

Identification of Work Accidents at PT. Plantation Nusantara IV Using the Job Safety Analysis Method

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Abstract

The development of industry in Indonesia is currently taking place very rapidly along with the advancement of science and technology. The development of science and technology has made the use of production tools increasingly complex. Every year there are more than 250 workplace accidents and more than 160 million workers become ill due to workplace hazards. Based on the results of a preliminary survey at PKS PTPN IV Air Batu, by conducting observations, literature studies and interviews with employees, it is known that there were 17 work accidents based on the recapitulation data of work accidents for the 2023 period. Based on this description, the researcher chose the Job Safety Analysis method. The work station in the boiler factory area is the part that has the most potential for accidents based on the analysis of potential accident risks that occur and requires serious treatment and mitigation measures. The potential hazards include burns, gas poisoning, boiler explosions due to component failure, noise, burning by residual steam, slipping due to slippery work floors. This is because workers are very close to hot objects from the boiler, the combustion of the boiler's fuel shell and the slippery work floor. The hazard controls carried out include workers being required to use complete PPE, good ventilation, routine inspection of safety valves, periodic pressure monitoring, routine maintenance, limiting maximum pressure, preventive maintenance, sound insulation, cooling the boiler gradually, using non-slip footwear, waiting until the boiler is completely cool, using complete APD.

Keywords: PPE; Boiler; Job Safety Analysis; Occupational Safety and Health (K3); PTPN IV

Introduction

Plantation Nusantara IV abbreviated as PTPN IV was established based on government regulation No. 9 of 1996, is the result of the merger of 3 State-Owned Enterprises (BUMN), namely PT. Plantation VI (Persero), PT. Plantation VII (Persero), and PT. Plantation VIII (Persero) as stated in the deed of establishment of the sole proprietorship PT. Plantation Nusantara IV No. 37 dated March 11, 1996 made before Notary Harun Kamil, SH, Notary in Jakarta, whose articles of association have been approved by the Minister of Justice of the Republic of Indonesia as referred to in the decree number: C2-8332.HT.01.01.Th.96 dated August 8, 1996 and has been announced in the State Gazette of the Republic of Indonesia dated October 8, 1996 Number 81 and Supplement to the State Gazette No. 8675. PT. Nusantara IV Plantation is located in Emplasmen Area, Air Batu District, Asahan Regency, North Sumatra Province. It is precisely located 50 km from the North Sumatra Trans-Sumatra Highway.

The development of industry in Indonesia is currently very rapid, along with the progress of science and technology. The development of science and technology has made the use of production tools increasingly complex. The more complex the equipment used, the greater the potential dangers that may occur and the greater the work accidents that arise if the handling and control are not carried out as well as possible [1].

Every year there are more than 250 workplace accidents, and more than 160 million workers become ill due to workplace hazards. Moreover, 1.2 million workers die from workplace accidents and illnesses. The figures show that the human and social costs of production are too high [2]. In Indonesia, the number of workplace accidents is still very high and increasing. BPJS Ketenagakerjaan data on cases of workplace accidents in 2014 showed 12,894 cases; in 2015 there were 110,285 cases; in 2016 there were 110,272 cases; and 123,000 cases of workplace accidents in 2017. 4 The cause of these

workplace accidents is the suboptimal supervision and implementation of K3 and K3 behavior in the workplace, as attached in Appendix VI [3].

Meanwhile, the work activities that take place at PKS PTPN IV Air Batu are carried out in accordance with official K3 standards. However, in its implementation by employees it is still far from the applicable standards so that it has the potential to be dangerous for workers. Based on the results of a preliminary survey at PKS PTPN IV Air Batu, by conducting observations, literature studies and interviews with employees, it is known that there were 17 work accidents based on the 2023 work accident recap data.

Based on the description, the researcher chose the Job Safety Analysis method because this method uses four simple stages and identifies hazards related to a person's work activities and to develop the best control to reduce risk and moreover at PTPN. IV Air Batu has never been carried out hazard identification and risk assessment using the JSA method, therefore the author is interested in conducting research related to hazard identification using the JSA method at PTPN. IV Air Batu Kab. Asahan, North Sumatra Province

Literature review

Human Resource Management (HRM) is the recognition of the importance of an organization's workforce as a vital human resource in contributing to organizational goals and the use of several functions and activities to ensure that these human resources are used effectively and fairly for the benefit of individuals, organizations, and society [4].

Meanwhile, in its meaning as a policy, HR is intended as a means to maximize the effectiveness of the organization in achieving its goals. In this context, HR is defined with the following description: Human resource management (HRM) comprises a set of policies designed to maximize organizational integration, employee commitment, flexibility, and quality of work [5]. The policies taken by the organization in managing its HR are directed at unifying organizational elements, employee commitment, organizational flexibility in operating, and achieving maximum quality of work results.

Occupational Safety and Health, commonly called K3, is an element in the employment system that has an important role in the sustainability of the economy in the workplace or work unit. The guarantee of the implementation of K3 is stated in Law Number 1 of 1970, which states that every worker has the right to receive protection for their safety in carrying out work for the welfare of life and increasing national production and productivity. This aims to ensure the safety of everyone in the workplace and ensure the use and utilization of production sources safely and efficiently. So that efforts are needed to realize this by providing guidance on work protection norms in the law in accordance with the development of society, industrialization, engineering, and technology. In its development, the Occupational Safety Law is accompanied by a Supplement to the State Gazette Number 2018 and other binding and interrelated laws and regulations [6].

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1. Provide everyone with a common understanding of what to do to do the job safely.
2. An effective training tool for new employees
3. Key elements can be included in safety checklists, pre-job briefings, safety observations, and as topics at safety meetings.
4. Assist in writing safety procedures for new or modified types of work.

Method

To conduct this research, the author first conducted field observations at PT. Plantation Nusantara IV Air Batu, Asahan Regency, Sumatra, Indonesia. And then formulate a conflict that occurs in the field so that the research carried out can run smoothly using the desired objectives. The formulation of the problem is adjusted to field observations, namely K3 research using the JSA method. Furthermore, the researcher sets research objectives so that researchers remain focused on finding data. Then the data collection stage, where researchers take data from interview data with workers (primary data) and work accident recap data in 2023 (secondary data) at PT. Plantation Nusantara IV Air Batu. Furthermore, data

processing is where researchers determine the type of work, describe the work and potential hazards in the plantation area, describe the work and potential hazards in the factory area, and perform hazard control. The research period was carried out for 1 month, starting from July 15 to August 15, 2024.

The type of research conducted by the author is Job Safety Analysis (JSA), which is an analysis technique used to identify hazards in work and develop ways to reduce the risk of accidents. This method aims to expect workers to play an active role in implementing JSA so that it can instill workers' concern for their work environment conditions in order to create safe work environment conditions and minimize unsafe conditions.

Results and Discussion

1. data collection

The data was obtained from the analysis of work accident history in the factory in the period 2023 – July 2023. This can be seen in Table 1 as follows:

Table 1. Work Accident Data 2023

Accident Place	Source of Accident	Cause of Accident
Plantation Area	Work tools	Outdated tools
	Work traffic	Road access is not smooth
	Pesticides	.Equipment is not up to standard
Boiler Station (Steam Boiler)	Boiler Explosion	Excessive steam pressure due to safety valve failure, scale buildup on boiler walls, or operating errors.
	Falling	
	Hit by an object	
	Burns	
Sterilizer Station	Falling	Slippery floor due to oil spill
	Exposed to hot steam	Capstan sling connection
	Exposed to hot iron	Stairs without handrails

2. Data Processing

2.1 Determining the Type of Job

Work activities are divided into two work areas with different types of activities, namely the plantation and factory areas. The identified work activities were carried out at PT. Plantation Nusantara IV Air Batu Regional II with safety analysis on workers in the plantation area and workers in the factory area (sterilizer, hoisting crane, and boiler work stations).

2.2 Describe the work and potential hazards in the garden area

The palm oil plantation area is where palm fruit is developed until it is ready to be harvested. In it, there are worker activities that are very prone to the danger of work accidents caused by humans and the work environment itself. The identification of hazards caused by work activities in the plantation area can be seen in Table 2 as follows:

Table 2. Identification of Occupational Safety Hazards at Work Stations in the Garden Area

Activity Sequence	Current Conditions	Potential Dangers
Fresh Fruit Bunch (FFB) Harvest	Workers climb trees using nails or ladders, carry fresh fruit bunches manually, and sometimes work in extreme weather.	Falling from trees, injuries caused by being hit by fresh fruit bunches, injuries caused by harvesting tools, insect stings, dehydration, fatigue, skin diseases.
Transportation of TBS	TBS is transported using two-wheeled or four-wheeled vehicles,	Traffic accidents, being crushed by a load, being trapped, slipping, spinal injuries.
Fallen Fruit Collection	Workers pick up fallen fruit from the ground, often in a	Back injuries, knee injuries, snake bites, insect stings, skin diseases.

	hunched or crawling position.	
Land Clearing	Workers use heavy and manual tools	Work accidents due to use of heavy equipment, being hit by a tree, injuries

2.3 Describe the Jobs and Potential Hazards in the Factory Area

The identification of hazards arising from sterilizer work activities can be seen in Table 3.5 as follows:

1. Work Activities at the Sterilizer Work Station

is a tool used in the process of boiling TBS using heat from pressurized steam by convection and conduction. The quality and quantity of results from a PKS are mainly determined by the success of the boiling. The steam used is saturated steam with a pressure of 2.8 - 3.0 kg / cm² with a temperature of 120 - 140 °C which is injected from the Back Pressure Vessel (BPV). This process is very important because it will affect subsequent processes [10]. The identification of hazards caused by sterilizer work activities can be seen in Table 3 as follows:

Table 3. Identification of Occupational Safety Hazards at Sterilizer Work Stations

Activity Sequence	Current Conditions	Potential Dangers
FFB (Fresh Fruit Bunches) that have been weighed and	TBS in large quantities, often still.	Pinched by conveyor, slipped, hit by sharp objects.
Low pressure steam is passed into the sterilizer to soften the fruit flesh.	The temperature inside the sterilizer begins to rise, steam begins to fill the space.	Burns due to contact with hot steam, trapped hot steam.
The temperature and pressure are increased gradually until they reach a peak point.	The temperature and pressure are very high, the conditions inside the sterilizer are very hot and humid.	Boiler explosion, severe burns, gas poisoning, falling into sterilizer.
The ap is removed and cold water is passed through to lower the temperature of the TBS.	The temperature is still high, the floor may be slippery due to steam condensation.	Burns, slips, falls.

2. Work Activities at the Hoisting Crane Work Station Hoisting Crane Work Station is an area in a palm oil mill where cranes are used to lift and move loads, especially Fresh Fruit Bunches (FFB). This crane has an important role in moving FFB from one station to another, such as from the FFB stacking area to the sterilizer or from the sterilizer to the thresher [11]. The identification of hazards arising from Hoisting Crane work activities can be seen in Table 4 as follows.

Table 4. Identification of Occupational Safety Hazards at Hoisting Crane Work Stations

Activity Sequence	Current Conditions	Potential Dangers
The crane operator receives signals from officers in the work area to start or stop crane operations.	Incorrect load attachment, broken sling, overload	Burdened
The crane moves to a position above the load to be lifted. This movement can be horizontal (traveling) and vertical (hoisting).	Crane moving parts, limited working space	Pinched by Crane Part
The crane hook is securely attached to the load (TBS). Make sure the hook is done correctly to avoid the load coming loose.	Slippery floor, no safety features	Falling from a Height
The crane lifts the load slowly and steadily.	Operators must ensure that loads do not shift when lifted, communication signals are not clear	Struck by the Burden
Crane moving load	Load shifts when lifted,	Struck by the Burden



	communication signal is unclear	
The crane lowers the load slowly and carefully.	Strong winds, heavy rain	Accidents Due to Bad Weather

3. Work Activities at the Boiler Work Station (Steam Boiler)

Boiler is a source of potential steam energy to drive turbines and process needs required by the factory. Boiler works by converting heat generated by fuel to convert water into steam, which is then used to drive steam turbines. The identification of hazards caused by Hoisting Crane work activities can be seen in Table 5 as follows.

Table 5 Identification of Occupational Safety Hazards at Boiler Work Stations

Activity Sequence	Current Conditions	Potential Dangers
The process of starting the boiler involves initial checks,	Excessive steam pressure, poor feed water quality	Boiler Explosion
The steam pressure is increased gradually until it reaches the desired level.	Direct contact with hot surfaces	Burns
Boilers are operated at stable pressure and temperature to meet the needs of the production process.	Leakage of combustion gases (CO, CO ₂)	Gas Poisoning
When production is to be stopped, the load on the boiler is gradually reduced.	Slippery floors, unsafe stairs	Fallen

2.4 Hazard Control

1. Control of hazards that occur at the sterilizer work station

The following is the control of the risk of work accidents that occur at the sterilizer work station, which can be seen in Table 6 as follows:

Table 6. Hazard control at sterilizer workstations

Activity Sequence	Current Conditions	Potential Dangers	Hazard Control
TBS Receipt	TBS in large quantities, often dirty	Pinched by conveyor, slipped, hit by sharp object	Use safety shoes, gloves and helmet. Make sure the conveyor is functioning properly and the work area is clean.
Preheating	The temperature starts to rise, steam	Contact burns	Use complete PPE
Main Boiling	Very high temperature and pressure	Boiler explosion, severe burns, gas poisoning	Perform regular checks on the boiler, install safety valves,
Cooling	The temperature is still high, the floor may be slippery due to steam condensation.	Burns, slips, falls	Use complete PPE, make sure the floor is dry, put up wet area warning signs.

2. Controlling hazards that occur at the Hoisting Crane work station The following is the control of the risk of work accidents that occur at the Hoisting Crane work station, which can be seen in Table 7 as follows:

Table 7. Hazard control at Hoisting Crane work station

Activity Sequence	Current Conditions	Potential Dangers	Hazard Control
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Signal Reception	The operator receives signals via radio, lights, or hand signals.	Unclear communication, misinterpreted signals	Use a clear two-way communication system, good operator training.
Crane Movement to Initial Position	Cranes move on rails or tracks.	Crane collides with another object, uneven track	Check the path before surgery, set physical boundaries, pay attention to the surroundings.
Load Assignment	The lifting cup is attached to the load.	Incorrect hook-up, load comes off, sling breaks	Use appropriate sling straps.
Load Lifting	The load is lifted vertically.	Swinging load, pinched load, overload	Lift the weight slowly and steadily
Load Transfer	Loads are moved horizontally or in combination.	Loads hitting building structures, falling loads	Make sure the path is free from obstacles, pay attention to safe distance.
Load Reduction	The load is lowered to the specified location.	Falling load, damage to goods.	Lower the load slowly and carefully, making sure the lowering area is safe.
Load Shedding	The lifting cup is removed from the load.	Sudden release of load, injury to operator.	Make sure the load is completely stable before removing it, use additional locking devices if necessary.

3. Control of hazards that occur at the Boiler work station The following is the control of the risk of work accidents that occur at the sterilizer work station, which can be seen in Table 8 as follows:

Table 8. Hazard control at Boiler workstations

Activity Sequence	Current Conditions	Potential Dangers	Hazard Control
Boiler Start-up	Temperature rises, pressure rises, fuel ignites	Burns, gas poisoning, boiler explosions	Use complete PPE, good ventilation, inspection routine, safety valve
Increase in Steam Pressure	The pressure continues to increase,	Boiler explosion, component failure	Monitor pressure regularly, maintenance
Stable Operation	Stable temperature and pressure, vibration	Burns, noise,	Preventive maintenance, sound insulation,
Load Reduction	Pressure and temperature start to drop, components start to cool	Burned by residual steam, slipped	Cool the boiler gradually, use non-slip footwear.
Boiler Shutdown	Temperature drops drastically, components are in a cold state	Burned by residual steam, slipped	Wait until the boiler is completely cool, use complete PPE

The data analysis carried out based on previous data processing can be seen as follows:

1. The types of work analyzed include two areas, namely the areaplantation and factory areas (sterilizer, hoisting crane, and boiler).
2. The potential hazards at the garden area work station include falling from tree, injury due to being hit by TBS, ludue to harvesting equipment, insect stings, dehydration, fatigue, skin diseases. With preventive measures taken is to

improve the quality and quantity of personal protective equipment during work.

3. There are potential hazards at work stations in the factory area. include being pinched by the conveyor, slipping, being hit by sharp objects. The precautions taken are to use safety shoes, gloves and a helmet. Make sure the conveyor is functioning properly and the work area is clean.
4. There are potential hazards at work stations in the factory area. includes unclear communication and misinterpreted signals. With the precautions taken are Use a clear two-way communication system, good operator training.
5. There are potential hazards at work stations in the factory area. includes burns, gas poisoning, boiler explosions. With the precautions taken are using complete PPE, good ventilation, routine checks, safety valves.

The work station in the boiler factory area is the part that has the most potential for accidents based on the analysis of potential accident risks that occur and requires serious treatment and mitigation measures. The potential hazards include burns, gas poisoning, boiler explosions due to component failure, noise, burning by residual steam, slipping due to slippery work floors. The boiler work station is one of the crucial parts of factory production activities where the environment around the work area must always follow strict K3 procedures. This is because workers are very close to hot objects from the boiler, the combustion of the boiler's fuel shell and the slippery work floor. The hazard controls carried out include workers being required to use complete PPE, good ventilation, routine inspection of safety valves, periodic pressure monitoring, routine maintenance, limiting maximum pressure, preventive maintenance, sound insulation, cooling the boiler gradually, using non-slip footwear, waiting until the boiler is completely cool, using complete PPE.

Conclusion

Workstations in the boiler factory area are the most potential accident areas based on the analysis of potential accident risks that occur and require serious treatment and mitigation measures. The potential hazards include burns, gas poisoning, boiler explosions due to component failure, noise, burning by residual steam, slipping due to slippery work floors.

The potential hazards at the garden area work station include falling from tree, injury due to being hit by TBS, ludue to harvesting equipment, insect stings, dehydration, fatigue, skin diseases. With the precautions taken is to increase the quality and quantity of personal protective equipment during work. And the potential hazards at the work station in the sterilizer factory area include being pinched by the conveyor, slipping, being hit by sharp objects. With the precautions taken is to use safety shoes, gloves, and helmets. Make sure the conveyor is functioning properly and the work area is clean. Potential hazards at the work station in the hoisting crane factory area include unclear communication and misinterpreted signals. With the precautions taken is to use a clear two-way communication system, good operator training. Dangers at the work station in the hoisting crane factory area crane includes unclear communication and sinyal misinterpretation. With the precautions taken are Use a clear two-way communication system, good operator training. The potential hazards at the work station in the boiler factory area include burns, gas poisoning, boiler explosions. With the precautions taken are use complete PPE, good ventilation, routine checks, safety valves.

The recommendations for improvement that can be considered are the improvement and optimization of the Work Procedure Improvement program, Improvement of Safety Equipment, Improvement of Working Conditions, Improvement of Alarm Systems, Ergonomic Control, Safety Training.

Thank-you note

Thanks to the presence of God Almighty, who has given his grace so that I can complete this research. I would like to thank my parents and family who have contributed in their prayers and support to me so that I can maximize my efforts in conducting this research. I would like to thank the rector and his staff and the staff of the faculty of engineering, Malikussaleh University who have provided a forum and facilitated me in administrative and academic matters for the continuation of this research. Thank you to the head of the department and staff who have given direction. I would like to thank the supervisor who gave me input and direction so that I could complete this research. Finally, I would like to say the director, manager, staff, employees of PT. Plantation Nusantara IV Air Batu, and especially to my supervisor, the processing assistant who has given me knowledge and motivation that is constructive. Thank you also to all parties who helped in the preparation of this report that the author cannot mention one by one.

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