



Picture 5 Canopy Installation Diagram

The assessment of the level of risk in the canopy installation process can be known as *the level of risk* which is then to determine the priority of handling. In the canopy making activity, a total of 20 moderate risks were obtained so that the risk can still be tolerated but action or handling is needed so that the risk can be reduced, and 15 high risks (intolerable) so that attention is needed to take action or handle as soon as possible. The Arivlas workshop must take action as soon as possible to reduce the level of risk of work loss and be prioritized to handle 15 high risks which are then continued to handle 20 moderate risks. Because according to the results of observations and interviews, the workshop has not known the dangers and risks in depth so that the actions or efforts they take to reduce the level of risk have not been maximized due to the limitation of this information.

3.2. Discussion

a. Identification of OSH Hazards and Risks in Canopy Making Activities

Cutting activities involve working with machines, which poses several potential hazards and risks to workers. These hazards include exposure to loud noises (noise hazards) that can cause hearing impairment, movement activities that are not in accordance with a good body position (movement hazards) that can cause back and muscle pain, feet being hit by iron during the process of moving iron (gravity hazards) that can cause foot injuries, risk of hands being cut off (mechanical hazards) when using grinding machines, tripping over electrical cables scattered on the floor (electrical hazards) and the potential for being electrocuted electricity when disconnecting the machine cable (electrical hazard).

In welding and joining activities, there is a danger and risk of electric shock due to contact with live electrical components and electrical cables scattered on the floor that can cause workers to trip. When working with welding machines, there is a risk of electric shock if proper safety precautions are not taken. This can lead to serious injury or even death. The hazards associated with lifting iron for joining include gravitational forces, movement-related risks, and the risk of being hit by falling pieces of iron. Workers involved in lifting pieces of iron are at risk of injuries such as leg injuries due to falling iron, pinched hands, and muscle strain (Mahbubi, 2023). In addition, the repetitive nature of these tasks can cause problems *Musculoskeletal* long-term such as back pain and other muscle-related discomfort (Setiaji, 2020).

The welding process poses risks such as radiation exposure, high temperatures, electric shock, corneal damage to the eye, and burns on the hands. Welding workers are exposed to a variety of hazards including radiation that can cause long-term health problems, burns from high temperatures, electric shock from damaged equipment, and eye injuries from not wearing proper protective equipment. These risks highlight the importance of following safety protocols during welding activities, hazards during tool removal including the risk of electric shock if not handled properly. When removing the machine, workers face the danger of electric shock if the machine is not properly disconnected from the power source. This can result in severe injury or even death if safety procedures are not strictly followed.

The process of refining iron, this activity involves several potential hazards such as mechanical, electrical, gravitational and movement hazards. Mechanical hazards from using grinding machines when smoothing welding residues, small flakes of iron flakes can get into the eyes causing eye irritation or even serious vision problems. Potential hazard activities in lifting activities include movement hazards, and gravity hazards. Improper lifting and handling techniques of heavy materials can lead to problems such as back strain or muscle sprains. Gravitational forces acting on materials can cause injuries to the feet and hands as a result of falling objects if not handled with care, the risk of limbs being pinched between materials causing serious injury. Proper training on safe lifting practices and proper use of equipment can help reduce these risks.

A mixture of ingredients that can pose various health risks to workers. One of the impacts is respiratory distress caused by a mixture of chemical particles from paint. This can lead to respiratory problems such as coughing or shortness of breath. In addition, workers are also at risk of experiencing symptoms such as dizziness due to exposure to strong aromas during the mixing process (Rosidin et al, 2023). The sharp and strong structure of the paint can improve the health of the nervous system and cause uncomfortable symptoms such as dizziness. Direct contact with the chemicals in them can also cause irritation to the eyes and skin. Workers who are overexposed can experience long-term health problems such as cancer, liver function damage, and chronic skin irritation. The emptying process in the spray also has health risks, especially related to skin irritation. Direct contact between the worker's skin and the chemicals in it which can cause irritation reactions such as redness, itching, or even wounds on the skin so that PPE must be used when doing the work. Starting a paint machine (compressor), When starting a machine like a compressor, workers need to pay attention to safety aspects, especially in terms of electric current. The process of painting paint media also has health risks that need to be considered. Respiratory distress due to chemical particles from the paint, as well as symptoms such as headaches and irritation of the eyes and skin, can also appear during this process.

Workers who are overexposed to the chemicals in them are also at risk of long-term health problems such as cancer, liver function damage, and chronic skin irritation (Rosidin et al, 2023). Workers also need to pay attention to the movement aspect to avoid injury, muscle pain or even cramps when moving around the drying area can be a health issue to watch out for.

The installation of the canopy frame has the potential for movement, gravity, mechanical, and radiation hazards. When performing this task, the risk of accidents such as falls, tremors in the hands, as well as pain in the back and other muscles, respiratory problems, and visual impairments. The danger of movement depends on the situation in which the worker's hand is performing the movement in the installation process. This can cause injuries to the arms and pain in the back and other muscles. In addition, mechanical and radiation hazards must also be considered. Workers must be careful to avoid these risks, these risks must be eliminated and managed properly. It is important for workers to pay attention to security, safety and comfort while carrying out these tasks.

b. K3 Risk Assessment in Canopy Making Activities

Based on direct observation and comparing with standards (AS/NZS 4360:2004) The results of the level of risk showed that the results of the risk level in iron cutting were 2 high risks (high risk), 5 medium risks (moderate risk), 2 high risks, namely hearing loss and feet being hit by iron. The sound produced in the process of cutting iron with a grinder can cause hearing loss, in the process of moving iron that has been cut there is a risk that the foot is hit by the iron which can cause the foot to be injured. In addition, in the process of cutting iron, the risk of cutting hands can also occur. Based on research (Fadhilah et al, 2024) The risk of cut hands occurs in iron-cutting activities in the process of making machetes.

Based on direct observation and comparing with standards (AS/NZS 4360:2004) In welding activities, the results of the level of risk were obtained, showing that the results of

the level of risk in welding were 4 high risks, and 4 medium risks. These results highlight the importance of implementing effective risk mitigation measures in welding activities. High risk requires special attention and strong preventive measures to minimize the possibility of failure or incident. This encourages the importance of proper training for workers, the safe use of equipment, and strict monitoring of the welding process.

Based on direct observation and comparing with standards (AS/NZS 4360:2004) In the welding smoothing activity, the results of the level of risk were obtained, showing that the results of the risk level in the smoothing of the welding results were 2 high risk, and 3 medium risk. 2 high risks include eye irritation and pain in the back and other muscles. When performing the smoothing process with a grinding machine, small iron flakes are at high enough risk of getting into the eyes so that they can cause irritation or even worse conditions in the eyes. When doing the process of smoothing posture in a poor position, namely lowering the head and squatting which is done repeatedly which can cause pain in the back and other muscles, besides that the danger of exposure to dust can also cause respiratory problems. Based on research conducted by (Fitri et al, 2019) Exposure to iron dust with an increased risk of lung cancer, inhaled iron particles can damage lung tissue and trigger the growth of cancer cells.

Based on direct observation and comparing with standards (AS/NZS 4360:2004) In the painting activity, the results of the level of risk were obtained, showing that the results of the level of risk in painting were 2 high risk, and 4 medium risk. Inhalation of fumes or vapors from paint materials can cause respiratory irritation. This can lead to symptoms such as shortness of breath, coughing, or even asthma. Chemicals in paints, such as lead, mercury, or volatile organic compounds (VOCs), can cause poisoning if inhaled in large amounts or exposed for long periods of time. This poisoning can affect organs such as the liver, kidneys, and nervous system. Continuous exposure to paint materials can increase the risk of serious diseases such as lung cancer, impaired liver function, or other health problems (Primadina, 2021).

Based on direct observation and comparing with standards (AS/NZS 4360:2004) In the canopy installation activity, the results of the level of risk were obtained, showing that the results of the risk level in the installation of the canopy were 5 high risks, and 4 medium risks. One of the main hazards faced by workers when installing a canopy is fall injuries. Workers may need to work at significant heights, and without appropriate safety equipment, the risk of falls becomes very high. Installing a canopy involves manipulating heavy and bulky building materials, such as iron, wood, galvalum or glass. Workers are at risk of experiencing tremors in the hands when drilling walls and respiratory problems when welding canopy frames.

c. Evaluation of K3 Risk in Canopy Making Activities

Risk evaluation can be used as an alarm to improve work processes that require priority handling. In canopy making activities, there are dangers and risks that require attention and need to be acted upon as soon as possible.

In the process of cutting iron that requires immediate attention and handling, there are noise hazards and gravity hazards because judging from the results of the risk assessment, these two hazards are included in the high risk category (high risk) cannot be tolerated. Noise hazards can cause workers to experience hearing loss and for gravity hazards, workers can experience the risk of their feet being hit by iron. Furthermore, the handling is carried out on the moderate risk category, there are 5 hazards that are included in the moderate risk category, including electrical, mechanical, and movement hazards.

The iron welding process, hazards and risks that require attention and handling as soon as possible (high risk) as many as 4 are gravity, mechanical, radiation, and movement hazards. Based on research (Koreanwan & Basuki, 2019) After determining the risk rating, the actions that can be taken in dealing with the risk with a risk evaluation. Based on the results that are included in the high risk category, it must be a priority for improvement. Then for risks in the moderate risk category, there are 4 of them, namely electrical hazards, and movement.

The iron refining process, hazards and risks that require an action and handling as quickly as possible (high risk) as many as 2 are movement and mechanical hazards that can cause workers to experience pain, low backpain and eye irritation. This is in line with research (Tjahayuningtyas, 2019) that in the informal sector work is still carried out with manual handling and when interviewed, the workers complained of pain in the back and hands. This is because work that is done repeatedly in an unergonomic body position is carried out for a long time. So there is a need for quick handling and action by implementing ergonomics in the workplace to reduce workload. As for the risk in the moderate category, there are 3, namely electrical hazards, gravity and movement.

The painting process, hazards and risks that require handling as quickly as possible and need more attention (high risk) there are 2 are movement and chemical hazards that can cause skin irritation and respiratory problems due to inhalation of paint. This is in line with research (Zumala, 2023) Thinner, paint and clear chemicals in the painting process have a strong odor and can irritate workers' skin, plus workers still lack awareness to use personal protective equipment. Skin contact with paint, thinner and clear can cause contact dermatitis irritation (dry and cracked skin). Exposure to thinners can cause headaches, dizziness, irritation of the eyes, nose and throat, reproductive problems and cancer. As for the risks in the medium category, there are 4 of them, namely chemical, electrical, and movement hazards

In the process of installing a canopy at the location of hazards and risks that require immediate action (high risk) as much as 5 are movement hazards, and mechanics because they can cause workers to experience complaints of soreness in the back, in addition to the risk of mechanical hazards can cause workers' hands to experience tremors. As for the moderate risk category, there are 4 of them, namely mechanical hazards, radiation, and movement.

Based on research, in the canopy making activity in the welding workshop, it can be known that there has never been an evaluation of K3 risk, which can be seen from the control efforts that are not optimal. In the canopy making activity, a total of 20 moderate risks were obtained so that the risk can still be tolerated but action or handling is needed so that the risk can be reduced, and 15 high risks (intolerable) so that attention is needed to take action or handle as soon as possible. The Arivlas workshop must take action as soon as possible to reduce the level of risk of work loss and be prioritized to handle 15 high risks which are then continued to handle 20 moderate risks. According to the results of observations and interviews, the workshop has not known the dangers and risks in depth so that the actions or efforts they take to reduce the level of risk have not been maximized due to the limitation of this information.

d. K3 Risk Control in Canopy Making Activities

Gravity hazard refers to the risks associated with lifting heavy objects or working at height. Gravity hazard control measures include using equipment such as forklifts or mini cranes to lift heavy objects, using ropes to lift, or creating emergency wheels for easier transportation. Administrative controls such as creating Standard Operating Procedures (SOPs), installing warning signs, and using personal protective equipment (PPE) such as safety helmets, gloves, and shoes are essential to reduce risk.

Movement hazards involve risks associated with excessive physical movement that can lead to injury. In order to control the danger of movement, it is necessary to set the working rhythm due to the unergonomic posture when working, then it is recommended to use equipment such as forklifts or mini cranes for heavy lifting tasks, and implement safe lifting practices such as using ropes or improvised wheels. Administrative controls such as creating SOPs, displaying warning signs, and ensuring workers wear appropriate PPE such as gloves and safety shoes are essential in managing these risks.

Mechanical hazards involve risks associated with machinery and equipment. Mechanical hazard control measures include replacing hand grinding machines with seated grinding machines, adding guards to grinding wheels, and labeling hazardous equipment. Workers should wear gloves, welding goggles, welding masks, masks, earplugs and safety shoes to protect themselves from danger.

Chemical hazards involve the risks associated with exposure to hazardous chemicals. Chemical hazard control measures include using suction blowers during activities

involving chemical fumes, displaying warning signs, and using respirators designed for chemical protection. Administrative controls such as creating SOPs, displaying warning signs, and ensuring workers wear appropriate PPE are essential in managing these risks.

Noise hazards are related to the risk of excessive noise levels in the workplace. Noise hazard control measures include replacing regular compressors with electric compressors, adding noise suppression devices to compressors. Workers must use earplugs to protect themselves from hearing damage caused by noise. Administrative controls such as creating SOPs, displaying warning signs, and ensuring workers wear appropriate PPE are essential in managing these risks.

Radiation hazards are related to the risk of exposure to ultra violet rays during the welding process. Radiation hazard control measures are administrative controls such as making welding SOPs, and workers must use personal protective equipment such as welding goggles or masks, masks, gloves and safety shoes.

Electrical hazards are related to the risk of the flow of electric current either on the cable or the machine used. Electrical hazard control measures are by replacing roller cables that have been exposed or injured, making power outlets in several areas that require electricity, administrative control by making signs for dangerous areas, and lastly, workers must use PPE such as gloves and safety shoes.

The remaining risks are the risks that remain after control efforts are carried out to find out whether the control recommendations given are effective or not. The control recommendations provided by the researcher are expected to be precise and effective so that they can reduce the level of risk.

4. Conclusion

The process of making canopies at the Arivlas Workshop in Bantul Regency has a high potential for hazards and risks to occupational safety and health, the dangers contained in canopy making activities are the dangers of movement, gravity, mechanical, electrical, chemical, noise, and radiation. With the risk of hearing loss, feet hit by iron, scratches, electric shocks and the risk of inhaling chemicals such as paint and dust from polishing results.

In the canopy making activity, a risk assessment of 20 risks is included in the medium risk category so that an action or treatment is needed so that the risk can be reduced, and 15 high risks so that attention is needed to take action or handle as soon as possible.

In the canopy making activity, a risk assessment of 20 risks in the medium risk category (moderate risk) can still be tolerated but action or handling is needed so that the risk can be reduced, and 15 high risks (high risk) are unacceptable so attention is needed to take action or handle as soon as possible.

The control recommendations given by the researcher in the canopy making process are that there are hazards of movement, gravity, mechanic, electricity, chemistry, noise, and radiation. Control is carried out by means of elimination, substitution, engineering engineering, administration, and PPE. It is hoped that the control recommendations given can be carried out and can minimize hazards and risks in the manufacturing process

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