JENIUS
Scientific Journal, Human Resource Management
p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Analysis of Potential Hazards of Work Accidents to Workers Using *the Hazard Identification, Risk Assessment And Risk Control* (HIRARC) Method in *Freight forwarding Companies*

Jerry Octovianus Tetelepta[1], Gabriel Barreto De Carvalho Belo[2]*
Faculty of Economics and Business, University of August 17, 1945 Surabaya
jerrytetelepta@gmail.com[1], gabrielbarretodecarvalhobelo@gmail.com[2]*

Received 22 December 2024 | Revised 6 January 2025 | Accepted 07 May 2025
* Correspondence Writer

Abstract

Every activity involving human factors, the environment, and machinery goes through stages of hazard processes. PT. XYZ is a company engaged in providing integrated logistics services. Issues concerning workers' safety an; Health practices remain, as certain work processes pose risks of workplace accidents, resulting in losses for both the company and the workers. The objective of this study is to identify potential Hazards, assess risks, and implement control measures using the HIRARC method. Observations were made on several activities performed by workers or drivers, such as document collection, picking up goods from clients, and delivering them to their destinations. Data collection was conducted through direct observation, interviews, and documentation, including reports on workplace accidents, safety policies, and operational procedures. The research findings identified various types of Hazards and assessed their likelihood of occurrence. Based on these findings, measures must be developed to prevent accidents or mitigate their impact through systematic Risk Control steps.

Keywords: *HIRAC; Occupational Health and Safety; Potential Hazards, Risk Assessment; Risk Control*

INTRODUCTION

Zero accident is one of the highest achievements in occupational health and safety management in the service industry and *freight forwarding* in particular. The quality of human resources plays an important role in achieving conditions for the implementation of work without these injuries. One of the efforts that can be made to improve the quality of human resources can be done by managing Occupational Health and Safety (SMK3). SMK3 management is an effort to identify work risks or hazards so that work risks can be improved or reduced with existing methods. The implementation of SMK3 is beneficial not only for employees, but also for company management and provides added value for the company in the eyes of customers.

The Government of Indonesia regulates SMK3 in Law No. 1, 1970 concerning occupational safety and health (K3), and defines K3 as, "every worker has the right to receive occupational health and safety protection". And Article 86 Paragraph 2 "To protect the safety of workers/workers in order to achieve the highest labor productivity, steps must be taken to ensure occupational safety and health".

K3 is a government policy in regulating business owners to protect all employees to avoid accidents and health problems as a result of a work activity. Classifying 2 factors that cause work accidents, namely unsafe action factors, such as not using PPE, misdefining SOPs, lack of experience, and the second factor is unsafe working conditions, such as a work environment exposed to radiation, improper equipment and unroadworthy vehicles.

Several previous studies have evaluated the application of K3 in *freight forwarding* companies, such as a study by Fatimah (2020) which found that most accidents occur due to a lack of control over ergonomic hazards and the use of unsafe heavy equipment. The study also emphasizes the importance of worker training in reducing the risk of accidents.

HIRARC is an activity that functions to find out the types of hazards that can occur or analyze various kinds of problems during the operational process, because there are differences in the goals in

designing processes at work. HIRARC has 3 levels, namely; *Hazard Identification*, Risk *Assessment*, and Risk *Control*.

PT XYZ is one of the leading logistics companies in Indonesia engaged in the provision of integrated logistics services. Founded in 1997, PT XYZ is part of one of the large business groups that focus on the energy and natural resources sectors. As the industry evolves and the need for efficiency in the supply chain, PT XYZ has expanded its services to include land, sea, and air transportation, as well as warehousing and distribution management.

The *Fleet* or Transportation Division at PT XYZ has the function of carrying out travel management, fleet management, shipment compliance, driver management, route optimization, cost control and safety of goods and driver safety. Based on the results of data collection and interviews with the head of the HSE department, it was found that there were still accidents when traveling using a fleet of trucks during the period of 2023 - October 2024, where the cause of work accidents occurred due to human error, wrong working methods and not implementing SOPs correctly. With work accidents still found that suffered minor injuries and damage to property and fleet is an indication that the implementation of K3 must always be improved

Theoretical Studies

Occupational Health and Safety (K3) in the Freight Forwarding Industry

Occupational Health and Safety (K3) is strictly regulated by law in various countries. In Indonesia, Law No. 1 of 1970 on occupational safety affirms that every worker has the right to health and safety protection in the workplace (Mahendra, 2022). In the logistics sector, especially freight forwarding, the risks related to work accidents are very high because workers are faced with hazards associated with the use of heavy vehicles, large materials, and challenging road conditions.

Research conducted by the International Labour Organization (ILO) highlights that the implementation of effective K3 management can improve workers' welfare while increasing operational efficiency. In the logistics industry, the risk of accidents is often caused by non-compliance with SOPs (Standard Operating Procedures), lack of vehicle maintenance, and inadequate training (ILO, 2020). Therefore, the importance of applying the HIRARC method in managing risks in this industry cannot be ignored.

Hazard *Identification*

Hazard identification is the first and most important step in the HIRARC method. At this stage, all potential sources of hazards are identified through direct observation in the workplace, interviews with workers, and a review of the condition of the equipment and the work environment (Williams & Geller, 2019). Hazards in the freight forwarding industry can come from a variety of factors, including poor road conditions, violations of SOPs by drivers, and the use of equipment that does not comply with safety standards.

According to a study conducted by Kogi et al. (2018), workers' participation in the hazard identification process is essential to increase its effectiveness. This is because workers have first-hand insight into potential dangers that management may not be aware of. In addition, a well-designed work environment as well as the use of appropriate equipment can significantly reduce the potential for work accidents.

Risk Assessment

Once the hazard identification is carried out, the next stage is the risk assessment, which aims to evaluate the severity and likelihood of the hazard occurring. This process is important in determining the priority of control measures to be taken. Research by Zimolong and Elke (2017) shows that systematic risk assessment helps identify areas of work that require more attention, especially in high-risk environments such as logistics and transportation.

Risk matrices are often used to assess risks based on their likelihood and impact. This matrix provides guidance for management in allocating resources for the most critical risk control. Another study by Alexander and Stacey (2020) highlighted that risk assessments conducted regularly and continuously are more effective in reducing work accidents compared to assessments conducted once.

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Risk Control

Risk control is the final stage of the HIRARC method and involves the implementation of measures to reduce or eliminate the risks that have been identified. The hierarchy of risk control includes hazard elimination, substitution, engineering control, administrative control, and the use of personal protective equipment (PPE) (Mahendra, 2022). A study by Sofyan (2022) shows that engineering controls, such as machine securing and process automation, have a more significant impact on preventing work accidents compared to administrative control or the use of PPE alone. This is because engineering controls directly address the source of the hazard, while administrative controls and PPE only serve as an additional layer of protection.

In addition, research by Dawson et al. (2019) emphasizes the importance of creating a strong safety culture in the workplace. Increased safety training, socialization of SOPs, and worker compliance with safety rules are important parts of ongoing risk control. By building a safety culture, companies can reduce the rate of work accidents and improve overall productivity.

Risk Control Hierarchy

Once the hazard is identified and the risk is assessed, the risk control method is applied based on the control hierarchy, which includes elimination i.e. eliminating the hazard completely, substitution i.e. replacing the hazardous process or material with a safer alternative, then control technique i.e. changing physical conditions or the working environment to reduce the risk, then administrative control which is making procedural changes or improving training to reduce the risk exposure to risks, and the last is the use of personal protective equipment to Reduce the impact of danger through personal protective equipment.

According to Surbakti (2019), risk control in the logistics industry is often less than optimal, especially in the use of PPE and the implementation of consistent safety procedures. However, the use of a control hierarchy within the framework of HIRARC can improve worker safety if implemented properly.

Case Study: Application of HIRARC in the Logistics Industry

Although the HIRARC method has been applied in various industrial sectors, its application in the logistics sector still requires further research. A study conducted by Tang et al. (2020) on logistics companies in Asia showed that the implementation of HIRARC was able to reduce accident rates by up to 30%. This is achieved through routine maintenance of vehicles, safety training for drivers, and strict monitoring of compliance with SOPs. In addition, a study by Chung et al. (2018) that examined the logistics industry in South Korea also supports the findings. They found that the implementation of HIRARC increased workers' awareness of the importance of safety and encouraged management to take proactive steps in managing risks.

METHOD

Data collection was carried out using a descriptive qualitative method, namely observations, interviews, and accident data reports in 2022-2023. Observations will be carried out directly by the researcher to find out the flow of the work process in the company and interviews will be conducted with workers and managers.The research method used will focus on the HIRARC approach to recognize existing hazards, evaluate the possibility or likelihood of accidents, and recommend relevant control of hazard identification (Sofyan H, 2022). In the HIRARC method, the first step is to identify the hazard, after which a risk assessment is carried out, then, at the last stage that must be carried out is risk control to prevent accidents to PT XYZ workers who carry out work activities.

Hazard *Identification*

Hazard can be interpreted as any form of inspection and checking process in the work environment that aims to find out what types of hazards may occur in the work environment. The working environment includes machinery, work equipment, laboratories, office areas, warehouses, and supporting transportation. The source of the danger is categorized into 5 factors, namely: *man*, *method*, *material*, *machine*, *environment*.

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Risk Assessment

After the next stage of identification enters the risk assessment stage, this stage is carried out to find out the extent of the risk of danger that will occur, it can be interpreted that this risk assessment is an assessment of the predetermined level of danger. At this stage, it is taken into account through the provisions of the Australian Standard/New Zealand Standard for Risk Management (AS/NZS 3260:2004) which is the standard provisions of Australia. In this provision, there are two parameters that are used as a benchmark in risk assessment. The risk assessment table according to AS/NZS 3260: 2004 is as follows.

Tabel 1. Parameter "Probality/likehood of hazard"

Tingkat	Deskripsi	Keterangan
5	*Almost certain*	Terjadi setiap saat
4	*Likely*	Sering terjadi
3	*Prosibble*	Terjadi sekali-sekali
2	*Unlikely*	Jarang terjadi
1	*Rare*	Hampir tidak pernah terjadi

Tabel 2. Parameter "Severity of hazard"

Tingkat	Deskripsi	Keterangan
1	*Insignificant*	Tidak ada cedera, kerugian keuangan kecil
2	*Minor*	Cedera ringan, kerugian keuangan kecil
3	*Moderate*	Cedera sedang sehingga memerlukan penanganan medis, kerugian keuangan cukup besar
4	*Major*	Cedera berat, yang terjadi pada lebih 1 orang, kerugian besar dan adanya gangguan produksi
5	*catastropic*	Korban meninggal lebih dari 1 orang, kerugian sangat besar, mengganggu seluruh proses kegiatan perusahaan, dampaknya sangat luas dan menyeluruh.

After the two parameters in Table.1 and .2, the risk assessment matrix level can be seen in table 3 and the level identification in table 4 as follows:

Tabel 3. Risk assesment matriks

Probability/likehood of hazard	*Severity of hazard*				
	Insignificant	*Minor*	*Moderate*	*Major*	*Catastropic*
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Tabel 4. Indication of risk level

Risk level	Keterangan
Low	Tidak perlu pengendalian tambahan.
Medium	Risiko dapat diterima, *monitoring* dilakukan sampai kepala bagian
High	Risiko tidak dapat diterima melibatkan para unit kerja
Extreme	Bencana, perlu keterlibatan pimpinan

The formula to find the level of danger in table 3 *of the Risk Assessment matrix* is:

Risk Level = L x S

Information:
L = *Likelihood*
S = *Severity*

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Risk Control

Risk control is an indispensable stage to determine the whole in risk management. Risk control is an effort to overcome potential hazards in the work area. Potential hazards can be controlled by determining the priority scale of potential hazards first which can then help in the selection of risk control called the risk control hierarchy. Risk control can follow a hierarchy of control approach.

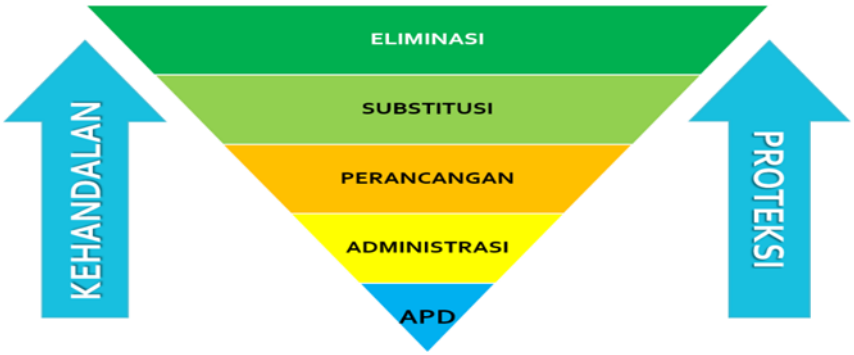

Figure 1. Risk Control Hierarchy (Mahendra)

RESULTS and DISCUSSION

Hazard *Identification*

The identification table based on the processes and activities that occur in the transport department (Fleet) is as follows:

Table 5. Hazard Identification

Process	Activity	Potential Hazards	Risk
Vehicle Inspection	Opening the hood of the vehicle	Pinched by the trunk door, pinched by the hood of the car, hit	injuries to fingers, hands (bruises)
	Opening and checking the radiator water	Radiator water sprayed (when the vehicle runs out of rest)	Burns, blistered skin
	Check the condition of the tyre	Improper in tightening bolts, tire bursts	accidents, injuries, asset damage
Operating the vehicle	Driving over the speed limit	Crashing, overturning, burning	asset damage, serious injury, and death
	Driving while receiving a phone or reading a WA message	Crashing, overturning, burning	asset damage, serious injury, and death
	Traveling at night	Drowsiness, lack of vision, bumping	accidents, injuries, property damage and death
Unloading and loading of goods	Opening the door of a container or large vehicle trunk	Pinched when opening the container door	injuries to fingers, hands (bruises)
	Carry out the process of tying goods	Hit by goods, pinched	Injuries, cuts, broken hands
	manually lifting items that exceed weight capacity	Falling, scratching, being hit by goods	Back Injury, Sprained Hand
Transporting hazardous category goods (chemicals, gases)	Carry out the process of physically checking the goods to ensure that the packaging is appropriate	Spilled, overturned, leaky material	Burns due to leaks, injuries
	lifting and placing dangerous goods from the fleet to the warehouse	Falling, being hit by goods	Back Injury, Sprained Hand
	Regulating the position of the dangerous goods on the tailboard of the vehicle	Pinched with goods, falling	back injury, sprained hand

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Risk Assessment

The following is an assessment table of the probability of an accident called Likelihood (L) in the activity section of the risk assessment table as follows:

Table 6. Risk Assessment

Yes	Activity	Risk	*Likelihood (L)*	Reason
1.	Opening the hood of the vehicle	injuries to fingers, hands (bruises)	2	It is rare, because workers use personal protective equipment
2.	Opening and checking the radiator water	Burns, blistered skin	2	It is rare, because workers use personal protective equipment
3.	Check the condition of the tyre	accidents, injuries, asset damage	1	It almost never happens, because workers obey work instructions
4.	Driving over the speed limit	asset damage, serious injury, and death	3	It happens occasionally, because there are already speed limit signs that have been determined in the company's regulations
5.	Driving while receiving a phone or reading a WA message	Asset damage, serious injury	2	It rarely happens, because it has been socialized through company regulations to prohibit the use of cellphones while driving
6.	Traveling at night	accidents, injuries, property damage and death	3	It happens once in a while, because the management has prepared a trip *plan*
7.	Opening the door of a container or large vehicle trunk	injuries to fingers, hands (bruises)	2	It rarely happens, because workers use personal protective equipment
8.	Carry out the process of tying goods	Injuries, cuts, broken hands	2	It is rare, because workers have received ergonomics socialization in the process of tying and lifting goods
9.	manually lifting items that exceed weight capacity	Back Injury, Sprained Hand	2	It is rare, because workers have received ergonomics socialization in the process of tying and lifting goods
10.	Carry out the process of physically checking the goods to ensure that the packaging is appropriate	Burns due to leaks, injuries	1	Almost never happens, workers are already using personal protective equipment
11.	lifting and placing dangerous goods from the fleet to the warehouse	Back Injury, Sprained Hand	2	It is rare, because workers have received ergonomics socialization in the process of tying and lifting goods
12.	Regulating the position of the dangerous goods on the tailboard of the vehicle	back injury, sprained hand	2	It is rare, because workers have received ergonomics socialization in the process of tying and lifting goods

After the Likelihood value is obtained, it is necessary to find the Severity of Hazard value, which is the value of the impact of the accident that occurred. Here is the table:

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Table 7. Risk Assessment

Yes	Activity	Risk	*Severity (S)*	Reason
1.	Opening the hood of the vehicle	injuries to fingers, hands (bruises)	2	Minor injuries, minor financial losses
2.	Opening and checking the radiator water	Burns, blistered skin	4	Severe injuries, which occur to more than 1 person, major losses lead to unutilization of the fleet
3.	Check the condition of the tyre	accidents, injuries, asset damage	1	No injuries, minor financial losses
4.	Driving over the speed limit	asset damage, serious injury, and death	4	Severe injuries, which occur to more than 1 person, major losses lead to unutilization of the fleet
5.	Driving while receiving a phone or reading a WA message	Asset damage, serious injury	3	Moderate injuries that require medical treatment, financial losses are quite large
6.	Traveling at night	accidents, injuries, property damage and death	3	Moderate injuries that require medical treatment, financial losses are quite large
7.	Open the door of a container or a large vehicle trunk.	injuries to fingers, hands (bruises)	2	Minor injuries, minor financial losses
8.	Carry out the process of tying goods	Injuries, cuts, broken hands	2	Minor injuries, minor financial losses
9.	manually lifting items that exceed weight capacity	Back Injury, Sprained Hand	3	Moderate injuries that require medical treatment, financial losses are quite large
10.	Carry out a physical inspection process of goods to ensure that the packaging is appropriate.	Burns due to leaks, injuries	2	Minor injuries, minor financial losses
11.	lifting and placing dangerous goods from the fleet to the warehouse	Back Injury, Sprained Hand	2	Minor injuries, minor financial losses
12.	Regulating the position of the dangerous goods on the tailboard of the vehicle	back injury, sprained hand	2	Minor injuries, minor financial losses

Risk Control

Risk assessment (risk level) by switching the Likelihood value to the Severity (S) value. The following is a risk assessment that occurs in the area of PT. XYZ as follows:

Table 8. Risk Assessment

Yes	Activity	Risk	*Likelihood (L)*	*Severity (S)*	*Risk - R-*	Color	*Risk Level*
1.	Opening the hood of the vehicle	injuries to fingers, hands (bruises)	2	2	4		*Low*
2.	Opening and checking the radiator water	Burns, blistered skin	2	4	8		*High*
3.	Check the condition of the tyre	accidents, injuries, asset damage	1	1	1		*Low*

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

4.	Driving over the speed limit	asset damage, serious injury, and death	3	4	12		*Extreme*
5.	Driving while receiving a phone or reading a WA message	Asset damage, serious injury	2	3	6		*Medium*
6.	Traveling at night	accidents, injuries, property damage and death	3	3	9		*High*
7.	Opening the door of a container or large vehicle trunk	injuries to fingers, hands (bruises)	2	2	4		*High*
8.	Carry out the process of tying goods	Injuries, cuts, broken hands	2	2	4		*High*
9.	manually lifting items that exceed weight capacity	Back Injury, Sprained Hand	2	3	6		*Medium*
10.	Carry out a physical inspection process of goods to ensure that the packaging is appropriate.	Burns due to leaks, injuries	1	2	2		*Low*
11.	lifting and placing dangerous goods from the fleet to the warehouse	Back Injury, Sprained Hand	2	2	4		*High*
12.	Regulating the position of the dangerous goods on the tailboard of the vehicle	back injury, sprained hand	2	2	4		*High*

In the risk assessment table (risk level) of the activity process at PT. XYZ was found to have a low risk result of three (3) symbolized by green, medium risk as many as two (1) symbolized by yellow, and high risk as many as six (6) with dark orange color and very high risk as one (1) with red, so risk control is needed for its handling.

Risk control is carried out by providing handling or control that can be applied to avoid or reduce the incidence of work accidents that occur in these processes. The following are the forms of efforts that can be made to reduce work risks in activities carried out by workers at PT. XYZ is:

Table 9. Risk Assessment

Yes	Activity	Risk	Control
1	Opening the hood of the vehicle	injuries to fingers, hands (bruises)	Make sure the hood support is installed, make sure that when inspecting the vehicle in accordance with the sequence of work instructions, use gloves
2	Opening and checking the radiator water	Burns, blistered skin	Using personal protective equipment such as gloves and goggles, make sure when checking the vehicle's radiator water is used up, check the spare radiator water box (do not open the radiator cap), follow the guidebook
3	Check the condition of the tyre	accidents, injuries, asset damage	using PPE such as helmets, safety shoes, gloves and goggles, checking every day through P2H.

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

4	Driving over the speed limit	asset damage, serious injury, and death	provide driving book guidance in accordance with the applicable PP, socialize through pre work briefing related to travel plans, conduct training for each driver through DDT *(Defensive Driving Training)*, use PPE while driving
5	Driving while receiving a phone or reading a WA message	Asset damage, serious injury	provide driving book guidance in accordance with the applicable PP, socialize through pre work briefing related to travel plans, conduct training for each driver through DDT *(Defensive Driving Training)*, use PPE while driving
6	Traveling at night	accidents, injuries, property damage and death	Prepare a travel plan, use personal protective equipment, perform regular maintenance, do a 360-degree check before continuing the trip
7	Opening the door of a container or large vehicle trunk	injuries to fingers, hands (bruises)	Provide guidance in unlocking and container doors according to the instructions of work instructions, opening the door with 2 people (1 *helper*)
8	Carry out the process of tying goods	Injuries, cuts, broken hands	Use personal protective equipment such as *safety shoes* and gloves, use suitable, *non-expired*, and strong fastening equipment for each type of load.
9	manually lifting items that exceed weight capacity	Back Injury, Sprained Hand	using personal protective equipment such as *body stripes*, gloves, providing work manuals in the lifting process, providing socialization related to *manual lifting handling*
10	Carry out a physical inspection process of dangerous category goods to ensure that the packaging is appropriate	Burns due to leaks, injuries	using personal protective equipment such as glasses, gloves and *safety shoes*, provided training in handling dangerous goods,
11	lifting and placing dangerous goods from the fleet to the warehouse	Back Injury, Sprained Hand	using personal protective equipment such as *body stripes*, gloves, providing work manuals in the lifting process, providing socialization related to *manual lifting handling*
12	Regulating the position of the dangerous goods on the tailboard of the vehicle	back injury, sprained hand	using personal protective equipment such as glasses, gloves and *safety shoes*, provided training in handling dangerous goods,

CONCLUSION

Potential hazards in the work area at PT. XYZ, namely, in the process of inspecting vehicles, operating vehicles, unloading and loading goods, and transporting dangerous category goods, then there are 12 kinds of activities carried out, namely opening the hood cap, opening and checking radiator water, checking the condition of tires, driving over the speed limit, driving while receiving calls or WA, traveling at night, opening the door of a container or a large vehicle tub, carrying out the process of tying goods, lifting goods manually that exceed the weight capacity, carrying out the process of checking goods, lifting and placing dangerous goods from the fleet to the warehouse, regulating the position of the location of dangerous goods on the vehicle trunk.

The level of danger by conducting a risk assessment of the potential hazards found at PT. XYZ. After the hazard identification is found, the stage that will be carried out is to calculate the severity of the potential hazard found, in order to determine what controls are needed.

Control can be carried out to reduce the danger of work accidents at PT. XYZ. This stage aims to prevent and handle hazards that can occur properly to avoid the danger of accidents that can occur to workers.

Appreciation

The author thanks the family, PT. XYZ and the entire extended family of the Faculty of Economics and Business, University of August 17, 1945 Surabaya who have supported in the process of making this journal.

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

BIBLIOGRAPHY

1. Asfandiyar and S. M. Cheema, "Relationship among Safety, Quality and Productivity in Construction Projects," *Journal of Development and Social Sciences*, vol. 4, no. I, Mar. 2023, doi: 10.47205/jdss.2023(4-i)17.
2. M. I. H. Umam, N. Nofirza, M. Rizki, and F. S. Lubis, "Optimalisasi Jumlah Kebutuhan Tenaga Kerja pada Stasiun Kerja Hoisting Crane Menggunakan Metode Work Sampling (Studi Kasus: PT. X)," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 5, no. 2, pp. 125–129, 2020.
3. M. Nur, "Pengaruh Pelaksanaan Program Keselamatan dan Kesehatan Kerja (K3) terhadap Produktivitas Kerja Karyawan pada PT. Bormindo Nusantara Duri," *Jurnal Teknik Industri: Jurnal Hasil Penelitian Dan Karya Ilmiah Dalam Bidang Teknik Industri*, vol. 3, no. 2, pp. 125–134, 2017.
4. R. Patradhiani, M. Amelia, and M. Rosyidah, "Pengaruh Keselamatan Kesehatan Kerja Terhadap Produktivitas Karyawan Dengan Metode Partial Least Square," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 8, no. 2, pp. 305–313, 2022.
5. M. Nur and A. P. Putra, "Analisa Lingkungan Kerja dan Program Kesehatan dan Keselamatan Kerja Menggunakan Metode 5S," *Jurnal Teknik Industri*, vol. 2, no. 2, p. 185, 2016.
6. M. Nur, "Analisis Keselamatan Dan Kesehatan Kerja Terhadap Kinerja Karyawan PT. Johan Sentosa (PKS-Bangkinang)," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 1, no. 2, pp. 75–82, 2020.
7. M. T. Tengku Nurainun ST, "Evaluasi Pelaksanaan Program Keselamatan Kerja Karyawan Bagian Produksi di PT. P&P Bangkinang Cabang Bangkinang," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 1, no. 1, pp. 48–53.
8. M. Nur, "Analisis Keselamatan dan Kesehatan Kerja Menggunakan Metode Hazard And Operability Study (HAZOP) Di PT. XYZ," *J. Tek. Ind*, vol. 4, no. 2, 2018.
9. D. O. D. R. Gucci and M. A. S. Nalendra, "Perancangan Visual Display Informasi Keselamatan Dan Kesehatan Kerja (K3) Dengan Pendekatan Ergonomi Dan Komunikasi Visual," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 8, no. 2, pp. 399–403.
10. A. Wahid, M. Munir, and A. R. Hidayatulloh, "Analisis Resiko Kecelakaan Kerja Menggunakan Metode HIRARC PT. SPI," *Journal Of Industrial View*, vol. 2, no. 2, pp. 45–52, Nov. 2020.
11. M. Nur, "Analisis Tingkat Risiko Kesehatan Dan Keselamatan Kerja (K3) Dengan Menggunakan Metode Hirarc Di PT. XYZ," *Jurnal Teknik Industri Terintegrasi*, vol. 4, no. 1, pp. 15–20, Apr. 2021.
12. E. G. Permata, "Analisa Program K3 di CV. Sispra Jaya Logam Dengan Konsep Traffic Light System," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 4, no. 1, pp. 49–54, 2018.
13. M. A. Pratama, A. W. Rizqi, and H. Hidayat, "Analisis Resiko K3 Pada Pekerjaan Fabrikasi Konstruksi Di Cv. Arfa Putra Karya Dengan Metode Jsa (Job Safety Analysis)," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 8, no. 2, pp. 314–323, 2022.
14. U. S. Ramlee, M. Hilmi, and I. A. Rahim, "*Hazard Identification, Risk Assessment* and *Risk Control* (HIRARC) of Safety and Health *Hazards* at Old High-Rise Residential Building Facilities: Case Study at Larkin Jaya Flat, Johor Bahru MALAYSIA

*Corresponding Author Designation," vol. 4, no. 1, pp. 1335–1344, 2023, doi: 10.30880/rmtb.2023.04.01.092.
15. S. Liandar, A. B. Putra, and E. Prahara, "Hazard and Risk Analysis of Driven Pile Foundation Works Using HIRARC Method," in *E3S Web of Conferences*, EDP Sciences, May 2023. doi: 10.1051/e3sconf/202338801004.
16. M. Siska and M. Gassani, "Analisis 5s dan Hirarc Pada Stasiun Kerja Rotary, Dryer dan Veneer Compouser di PT. Asia Forestama Raya Pekanbaru," *Jurnal Teknik Industri*, vol. 4, no. 1, 2018.
17. E. W. Abryandoko, "Dengan Menggunakan Metode HIRARC Dan Safety," vol. 12, no. 1, pp. 50–57, 2018.
18. A. M. Mayadilanuari, "Penggunaan HIRARC dalam Identifikasi Bahaya dan Penilaian Risiko pada Pekerjaan Bongkar Muat," *Higeia Journal of Public Health Research and Development*, vol. 4, no. 2, pp. 504–512, 2020.
19. A. Wijaya, T. W. S. Panjaitan, and H. C. Palit, "Evaluasi Kesehatan dan Keselamatan Kerja dengan Metode HIRARC pada PT. Charoen Pokphand Indonesia," *Jurnal titra*, vol. 3, no. 1, pp. 29–34, 2015.
20. J. Kesehatan Masyarakat Andalas diterbitkan oleh, P. Studi S-, K. Masyarakat Fakultas Kesehatan Masyarakat Universitas Andalas, T. Ihsan, T. Edwin, and R. Octavianus Irawan, "Analisis Risiko K3 Dengan Metode HIRARC Pada Area Produksi Pt Cahaya Murni Andalas Permai".
21. S. N. Trisaid, "Analisis Risiko Kecelakaan Kerja Pada Kegiatan Rig Service Menggunakan Metode Hirarc Dengan Pendekatan Fta," *Jurnal Ilmiah Teknik Industri*, vol. 8, no. 1, pp. 25–33, 2020, doi: 10.24912/jitiuntar.v8i1.6343. Jurnal Teknologi dan Manajemen Industri Terapan (JTMIT) Vol. 2, No. 3, September 2023 pp. 150 - 158 P-ISSN: 2829-0232 E-ISSN: 2829-0038 158
22. Lina Dianati Fathimahhayati, Muhammad Rafi Wardana, and Nadine Annisa Gumilar, "Analisis Risiko K3 Dengan Metode Hirarc Pada Industri Tahu Dan Tempe Kelurahan Selili, Samarinda," *Jurnal Rekavasi*, vol. 7, no. 1, pp. 62–70, 2019.
23. M. Nur, "Analisis Tingkat Risiko Kesehatan Dan Keselamatan Kerja (K3) Dengan Menggunakan Metode Hirarc Di Pt. Xyz," *Jurnal Teknik Industri Terintegrasi*, vol. 4, no. 1, pp. 15–20, 2021, doi: 10.31004/jutin.v4i1.1937.
24. R. Alfatiyah, "Analisis Manajemen Risiko Keselamatan Dan Kesehatan Kerja Dengan Menggunakan Metode Hirarc Pada Pekerjaan Seksi Casting," *SINTEK JURNAL: Jurnal Ilmiah Teknik Mesin*, vol. 11, no. 2, pp. 88–101, 2017.
25. Ramli, "Identifikasi Bahaya dan Penilaian Risiko K3 Pada Tindakan Perawatan dan Perbaikan Menggunakan Metode HIRARC pada PT. X," *Seminar Nasional Riset Terapan*, no. July, pp. 281–286, 2010.
26. K. R. Ririh, "Analisis Risiko Kecelakaan Kerja Menggunakan Metode HIRARC dan Diagram Fishbone pada Lantai Produksi PT DRA Component Persada," *Go-Integratif : Jurnal Teknik Sistem dan Industri*, vol. 2, no. 2, pp. 135–152, Nov. 2021, doi: 10.35261/gijtsi.v2i2.5658.
27. F. Ramadhan, "Analisis Kesehatan dan Keselamatan Kerja (K3) Menggunakan Metode *Hazard Identification Risk Assessment* and *Risk Control* (HIRARC)," no. November, 2017.
28. S. Supriyadi, A. Nalhadi, and A. Rizaal, "Identifikasi Bahaya dan Penilaian Risiko K3 pada Tindakan Perawatan & Perbaikan Menggunakan Metode HIRARC (*Hazard Identification* and Risk Assesment *Risk Control*) pada PT. X," in *Prosiding Seminar Nasional Riset Terapan| SENASSET*, 2015, pp. 281–286.
29. D. S. Purnama, "Analisia Penerapan Metode Hirarc (*Hazard Identification Risk Assessment* and *Risk Control*) Dan Hazops (Hazard and Operability Study) Dalam Kegiatan

p-ISSN: 2581-2769; e-ISSN: 2598-9502
DOI: http://dx.doi.org/ 10.32493/JJDP.v8i3.46222

Identifikasi Potensi Bahaya Dan Resiko Pada Proses Unloading Unit Di Pt. Toyota Astra Motor," *None*, vol. 9, no. 3, p. 182893, 2015.
30. D. S. Urrohmah and D. Riandadari, "Identifikasi Bahaya Dengan Metode *Hazard Identification, Risk Assessment* And *Risk Control* (Hirarc) Dalam Upaya Memperkecil Risiko Kecelakaan Kerja DI PT. PAL Indonesia," *JPTM*, vol. 08, no. 1, pp. 34–40, 2019.
31. Standards Australia International Ltd and Standards New Zealand, "AS/NZS Risk Management 4360. 2004," 2004.
32. I. N. Riandika, A. F. Alwie, and S. Syapsan, "Analisis Perceived risk, Perceived Value dan Online Consumer Review Terhadap Online Repurchase Intention Produk Fashion di Kabupaten Kampar di Moderasi Kepercayaan," *Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri*, vol. 8, no. 2, pp. 271–279.
33. P. Giananta, J. Hutabarat, and S. Soemanto, "Analisa Potensi Bahaya Dan Perbaikan Sistem Keselamatan Dan Kesehatan Kerja Menggunakan Metode HIRARC DI PT. Boma Bisma Indra," *Jurnal Valtech (Jurnal Mahasiswa Teknik Industri)*, vol. 3, no. 2, pp. 106–110, 2020.
34. R. N. Putri and M. Trifiananto, "Analisa *Hazard Identification Risk Assessment* And *Risk Control* (HIRARC) Pada Perguruan Tinggi Yang Berlokasi Di Pabrik," in *Seminar dan Konferensi Nasional IDEC*, May 2019, p. B11.1-B11.10.
35. Muhammad Nur, Verly Valentino, Resy Kumala Sari , Abdul Alimul Karim, "Analisa Potensi Bahaya Kecelakaan Kerja Terhadap Pekerja Menggunakan Metode *Hazard Identification, Risk Assessment and Risk Control* (HIRARC) Pada Perusahaan Aspal Beton", Jurnal Teknologi dan Manajemen Industri Terapan (JTMIT) Vol 2. No3, September 2023 pp 150-158
36. R. N. Putri and M. Trifiananto, "Hazard *Identification Risk Assessment* and *Risk Control* (HIRARC) Analysis in Universities Located in Factories," in *IDEC National Seminar and Conference*, May 2019, p. B11.1-B11.10.
37. Muhammad Nur, Verly Valentino, Resy Kumala Sari, Abdul Alimul Karim, "Analysis of the Potential Hazard of Work Accidents to Workers Using *the Hazard Identification, Risk Assessment and Risk Control* (HIRARC) Method in Concrete Asphalt Companies", Journal of Applied Industrial Technology and Management (JTMIT) Vol 2. No3, September 2023 pp 150-158