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State Islamic University of Sultan Syarif Kasim Riau

MITIGATION OF WORK ACCIDENT RISK USING (HIRARC) AND (JSA) CASE STUDY: TECHNICAL SERVICE DEPARTEMENT OF PT. PLN (PERSERO) ULP EAST CITY PEKANBARU

LAPORAN TUGAS AKHIR

Diajukan Sebagai Salah Satu Syarat Untuk Memperoleh Gelar Sarjana Teknik
Pada Program Studi Teknik Industri Fakultas Sains dan Teknologi Universitas Islam
Negeri Sultan Syarif Kasim Riau

Disusun Oleh:

WULAN CAHYANA PRATIWI
11950224927



UIN SUSKA RIAU

PROGRAM STUDI TEKNIK INDUSTRI
FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI SULTAN SYARIF KASIM RIAU
PEKANBARU
2024



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**MITIGATION OF WORK ACCIDENT RISK USING HIRARC
AND JSA
CASE STUDY: TECHNICAL SERVICE DEPARTEMENT OF
PT PLN PERSERO ULP EAST CITY PEKANBARU**

TUGAS AKHIR

Oleh:

WULAN CAHYANA PRATIWI
11950324927

Telah Diperiksa dan Disetujui, sebagai Tugas Akhir
pada Tanggal 12 Juni 2024

Pembimbing I

Muhammad Nur, S.T., M.Si.
NIP. 198205282023211006

Pembimbing II

Suherman, S.T., M.T.
NIP. 198403012023211013

Mengetahui,
Ketua Program Studi Teknik Industri
Fakultas Sains dan Teknologi
Universitas Islam Negeri Sultan Syarif Kasim Riau

Misra Hartati, S.T., M.T.
NIP. 198205272015032002

UIN SUSKA RIAU




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Oleh:


WULAN CAHYANA PRATIWI
11950224027

Telah Dipertahankan di Depan Sidang Dewan Penguji
sebagai Salah Satu Syarat untuk Memperoleh Gelar Sarjana Teknik
Fakultas Sains dan Teknologi Universitas Islam Negeri Sultan Syarif Kasim Riau
di Pekanbaru, pada Tanggal 12 Juni 2024

Pekanbaru, 12 Juni 2024
Mengesahkan

Ketua Program Studi



Dr. Hartono, M.Pd.
NIP. 196403011992031003


Misra Hartati, S.T., M.T.
NIP. 198205272015032002

DEWAN PENGUJI :

Ketua : Nazaruddin, S.ST., M.T.
Sekretaris I : Muhammad Nur, S.T., M.Si.
Sekretaris II : Suherman, S.T., M.T.
Anggota I : Muhammad Ihsan Hamdy, S.T., M.T.
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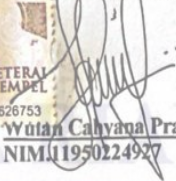
Nama : Wulan Cahyana Pratiwi
NIM : 11950224927
Tempat/Tanggal Lahir : Pekanbaru, 25 November 2000
Fakultas : Sains dan Teknologi
Program Studi : Teknik Industri
Judul Skripsi : Mitigation of Work Accident Risk Using (HIRARC) and (JSA) Case Study: Technical Service Department of PT. PLN (PERSERO) ULP Kota Timur Pekanbaru)

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KATA PENGANTAR



Segala puji bagi Allah SWT atas segala Rahmat, Karunia serta Hidayah-Nya, sehingga penulis dapat menyelesaikan laporan tugas akhir ini dengan judul “**Mitigasi Risiko Kecelakaan Kerja Menggunakan Metode Hazard Identification Risk Assesment and Risk Control (HIRARC) dan Job Safety Analysis (JSA) Studi kasus : PT. PLN (Persero) ULP Kota Timur Pekanbaru**”, sesuai dengan waktu yang ditetapkan. Shalawat dan salam semoga terlimpah kepada Nabi Muhammad S.A.W.

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0. Untuk diri saya sendiri yang telah berjuang, tidak menyerah dan selalu mau mencoba. Yang tetap selalu berdoa apapun yang terjadi. Yang tetap mau berdiri dikaki sendiri meski dengan cobaaan yang datang terus menerus. Terimakasih karena telah percaya dan membuktikan bahwa kita mampu untuk menyelesaikan penilitian ini.

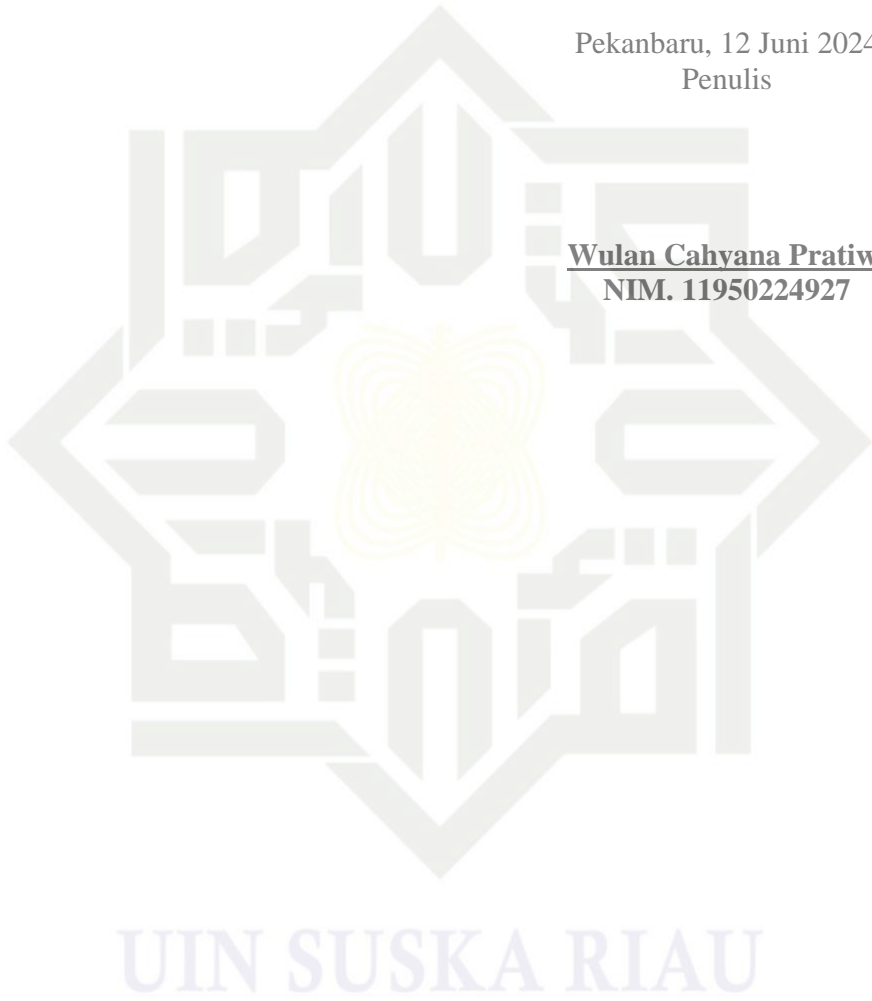
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2. Rekan-rekan seperjuangan, Mahasiswa Teknik Industri Universitas Islam Negeri Sultan Syarif Kasim Riau yang namanya tidak dapat disebutkan satu-persatu yang telah memberikan semangat serta dorongan kepada penulis sehingga penulis dapat menyelesaikan laporan tugas akhir ini.

Penulis menyadari dalam penulisan laporan ini masih banyak terdapat kekurangan serta kesalahan, untuk itu penulis mengharapkan adanya masukan berupa kritik maupun saran dari berbagai pihak untuk kesempurnaan laporan ini. Akhirnya penulis mengharapkan semoga laporan ini dapat berguna bagi kita semua.

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Mitigation of Work Accident Risk Using (HIRARC) and (JSA) Case Study: Technical Service Department of PT. PLN (PERSERO) ULP Kota Timur Pekanbaru)

Wulan Cahyana Pratiwi¹, Muhammad Nur^{2*}, Suherman³, Muhammad Ihsan Hamdy⁴, Muhammad Isnaini Hadiyul Umam⁵

Department of Industrial Engineering, Faculty of Science and Technology, Sultan Syarif Kasim State Islamic University Riau^{1,2,3} Panam, Jl. HR. Soebrantas No.Km. 15, RW.15, Simpang Baru, Pekanbaru City, Riau 28293, Indonesia

E-Mail: 11950224927@student.uin-suska.ac.id,

Corresponding Author: muhammad.nur@uin-suska.ac.id

ABSTRACT

Occupational safety and health is one of the maintenance programs in the company. The implementation of occupational safety and health programs for employees is very important because it aims to create a safety and work unit system that can later increase employee work productivity. The purpose of this study is to find out whether there is an effect of occupational safety and health (K3) on employee work productivity at PT. PLN ULP East City Pekanbaru. This type of research method is a mixed research using an approach that combines qualitative and quantitative forms. This research was conducted from February 2022 to March 2022, namely on employees of the technical service department of PT. PLN ULP East City Pekanbaru. The results of this study are 9 sources of occupational accident hazards in 4 occupations. Then for *the risk level* in risk assessment, there are 4 risk categories, namely extreme, high, medium, and low risk. There are 7 employment processes that are categorized as medium risk, and medium risk there are 9 employment processes. Meanwhile, risk control uses the *hierarchy of control method*, namely: elimination, substitution, *engineering control*, *warning system*, *administrative control* and PPE.

Keywords: APD, Health, HIRARC, JSA, Mitigation, Risk, Safety.

INTRODUCTION

Industrial growth in the current era is very fast and rapid as the progress of science and technology continues to be a lot of competition in the industrial field, so many industries are constantly willing to advance their companies to be better. The change is shown through the continued rapid development of technology used in carrying out the creation process so that it can increase work efficiency and productivity.

Occupational safety and health (K3) is a healthy and safe work in the workplace, organization, community, and work environment so that employees can work calmly and diligently. Occupational Safety and Health as a thought and



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effort to ensure the integrity and perfection of both physical and spiritual labor in particular, and humans in general, the results of work and culture to lead to a just and prosperous society (La Bau, et al, 2021).

Work accident is an unwanted event or event that causes losses to humans, losses to processes, or damage to property that occurs in an industrial work process. Work accidents occur due to a series of previous events or factors, where if one part of the event or factors is omitted then the work accident does not occur. The causes of work accidents are classified into two, namely unsafe action and unsafe condition. Unsafe action is the act or action of humans who do not comply with safety principles, for example not using a safety belt when doing work at height. Meanwhile, unsafe condition is the state of an unsafe workplace environment, for example the state of a dirty and messy workplace, an unsafe workplace, for example a dirty and messy workplace (Rohmah and Kuswinarti, 2021).

In the area of PT. PLN (Persero) ULP Kota Timur Pekanbaru has several jobs such as:

1. Right on way (Tree Rubbing)
2. Engineering Services
3. Maintenance (HAR)
4. Network Inspection

From several jobs in the area of PT. PLN (Persero) ULP Kota Timur Pekanbaru there are several possibilities for work accidents. It can be taken as an example in the work on engineering services which if workers do not use PPE can trigger work accidents ranging from the Low category to the Very High category. Work accidents have a risk of work accidents that can occur in these 4 jobs. Work accidents can be accidents, or fatalities.

Table 1. Activity Data and Impact Effects of K3 Risk

Activities	Description of Hazard Findings	Risk
Network Inspection	Workers do not use Safety Gloves / Insulating Gloves	Electric shock during substation inspection and load measurement
Right On Way	Not using Body Harness	Falling down stairs can cause bruises, injuries, and broken bones
Maintenance (HAR)	Not installing pulley auxiliariy canals	Being crushed by a transformer during transformer replacement or maintenance activities
Engineering Services	PPE thickness less than 20KV	Electrocuted during Low Voltage Network (JTR) repair and House Connection (SR) distribution

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It is known that in 2022 there has been an increase in work accidents caused by worker negligence on the importance of using PPE in carrying out daily work and even in jobs that have little risk of work accidents. In field practice, the Company has certainly implemented K3 such as installing warning signs and providing PPE to each department. However, workers prefer to ignore the danger signs and not use PPE because they consider it normal to do the same job every day.

From data obtained through interviews with employees of the technical service department, work accidents can have significant impacts such as financial impact and the number of working days lost. The financial impact of minor work accidents is Rp. 100,000 to Rp. 500,000. In moderate work accidents, financial losses reach Rp. 600,000 to Rp. 5,000,000. While for work accidents the heavy level reaches Rp. 6,000,000 to Rp. 50,000,000. The number of working days lost in minor work accidents is 1 to 3 days, moderate work accidents are 3 to 5 days, while severe accidents are 7 to 30 days for this reason, it is necessary to improve K3 by controlling K3 risk management using the Hazard Identification Risk Assessment and Control (HIRARC) and Job Safety Analysis (JSA) methods

LITERATURE REVIEW

Occupational Health and Safety (K3)

Occupational Safety and Health (K3) is an activity to ensure the creation of safe and comfortable working environment conditions, as well as avoid physical and mental disturbances. Thus, guidance is needed through training, direction, and monitoring of the implementation of workers' duties and dissemination of regulations and clear information, both from government agencies and companies where these workers carry out their work (Ramadan and Fitriani, 2021).

Impact of Work Accidents

The impact of work accidents is approximately direct cost and indirect cost. Examples of direct costs include ambulance services, medical and additional care, medication, hospitalization, and disability benefits (Pranata and Sukwika, 2022).

HIRARC (Hazard Identification Risk Assessment And Risk Control)

HIRARC (Hazard Identification Risk Assessment And Risk Control) is a series of hazard identification processes that occur in routine and non-routine activities in the company which are expected to make efforts to prevent and reduce the occurrence of work accidents that occur in the company, and avoid and minimize risks in an appropriate way by avoiding and reducing the risk of work accidents and their control in doing the process of repair and maintenance activities so that the process becomes safe (Rahmanto and hamdy, 2022). Hazard identification and risk assessment and control are part of the risk management system which is the basis of SMK3 occupational health and safety management



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system consisting of hazard identification, risk assessment and risk control (Poernomo and Sutapa, 2019).

Job Safety Analysis (JSA)

Job Safety Analysis (JSA) is a hazard analysis on a job, which is a technique that focuses on job tasks as a way to identify hazards before a work incident or accident occurs. Focus on the relationship between workers, tasks, tools, and work environments. Ideally, after identifying hazards that cannot be controlled, action or steps will be taken to eliminate or reduce hazards to a level of risk acceptable to workers (Rohmah and Kuswinarti, 2021).

JSA can be useful for identifying and analyzing hazards in a job so that hazards in each type of work can be prevented appropriately and effectively. Then JSA can also help workers to better understand their work, especially understand the potential hazards that exist and can be directly involved in developing accident prevention procedures. This makes workers think that the results involving work-related safety cannot be underestimated (Sani, et al, 2023).

The JSA method aims to identify potential hazards in each job operation, so that the workforce is expected to be able to recognize these hazards before accidents or occupational diseases occur. The stages needed in identifying JSA after determining the type of work to be analyzed and translated into work steps are researching and determining the hazards that may occur at each work step, then determining the precautions that can be taken from each hazard (Moniaga and Rompies, 2019).

Identify Potential Hazards

Hazard identification is a process that can be done to identify all situations or events that have the potential to cause accidents and occupational diseases that may arise in the workplace. Hazard identification is carried out with the aim of determining the potential hazards of a material, tool or system (Pamungkas and Suseno, 2022).

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is a device used by workers to protect themselves from potential hazards and work accidents that may occur in the workplace. The use of PPE by workers while working is an effort to avoid exposure to hazard risks in the workplace. Although this effort is at the last level of prevention, the application of personal protective equipment is highly recommended (Gianantha, et al, 2020).

RESEARCH METHOD

After data collection is carried out, the next stage is data processing. The data to be processed in completing this data processing uses methods that have been studied at the beginning in literature studies and uses risk management



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methods. There are several stages that will be carried out in this data processing, which are as follows:

1. Risk Assessment Using HIRARC Method (*Hazard Identification, Risk Assessment and Risk Control*)
In risk assessment, HIRARC is one of the methods in risk management where the stages in carrying out this method are by identifying hazards, identification is carried out based on the source of danger, the location of the hazard or dangerous activities. Risk assessment is carried out after identification and analysis of the risk. In this risk assessment is formulated as a function of the probability of occurrence (*probability*) and also the impact (*consequences*) or it can also be from the risk index equal to the multiplication of probability by impact
2. Risk Control Using HIRARC Method (*Hazard Identification, Risk Assessment and Risk Control*)
Risk control or control of hazards in the work environment are actions taken to minimize or also eliminate the risk of work accidents through elimination, substitution, *engineering control, warning system, administrative control* and personal protective equipment (PPE).
3. Risk Identification Using JSA (*Job Safety Analysis*) Method
One hazard analysis technique that is very widely used in the work environment is job safety analysis (JSA), where this technique is very useful for identifying risks and can also analyze hazards in a job.

RESULTS

Number of Work Accidents in Field Workers in 2020-2023

The following is the number of work accidents that occurred at PT. PLN (Persero) ULP Fifty Cities in 2020-2023.

Table 2 . Work Accident Data at PT. PLN (Persero) ULP Fifty Teams for 2020-2023

Year	Category	Types of Accidents	Sum
2020	Light	- Scratched tree branches	1
	Keep	- Injured by wire network	3
		- Crushed by a tree branch	
		- Snapped Warehouse material	
	Heavy	- Falling down stairs to breaking bones	1
	Total Accidents		5
2021	Light	- Scratched tree branches - Network cable slip	2
	Keep	- Eye irritation due to scratching tree branches	1
	Heavy	-	-
	Total accidents		3



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2022	Light	- Scratched tree branches - Tripping over material	2	
	Keep	- Low-voltage electric shock - Crushed by a tree branch - Eye irritation due to leaf slash - Slipped excavated soil	4	
		Heavy	- Slipping down stairs during low-voltage network repairs	1
		Total accidents		7
2023	Light	- Scratched tree branches - Scratched tree branches	2	
	Keep	- Eye irritation due to exposure to tree branches - Low-voltage electric shock	3	
		Heavy	- Being crushed by a large tree branch caused a fracture	1
	Total accidents		6	

In Table 2, it can be seen that work accidents have greatly increased in 2022. Based on the table, it can be known that the clarification of the types of work accidents based on the following categories:

1. Minor Accidents: minor injuries or minor illnesses (no loss of working days)
2. Moderate Accident: severe injury or illness in intensive care (loss of working days under 3 days)
3. Severe Accident: serious injury (loss of working day more than 3 days)

Risk Identification Using JSA (Job Safety Analysis) Method

In identifying this risk using the Job Safety Analysis (JSA) method where this technique is useful for identifying and also analyzing hazards in a job. The following are data from the process of activity in the technical service department and hazard data from the work process:

Table 3. Work Activity and Hazard Data

Work Activities	Danger
Network Inspection	Workers can be electrocuted or have a work accident while performing network inspection work
Right on way (Tree Rubbing)	Workers can fall down stairs, be hit by transformers, electrocuted, and hit by wood chips
Maintenance (HAR)	Workers can be crushed by transformers during transformer replacement or maintenance activities and crushed by poles during replacement or repair of



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poles and construction
Engineering Services
Workers can be electrocuted and can trip over electric cable reels , hampering the production process if it occurs.

Risk Assessment Using Hazard Identification, Risk Assessment and Risk Control (HIRARC) Method

In risk assessment HIRARC is one method in risk management where the stages in carrying out this method are by identifying hazards, identification is carried out based on the source of danger, the location of the hazard or dangerous activities.

Table 4. A measure of severity (severity)

Level	Severity	Definisi
1	Insignificant	No injuries, small financial losses.
2	Minor	P3K, on-site handling, and moderate financial loss
3	Moderate	Requires medical treatment, on-site handling with outside assistance, major financial losses.
4	Weight (Major)	Severe injuries, loss of production ability, outdoor handling of the area without negative effects, heavy losses.
5	Catastropic	Death, poisoning outside the area with the effects of interference, large financial losses.

Table 5. A measure of likelihood (likelihood)

Level	Criterion	Definisi
5.	Almost certain	It almost certainly happens
4.	Likely	Frequent occurrence
3.	Possible	May occur
2.	Unlikely	Sometimes
1.	Rare	It's rare

Based on table 4 shows the level or measure of risk severity, the lowest level is 1 and the highest level is 5. In table 5 it shows the level of risk occurrence determined in 5 levels, the first level is the lowest level which has a value of 1 with information on the possibility of risk occurrence is very rare while the highest level has a level value of 5 with the possibility of risk occurring almost at any time. Furthermore, after the results of the comparison of the level of probability and severity of risk occurrence are obtained, it can be used to determine the level of risk by providing the comparison results which will be shown in table 6 below.

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Table 6. Risk level

Risk Level	Catastropic (5)	Mayor (4)	Moderate (3)	Minor (2)	Insignificant (1)
Almost Certain (5)	Very High	Very High	High	High	High
Likely (4)	Very High	High	High	Moderate	Moderate
Possible (3)	High	High	Moderate	Moderate	Moderate
Unlikely (2)	High	Moderate	Moderate	Low	Low
Rare (1)	Moderate	Moderate	Low	Low	Low

The technical service department has 4 types of jobs where each job has different risks and levels of risk. The following is an identification of hazards that have been obtained in the JSA (Job Safety Analysis) method and also the assessment process that will be used to determine how much risk level of the impact of work accidents that will be experienced by workers on the work process in the area.

Table 7. Identification of hazards in the work of the technical service department

Work Process	Danger	Impact	S	L	Risk Level
Network inspection	Workers can be electrocuted or have a work accident while performing network inspection work	Bruise	2	3	Keep
		Injuries	2	2	Low
		Numbness, difficulty moving limbs	3	2	Keep
Right On Way	Workers can fall down stairs, be hit by transformers, electrocuted, and hit by wood chips	Bruise	2	3	Keep
		Injuries	2	2	Low
		Mild eye irritation	2	4	Keep
		Severe eye irritation	3	3	Keep
		Fracture	3	1	low
Maintenance (HAR)	Workers can be crushed by transformers and crushed by poles during the replacement or repair of poles and constructionWorkers can	Injuries	2	2	Low
		Fracture	3	1	Low
		Bruise	2	2	low
		Broken head	5	1	Keep
Work Process	Danger	Impact	S	L	Risk

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				Level
Technical service	When unwinding cables, workers can trip, slip, and be electrocuted by high-voltage electricity	Injuries	2 2	Low
		Fracture	3 1	Low
		Bruise	2 2	low
		Electrocuted so that	3 2	Keep

Risk Control Using Hazard Identification, Risk Assessment and Risk Control (HIRARC) Method

Analysis of the evaluation of improvement proposals by means of Risk Control is carried out for all work processes in the technical service department includes several steps as follows:

1. Elimination

In this control by eliminating or eliminating the source of the hazard so that the impact to be obtained becomes zero, work that can pose a danger to its workers can be overcome with a better work system and that will not pose a danger to the worker.

2. Substitution

In hazard control by substitution, it is intended here by replacing tools, materials, systems or procedures that are dangerous for workers so that the possibility of work accidents can be suppressed or reduced. not in a hurry.

3. Engineering

This control is installed in a machine or equipment unit by modifying the design such as limiting each tool and providing road distance for workers when carrying out pulley lifting work or at lifting network poles

4. Warning System

Risk control with a warning system is carried out by providing warnings, instructions, signs, labels or displays at every point of the production process and displays on tools and machines that can make workers aware of hazards at the work site.

5. Administrative Control

Risk control with administrative control is carried out by modifying the interaction of workers with the work environment such as job rotation, training, development of work standards, work shifts and housekeeping. It can also create several systems in the form of procedures to ensure safe work such as notifying workers when carrying out work processes in accordance with Standard Operational Procedures (SOPs) and also providing notifications about K3 so that workers can perform work according to SOPs.

6. Personal Protective Equipment (PPE)

Risk control by using personal protective equipment (PPE) aims to protect themselves from hazards that exist in the work environment and pollutants so that they remain always safe and healthy and can also reduce the risk of danger. In using PPE also has safety measures such as:



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© There are various types of PPE (personal protective equipment) available, and the following are PPE used in activities in the technical service department which are observed as follows:

1. Glove

This PPE equipment serves to protect hands from direct physical contact with chemicals and injury when in contact with sharp objects, electric currents, and chemicals.

2. Safety Shoes

Safety shoes or protective shoes are one of the PPE equipment that is useful for protecting the feet from a danger of sharp objects, falling objects, exposed to chemical solutions and even electricity.

3. Wearpack

This wearpack or coverall is a special clothing used by workers in work environments that have high work risks. Usually this clothing covers from neck to ankle which can secure and also protect all parts of the body.

4. Mask

Masks serve to provide protection against sources of air hazards in the workplace. Gas masks and dust masks are protective devices to protect breathing from toxic gases and dust.

5. Helm safety

Safety helmets or safety helmets or can also be called protective caps are PPE tools that are useful for protecting the head from various dangers that will occur.

6. Safety Glasses

Protective Goggles to protect the eyes from liquid metal splashes, chemical splashes, and protective goggles for grinding and dusty work.

7. Body Harness

Body harness is a PPE tool that functions to do work in high altitude areas, this tool can avoid the possibility that the body will fall.

DISCUSSION

Analysis of this data processing will be carried out based on research objectives such as identifying risks in the work process in the technical service department, and after identifying what risks exist in the work process in the technical service department using the Job Safety Analysis (JSA) method then the next step will be to assess the risk using the Hazard Identification method, Risk Assessment and Risk Control (HIRARC), and in the last step, namely carrying out risk control which also uses the Hazard Identification, Risk Assessment and Risk Control (HIRARC) method. The purpose of the research and the proposal of this risk control is to

Can prevent or can reduce the risk of work accidents both accidents to workers, accidents that cause financial losses to the company and also the environment in the technical service department. Also to maintain the safety of each worker in accordance with standard operational procedures (SOP) in order to avoid and also



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© minimize the risk of work accidents that will occur. The following is the analysis stage of the data processing to be done.

CONCLUSION

Hazards that will be caused to the network inspection work process Workers can traffic accidents during ROW inspections, electric shocks during substation inspections and load measurements resulting in bruises, injuries or electric shock to workers. Hazards posed to workers' righ on way work Workers can fall from stairs, be hit by transformers, electrocuted, and hit by wood chips which cause workers to experience bruises, injuries, fractures, electric shocks to workers and can cause eye irritation. The hazards posed to workers' HAR maintenance work can be hit by transformers and crushed by poles during the replacement or repair of poles and construction resulting in injuries, fractures, and also broken heads in workers. In engineering service work, the danger that can be caused is tripping over electric cable reels so that it can hamper the course of the production process if there is a work accident in workers so that workers can experience bruises, injuries, fractures or electric shock to workers.

The risk assessment obtained in data processing is in the process of network inspection work that causes impacts such as bruises with severity values (S) 2 and Possibility (L) values of 3 get a moderate risk level, injuries with values of S 2 and L 2 get a low risk level, numbness due to electric shock with a severity value (S) 3 Possibility (L) is worth 3 with a moderate risk level. In right on way work causes impacts such as bruises with severity (S) value 2 and Possibility (L) value 3 get a moderate risk level, injuries with a severity value of 2 and possibility value 2 get a low risk level, mild eye irritation value severity 2 and possibility Value 4 gets moderate risk, severe eye irritation is severity 3 and possibility is 3 gets moderate risk, fracture is severity 3 and possibility is 1 with low risk. In HAR maintenance work, it causes impacts such as injuries with a severity value of 2 and possibility value 2 with a low risk level, fractures with a severity value of 3 and possibility value 1 with a low risk level, bruises with a severity value of 2 and possibility Worth 2 with a low risk level and also head rupture in workers with a severity value of 5 and possibility worth 1 with a moderate risk level. In engineering service work, it causes impacts such as bruises with a severity value of 2 and possibility value 2 with a low risk level, injuries with a severity value of 2 and possibility value 2 with a low risk level, fractures with a severity value of 3 and possibility Value 1 with a low risk level and electric shock in workers is a severity value of 3 and possibility is worth 2 with a moderate risk level. The last objective is risk control, risk control from work in the technical service department obtained several steps such as elimination, substitution, engineering control, warning system, administrative control and personal protective equipment.

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ISN 174 : Mitigation of Work Accident Risk Using (HIRARC) and (JSA) Case Study: Technical Service Department of PT. PLN (PERSERO) ULP Kota Timur Pekanbaru

Author: Cahyana Pratiwi, Muhammad Nur, Suherman, Muhammad Ihsan Hamdy, Muhammad Isnaini Hadiyul Umam

Universitas Islam Negeri Sultan Syarif Kasim

Dear Authors:

On behalf of Editors, we are delighted to inform you that your article has been accepted, to be publishing through the periodical International Journal of Engineering Business and International Management (IJE BIM) Volume 10 Number 1.

Thank you for submitted and registration.

Editors



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