

A Systematic Approach to Enhancing Occupational Safety and Health Management using Job Safety Analysis

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ABSTRACT

Occupational Safety and Health is an important aspect in preventing accidents and protecting the health of workers, especially in high-risk work environments. Every production activity has the potential for hazards that can cause injury if not controlled properly. This research was carried out at PT Kereta Api Indonesia (Persero) Balai Yasa Kiaracondong Bridge unit with the object of the Pen Puller manufacturing process. The production stages include material removal, cutting, perforation, welding, smoothing, painting, and packaging that contain potential physical, mechanical, chemical, and ergonomic hazards. The method used is Job Safety Analysis (JSA) through the identification of work steps, determination of potential hazards, and the preparation of risk control measures.. The results of the study show that JSA is effective in helping to identify hazards and improve the implementation of K3. Companies are advised to increase supervision of the use of personal protective equipment and conduct regular JSA evaluations.

Keywords: *Occupational Safety and Health, Job Safety Analysis, Potential Hazards, Pen Puller*

INTRODUCTION

Every activity carried out by workers in the work environment basically has a risk of safety and health hazards. Therefore, the implementation of Occupational Safety and Health (K3) is one of the important efforts in providing protection against various potential hazards, so that every individual who is at work can remain in a safe and healthy condition. Occupational health itself is a protective measure for employees to prevent work accidents that are generally related to the use of machines, work equipment, work environment conditions, and work implementation procedures (Robi Rojaya Simbolon et al., 2024).

PT Kereta Api Indonesia (Persero), or known as PT KAI, is one of the State-Owned Enterprises (SOEs) engaged in the railway transportation sector that plays an important role in the national transportation system. As the only railway operator in Indonesia, PT KAI is responsible not only for running train operations, but also for maintaining and maintaining various supporting infrastructure such as rails, stations, and bridges. (Siti et al., 2024)

One of the important units that supports the smooth operation of PT KAI is Balai Yasa Jembatan Kiaracondong, which is located in the city of Bandung. This unit is under the Directorate of Infrastructure of PT KAI and is primarily responsible for maintenance, repair, and reconditioning of railway bridges in certain operational areas. The work

process at this building center involves various heavy technical activities, such as welding, metal cutting, lifting heavy components, and work at heights and open areas. These activities carry high risks related to occupational safety and health (K3).

In daily activities, workers face risks such as falling from heights, being exposed to metal debris, exposure to noise, and the use of heavy and high-voltage equipment that has the potential to cause serious accidents if not handled with proper occupational safety procedures. Although PT KAI has implemented Occupational Safety and Health (K3), there are still a number of shortcomings in the field, especially related to the existence and implementation of Standard Operating Procedures (SOP) which have a very important role because they function as guidelines in forming an organized, systematic, and accountable work system and workflow. (Siti et al, 2024) Some work activities that have high potential hazards have not been fully supported by SOPs that are clear, detailed, and easy to understand for all workers. This condition causes many workers to be less aware of the importance of implementation (K3) in each of their tasks, so the implementation of the K3 system is often ignored.

Job Safety Analysis or JSA is a safety management method that focuses on eliminating hazards and controlling hazards related to the series of work to be done (Ardani, N. C., & Waluyo, M., 2025). Job Safety Analysis (JSA) is an appropriate method to address workplace safety issues because it allows potential risks to be analyzed systematically so that control measures can be determined before work begins. Based on this, the research was conducted at PT. KAI Balai Yasa Kiaracondong Bridge to identify potential hazards and determine proper control measures in the Pen Puller production process. This study also provides a scientific contribution by showing how JSA can be applied in a structured way to improve hazard identification and risk control based on actual field conditions, thereby supporting the implementation of Occupational Health and Safety (OHS).

LITERATURE REVIEW

Every activity carried out by workers in the work environment has potential risks to occupational safety and health. (Ningsih & Ferijani, 2020). Therefore, the implementation of occupational safety and health (K3) is very important to control various sources of danger that may arise (Tawaddud, 2020). With a good implementation of K3, all individuals in the workplace can work in safe and healthy conditions, free from environmental pollution, and protected from the risk of work accidents, so that ultimately they are able to increase work efficiency and productivity (Robi Rojaya Simbolon et al., 2024).

Work accidents not only cause injuries and even deaths, but also cause material losses for both workers and the company, and can hinder the smooth production process. Occupational safety is one of the efforts made to protect workers from the risk of accidents, especially those related to the use of machines, work equipment, environmental conditions, and work procedures (Walidah et al., 2024). In addition, attention to worker health also plays an important role in reducing the risk of accidents, because the aspects of K3 are interrelated in efforts to prevent accidents in the workplace. (Asrianti Askar et al., 2022)

According to the World Health Organization (WHO), occupational safety and health is a series of efforts that aim to improve and maintain the physical, mental, and social health conditions of workers at an optimal level in all sectors and types of work. In addition, K3 also functions as a preventive measure to avoid health problems that may arise due to activities or work environment conditions. Thus, occupational safety and health can be interpreted as protection for workers to avoid risks that can endanger their health while carrying out their duties.

Job Safety Analysis (JSA) is a systematic technique designed to identify potential hazards related to a specific task or job (Nugraha & Riandadari, 2022). In this process, the risks that may arise will be evaluated, then appropriate control measures are taken to reduce or eliminate these risks. This process involves a detailed analysis of each step of the job to recognize the hazards that exist and develop safe work procedures to prevent accidents and injuries in the workplace.

JSA is very important to be applied especially to types of work that have a medium to high level of risk, newly introduced jobs, or routine jobs that have undergone changes in both work procedures and the use of work tools (James, 2018). By implementing JSA, potential hazards can be identified early so that appropriate control measures can be taken immediately to prevent accidents. In addition, JSA is also very useful in the process of following up on the results of investigation of work incidents or accidents, so that the cause of the problem can be identified and corrected.

It also helps in updating and improving standard operating procedures (SOP) related to work safety, therefore the work environment becomes safer and the risk of accidents can be effectively minimized. Thus, the implementation of JSA not only maintains the safety of workers, but also helps to increase work efficiency and productivity.

Job Safety Analysis (JSA) not only functions as an effort to prevent work accidents that have the potential to endanger worker safety, but also plays a role in maintaining the condition of work equipment to remain safe and functioning properly and avoid damage that can hinder operational activities. According to the National Safety Council (NSC), the JSA consists of several important components that need to be considered thoroughly, including the identification of potential hazards, the assessment of the level of risk that may arise, and the implementation of appropriate control measures. Therefore, JSA can be said to be a comprehensive instrument, not only to ensure labor safety, but also to maintain the reliability of equipment and the sustainability of work processes, so as to be able to increase productivity and reduce costs incurred due to accidents and equipment damage.

METHODOLOGY

This research was conducted on the Pen Puller production process at Balai Yasa Kiaracandong Bridge, which consists of several stages from material preparation to final packaging, each with different potential hazards. Therefore, risk identification and analysis were carried out using the Job Safety Analysis (JSA) method to identify hazards and determine appropriate control measures. Data were collected through direct observation and interviews with operators and supervisors, conducted 5 times over a period of 3 weeks, involving 5 operators and 2 supervisors, ensuring that the data reflected actual working conditions in the field. This method also helps increase workers' awareness of potential hazards and supports accident prevention efforts in the workplace. In conducting a potential hazard analysis using the Job Safety Analysis (JSA) method, there are four basic steps carried out in this study, which are as follows:

1) Determine the work to be analyzed

The initial step is taken by determining the object of work to be analyzed, namely the Pen Puller production process. The selection of this job is based on a fairly high level of risk because it involves the use of machines such as cranes, cutting machines, drilling machines, bending machines, welding machines, and grinders that have the potential to cause work accidents.

2) Break down the work into basic steps

The Pen Puller production process is then described into systematic work stages, namely the stages of preparation, measurement, cutting, perforation, bending, welding, smoothing, assembly, painting, drying, inspection, and packaging. The elaboration of work steps is carried out through direct observation in the field and discussions with workers to ensure conformity with actual conditions in the production area.

3) Identify potential hazards at each step of the job

After the work steps are described, the identification of potential hazards is carried out at each stage. Potential hazards found include mechanical hazards (pinching, cut, being struck by materials), physical hazards (noise, welding radiation), chemical hazards (exposure to welding fumes and paint vapors), and ergonomic hazards (inappropriate working positions). This identification aims to find out the source of danger that can cause work accidents and health problems.

4) Develop hazard control efforts

The final stage is to determine the appropriate control measures based on the principle of the hazard control hierarchy. Recommended control efforts include the use of personal protective equipment (PPE) such as helmets, gloves, safety shoes, protective glasses, respirator masks, welding aprons, and earplugs, as well as the implementation of Standard Operating Procedures (SOP), increased work supervision, and improved working environment conditions.

Through these stages, the Job Safety Analysis (JSA) method is used as a tool to systematically identify and control potential hazards to minimize the risk of work accidents and improve the implementation of occupational safety and health (K3) in the Kiaracandong Bridge Yasa Building.

DISCUSSION

Based on direct observation and the preparation of Job Safety Analysis (JSA) on the Pen Puller production process at PT Kereta Api Indonesia (Persero) Balai Yasa Kiaracondong Bridge unit, it was found that each stage of work has different potential hazards, identified by outlining work steps, determining hazards, their impacts, and appropriate control measures. The risks occur due to factors such as lack of machine protection, unsafe work practices, and low worker awareness; for example, the risk of cuts arises from direct contact with sharp machine components. Control measures such as the use of Personal Protective Equipment (PPE), safe work procedures, and supervision are effective because they reduce exposure to hazards and minimize the likelihood of accidents, thereby supporting the principles of Job Safety Analysis (JSA) and Occupational Health and Safety (OHS). The production process consists of several stages, ranging from preparation to packaging, and each stage has potential hazards such as being struck by materials, getting pinched or cut by machinery, and exposure to heat. This is in line with Occupational Health and Safety (OHS) theory, which states that every job has risks that must be controlled. Through the Job Safety Analysis (JSA) method, each task can be analyzed to identify hazards and determine appropriate control measures, such as the use of Personal Protective Equipment (PPE), safe work procedures, and supervision, demonstrating that JSA is effective in supporting the implementation of OHS. Each of these stages is then arranged in a format. Job Safety Analysis (JSA) to identify potential risks and determine appropriate control measures, as shown in the following Table:

Table 1. Job Safety Analysis of Pen Puller production

JSA-Job Safety Analysis Worksheet Form			
Job Title: <i>Pen Puller Production</i>		JSA No: 01	Date of Analysis : 20/10/25
		Location: PT. KAI	Revision Date : -
		Kiaracondong Bridge Construction Hall	JSA Revision No : 01
JSA Team Leader		JSA Team Member	Approved By : -
No	Sequential Basic Work Steps	Potential Hazardous Events	Control Actions
Preparation stage			
1	Transporting hollow iron raw materials, pipe iron, steel plates with the help of crane	The raw material fell from the crane hook and fell on the worker. Hit by a load who are Appointed	Using slings and crane hooks that are in good capacity and in good condition. Make sure the material being lifted is balanced. Workers are required to use PPE such as safety helmets, gloves, and safety shoes. Provide safe distance warnings and signs in the lifting area, and only operators have a certificate to operate the crane.
Measurement stage			

1	Measuring the length and diameter of the material	Punctured material end, wrong measurement, unergonomic working position	Using gloves, standard measuring tools, and a workbench according to body height
2	Marking the size with a marker	Repeated accidents due to mismeasurements	Follow the appropriate working drawings.
Cutting Stage			
	Cutting materials with CNC machines and cold saw machine	Cut blade blade, Pinched machine knife, metal fragment hit the eye.	Use protective goggles, gloves and make sure the machine operates normally without any damage.
No	Sequential Basic Work Steps	Potential Hazardous Events	Proposed Control Actions
Hole Level			
1	Punching the material with a milling machine.	Pinched hand, hit by metal fragments	Gloves, protective goggles, and workpiece clamps.
Bending Stage			
1	Bending plates using a bending machine	Pinched fingers	Use gloves and keep your hands away from the pressing area of the machine.
Welding Stage			
1	Welding iron bodies, handles, and hook holders	Sparks hit the eyes, welding light radiation hit the eyes, contaminated welding fumes	Always use a welding helmet,. Welding aprons and welding gloves.
Refinement stage			
1	Grinding welds, sharp edges, and uneven surfaces.	Metal splashes on the eyes, hearing loss due to noise, incision wounds on the hands	Use goggles, gloves, safety shoes and earplugs.
Assembly Stage			
1	Assemble iron bodies, pipe handles, hook holders already welded with hooks, nuts and bolts.	The hand is pinched when tightening the component, the hand is scratched by the sharp iron edge, the	Use gloves, safety shoes, use a fitting wrench that fits the size so that it does not slip.

		component falls on the foot.	
Painting Stage			
1	Painting the entire section with a spray gun	Inhalation of paint vapors, irritation of the skin and eyes	Use respirator masks, gloves, protective goggles, protective helmets.
Drying Stage			
1	Drying the paint in the drying chamber	Slipped due to paint spill	Use safety shoes, Keep floors dry and clean from paint spills
No	Sequential Basic Work Steps	Potential Hazardous Events	Proposed Control Actions
Examination stage			
1	Checking the size, strength of the connection, and the function of the hook	Hands are pinched, products fall on the feet	Use gloves, safety shoes, protective helmets. Hold the product in a stable position.
Packaging Stage			
1	Wrap the Pen Puller in plastic, put it in a box, and then arrange it into a wooden crate.	Hand scratched by cutter when cutting plastic or cardboard, hand pinched when stacking into a wooden crate, slipped.	Use gloves, safety shoes, and protective helmets. Arrange wooden crates neatly and stably so that they do not collapse. Ensure the packing area is clean and non-slippery to prevent slipping.

Source: (Risk et al., 2023)

CONCLUSION AND RECOMMENDATION

Based on the results of the Job Safety Analysis (JSA) on the process of making Pen Pullers at PT. KAI Balai Yasa Kiaracandong Bridge, it can be concluded that each stage of production, from preparation to packaging, has different potential hazards, including mechanical, physical, chemical, and ergonomic risks that can cause work accidents if not controlled properly. The results of the JSA show that most of the risks can be minimized through the implementation of safe work procedures, the use of appropriate personal protective equipment (PPE), and good work environment management. However, there are still workers who have not used PPE completely, which has the potential to increase the risk of accidents. Therefore, it is necessary to increase supervision and discipline in the use of PPE, the implementation of regular socialization and K3 training, as well as regular evaluation and update of the JSA in order to create a safer, more comfortable, and productive work environment.

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