

Risk Assessment of Telecommunication Maintenance in High-Voltage Substations Using HIRARC and FMEA

Adinda Rizki Zuhal¹ and Chairul Hudaya^{2*}

^{1,2}Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia, Indonesia

¹adindariski89@gmail.com, ²chairul.hudaya@ui.ac.id

*Corresponding author, chairul.hudaya@ui.ac.id

Abstract — Maintaining 70 kV, 150 kV, and 500 kV telecommunications equipment at substations in the Java, Madura, and Bali interconnection system is vital to ensure asset reliability and performance. Accidents have caused delays and human resource, power supply issues. Implementing a risk management strategy could be considered as the effort to minimize the work accidents. Thus, this study aimed to conducting a systematic analysis and control by integrating the identification process for the effective policies. We used questionnaires to collect precise regional data and then the Hazard Identification, Risk Analysis and Risk Control (HIRARC) and Failure Mode and Effects Analysis (FMEA) methods were used to identify risks and formulate control recommendations. The HIRARC method indicated medium risk levels at 60% and low levels through Risk Priority Number (RPN) assessment, indicating routine monitoring and control is sufficient. The maintenance policies are derived from three approaches: education/training, supervision, and personal protective equipment (PPE). The study found that the Asset Management Contract (AMC) work accidents are due to deficiencies in PPE, technical training, and Occupational Health and Safety (OHS) supervision, which directly impact sustainability.

Keywords: FMEA analysis, HIRARC method, Maintenance, Risk assessment, Substation.



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INTRODUCTION

Asset management can be executed through two primary mechanisms: preventive maintenance and corrective maintenance. The present maintenance program is centered on telecommunications equipment dispersed across substations with 70 kV, 150 kV, and 500 kV voltages throughout Java, Madura, and Bali. The primary objective of implementing maintenance work is to ensure the optimal performance of assets, to minimize system disruptions, and to ensure the sustainability of electricity system operations in an efficient and economical manner. However, in practice, the maintenance of telecommunications network devices presents significant challenges. A salient challenge pertains to the occurrence of work accidents during the implementation phase. A review of data collected over the past three years reveals several cases of work accidents that have resulted in delays, temporary suspension, or even cancellation of maintenance activities. Such accidents have the potential to result in losses with regard to human resources, in addition to posing a risk to the reliability of the telecommunications system in its entirety. This, in turn, can have repercussions for the stability of the electricity supply.

The implementation of maintenance necessitates a comprehensive risk management strategy to mitigate the potential for work accidents. In contemporary business environments, effective risk management has become a critical component for organizations to navigate. However, a discrepancy persists between the theoretical underpinnings of risk management and its practical execution. This discrepancy poses a substantial challenge for numerous enterprises [1]. The implementation of risk management strategies is instrumental in ensuring business continuity by mitigating the potential consequences of accidents, loss, and security and safety concerns [2]. The risk assessment and management process is comprised of five sequential steps: risk identification, risk modeling, qualification and measurement, risk evaluation, risk acceptance and avoidance, and risk management [3]. As illustrated in Table 1, risk analysis is classified into multiple categories [4].

Table 1. Category in Risk

Category	Type of Analysis	Example of Methos
Simplified risk analysis	Qualitative	Coarse risk analysis
Standard risk analysis	Qualitative or Quantitative	- Brainstorming sessions - Risk analysis assisted by HAZOP - Risk matrices - Job safety analysis - Fault tree analysis
Model-based risk analysis	Primarily Quantitative	- Event tree analysis - Reliability analysis - Bayesian networks - Electrical system simulation - Benchmarking methods

Occupational safety management depends on commitment, culture, training, and communication from management. Documenting this management ensures success [5]. The Asset Management Contract (AMC) work in the maintenance of telecommunications network devices in the electricity system still faces various potential hazards that have not been systematically analyzed and controlled. This phenomenon has the potential to increase the risk of work accidents, which can impede the seamless execution of maintenance operations. Furthermore, the integration of risk identification and analysis methodologies, such as HIRARC and FMEA, within the work safety management system remains suboptimal, manifesting at both the technical and managerial levels. The method to be used for analysis is HIRARC (Hazard Identification, Risk Analysis and Risk Control). HIRARC is a series of processes designed to identify potential hazards in a company's activities, assess the associated risks, and implement control measures to minimize these risks and prevent accidents[6]. Additionally, FMEA (Failure Mode and Effects Analysis) will be used to identify failure modes and their effects on work accidents[7]. This uncertainty can be explored by performing risk analyses, but it can never be eliminated[8]. This absence of integration has consequences for the absence of a comprehensive and adaptive control policy for existing risks. To date, the implementation of additional mitigation policies has been inadequate in reducing the incidence of work accidents. Consequently, a novel, more strategic, and data-driven approach is imperative in the formulation of work safety policies.

METHOD

A. Flowchart

Figure 1 illustrates the risk assessment process for maintaining telecommunications equipment in high-voltage substations using the HIRARC and FMEA methods. The process begins with field observations to collect workplace accident data through questionnaires and interviews. This data is then analyzed in parallel using two approaches: HIRARC, which identifies hazards, evaluates risk levels based on likelihood and severity, and recommends controls according to the hierarchy (such as PPE or engineering controls); and FMEA, which evaluates failure modes, their causes and effects, and calculates the Risk Priority Number (RPN) to determine mitigation priorities. The results from both analyses are integrated to formulate risk control recommendations, followed by strategic decision-making regarding occupational safety policies. The final step concludes the process; however, this cycle continues as part of ongoing risk management. The integration of these two methods enables comprehensive risk identification and supports the development of a stronger workplace safety culture.

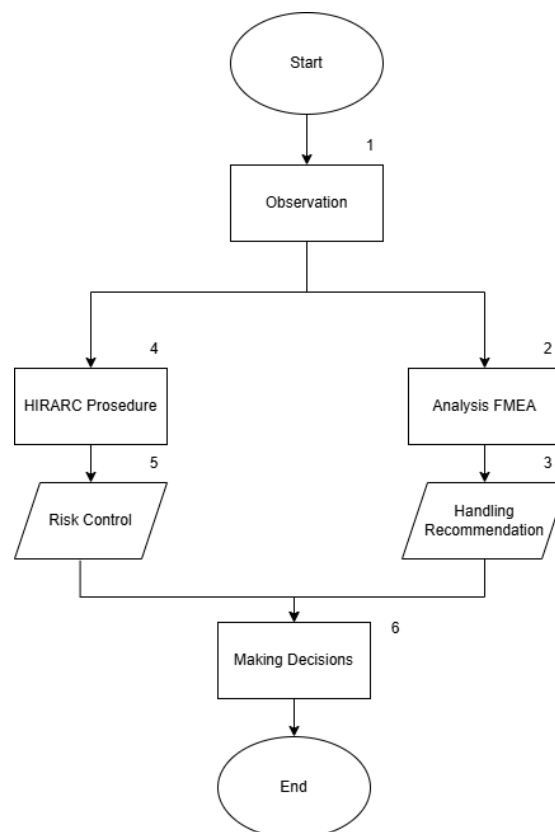


Figure 1. Flowchart of Integrated HIRARC and FMEA Risk Assessment Method

B. Observation

This observation aims to obtain data on real conditions in the field as supporting material for conducting analysis in research which is divided into 2 observations: (1) collecting information about incidents that have occurred by filling out questionnaires with field engineers, (2) conducting direct interviews with engineering staff in the office to obtain information related to work safety [9]. The results of the work accident data collection from 2022 to 2024 are shown in Table 2.

Table 2. Work Accident Data

No	Risk	Number of Incident		
		2022	2023	2024
1.	Traffic accident with minor injuries	1	2	1
2.	Traffic accident with no injuries	0	0	3
3.	Cut with minor injuries	0	2	0
4.	Bruised	1	3	1
5.	Abrasion	1	3	1
6.	Fracture of the thumb	1	0	0
7.	Muscle and joint injuries	0	1	0
8.	Electrocuted without long term effect	1	1	2
9.	Eye irritation due to dust	0	1	0
10.	Slip	0	1	0

C. HIRARC Procedure

Hazard Identification

Hazard identification can be done with several methods, namely the hazard identification checklist, workplace inspection (observation and interview), task safety analysis or job hazard analysis, accident and incident investigations [10]. The occurrence of occupational accidents can be attributed to two primary factors: firstly, the presence of unsafe conditions, and secondly, the performance of unsafe actions. The term "unsafe conditions" refers to work accidents that are caused by a substandard working environment. Conversely, the term "unsafe actions" refers to work accidents that are caused by the unsafe actions of workers[11].

Risk Assessment

Analyzing risk entails identifying risks from the internal and external sources identified in the first phase of the process and then evaluating each identified risk to determine its likelihood and severity[12]. The indications of the likelihood and severity rate are shown in Table 3 and Table 4 respectively.

Table 3. Likelihood Indicators

Likelihood	Description	Rating	Value Range
Probable	The most probable outcome if the hazard or event takes place	5	≤ 5
Feasible	It is considered fairly common	4	4
Understandable	It could potentially happen at some point in the future	3	3
Unlikely	It has rarely, if ever, been observed over a long period	2	1-2
Impossible	It is virtually impossible and has never been recorded	1	0

Table 4. Severity Indicators

Severity	Description	Rating
Devastating	Many deaths, total loss of property, and severe impact on productivity	5
Terminal	Roughly one death and significant property destruction if the hazard occurs	4
Significant	Injury without death, resulting in permanent disability	3
Slight	Injury that causes temporary disability but is not permanent	2
Unimportant	Small injuries like scrapes, bruises, and injuries that require only basic first aid	1

The range value is explicated in the description of the severity indicator.

Risk Control

After assessing the risk, appropriate control measures are determined based on the risk control hierarchy. There are several types of risk control hierarchies is hazard elimination, substitution, technical control, administrative control, and personal protective equipment (PPE) [13][14].

D. FMEA Analysis

Some categories of risk indicators that are often used in companies include economy, safety issues, reputation, environmental issues, quality of supply, fulfillment of contractual obligations[15]. Assessing the risk level, either using risk matrix or FMEA analysis is performed based on two parameters: (1) Probability represented by probability of arc occurrence (function of protective covers, internal separation, aging etc.), (2) Severity represented by incident energy EI or arc energy WARC[16]. Third parameter (loss impact) is used to determine the level of losses incurred, both in terms of material, work delays, and other losses. The indications of the loss impact rate are shown in Table 5.

Table 5. Severity Indicators

Loss Impact	Description	Rating
Fatal	Severe injury; work stopped completely; impact on electrical operating system	5
High	Moderate injury; work delayed ≥ 1 day; considerable repair costs	4
Medium	Mild to moderate injury; work delayed < 1 day; minor equipment damage	3
Low	Mild injury; minor asset damage; no disruption to operations	2
Very Low	No significant impact; no injuries; no additional costs	1

RESULT AND DISCUSSION

A. HIRARC Procedure

Hazard Identification

Identification as shown in Table 6 is carried out on work activities that cause work accidents.

Table 6. Hazard Identification

No	Risk	Hazard Source
1.	Traffic accident-causing minor injuries	Fatigued driver, lack of road awareness
2.	Traffic accident with passengers unharmed	Fatigued driver, lack of road awareness
3.	Minor cuts	Scratched by sharp object
4.	Bruises	Bumped into panel
5.	Scratches	Bumped into panel
6.	Minor bone fracture	Hit by platform
7.	Muscle and joint injury	Tripped
8.	Electric shock without long-term effects	Leakage voltage on panel
9.	Eye irritation due to dust	Dust on panel
10.	Slipping	Slippery floor

Risk Assessment

Once the hazards are identified, a risk assessment is performed using the likelihood and severity matrix. The assessment results can be seen in Table 7. Based on the results of the risk assessment, it shows that the highest risk level is at HI04 and HI06. Both of these risks arise because these work accidents often occur in AMC work. In the risk assessment graph, it shows that the maintenance work for the past 3 years has been at a medium level, which level requires supervision so that more dangerous work accidents do not occur.

Table 7. Risk Assessment Data

No	ID	Risk	Severity	Likelihood	Risk Score	Risk Level
1.	HI01	Traffic accident with minor injuries	2	4	8	Medium
2.	HI02	Traffic accident with no injuries	1	3	3	Low
3.	HI03	Cut with minor injuries	2	2	4	Low
4.	HI04	Bruised	1	5	5	Medium
5.	HI05	Eye irritation due to dust	2	2	4	Low
6.	HI06	Abrasion	1	5	5	Medium
7.	HI07	Fracture of the thumb	3	2	6	Medium
8.	HI08	Muscle and joint injuries	3	2	6	Medium
9.	HI09	Electrocuted without long term effect	2	4	8	Medium
10.	HI10	Fell on the floor	2	2	4	Low

Risk Control

Recommended risk control measures are classified according to the hierarchy of control principle, as shown in Table 8.

Table 8. Risk Control

No	ID	Risk	Risk Level	Risk Control
1.	HI01	Traffic accident with minor injuries	Medium	Administrative Control
2.	HI02	Traffic accident with no injuries	Low	Administrative Control
3.	HI03	Cut with minor injuries	Medium	PPE
4.	HI04	Bruised	Medium	Engineering Control
5.	HI05	Eye irritation due to dust	Medium	PPE
6.	HI06	Abrasion	Medium	PPE
7.	HI07	Fracture of the thumb	Medium	PPE
8.	HI08	Muscle and joint injuries	Medium	Administrative Control
9.	HI09	Electrocuted without long term effect	Low	Engineering Control
10.	HI10	Fell on the floor	Low	Engineering Control

The systematic application of HIRARC helps to map the areas of work that have the highest potential risk. To get a more in-depth analysis, FMEA can be used.

B. FMEA Analysis

Some of the failures that were successfully identified including those listed in Table 9.

Table 9. Failure Mode Analysis

No	ID	Activities	Potential Failure	Cause of Failure	Effect
1.	FM01	Trip to the substation	Traffic accident.	tired, unroadworthy vehicle.	minor injuries.
2.	FM02	Work within the panel	Scratched by a sharp object.	untidy cables, end plate of the device.	cut with minor injuries, abrasions.
3.	FM03		Hit the panel.	in a hurry.	bruised.
4.	FM04		Dust gets into eyes during cleaning panels.	there are no SOPs, not wearing complete PPE.	eye irritation due to dust.
5.	FM05		Electrocuted.	not voltage test on panel.	electrocuted without long term effect.
6.	FM06	Work on panels	A boarder fell on the hand.	there are no SOPs, not wearing complete PPE, in a hurry.	fracture of the thumb.
7.	FM07	Work to the panel	Stumbled upon an open landing.	in a hurry, not focused while walking.	muscle and joint injuries
8.	FM08	room	Slippery floor.	in a hurry.	fell the floor.

RPN (Risk Priority Number) Assessment

Each failure mode is assessed using three parameters, namely severity, occurrence, and loss impact. These parameters are used because in this risk assessment, the priority is on the frequency of accidents and the impact of costs or losses caused by failure or work accidents. This level of loss is not only on medical costs, but will also have an impact on the failure to carry out maintenance and other losses, with the risk score interpretation, shown in Table 10.

Table 10. Range RPN Scores

Risk Score	Risk Level	Risk Control
1 - 50	Low	Monitoring and routine control
51 - 100	Medium	Additional controls are required
100 - 125	High	Immediate action and priority mitigation

The results of the RPN assessment are indicated in Table 11.

Table 11. RPN Scores

No	ID	Potential Failure	Severity	Occurrence	Loss Impact	RPN Score
1.	FM01	Traffic accident	2	4	4	32
2.	FM02	Scratched by a sharp object	1	5	2	10
3.	FM03	Hit the panel	1	5	1	5
4.	FM04	Dust gets into eyes during cleaning panels	2	2	2	8
5.	FM05	Electrocuted	2	4	1	8
6.	FM06	A boarder fell on the hand	3	2	4	24
7.	FM07	Stumbled upon an open landing	3	2	4	24
8.	FM08	Slippery floor	2	2	1	4

Based on the RPN assessment table, it shows that the risk level is in a low condition. Therefore, handling in the form of routine monitoring and control is needed.

Control Recommendations

Based on the RPN assessment, this can also be used as a parameter for the success of the safety of project personnel. The personnel in question have carried out various occupational safety and health programs, including safety induction, sign making and installation for occupational safety and health and the environment, safety talk/safety morning talk, daily safety inspection for occupational safety and health and environment, safety patrol, PPE provision, monthly meeting committee, safety award, licensing/legal, training for full body harness, and occupational safety and health programming and environment, HIRARC and JSA. The Occupational Safety and Health Programming has been demonstrated to enhance the level of knowledge possessed by employees. The findings of the study indicate that education and knowledge have the capacity to positively influence the incidence of injury[17]. The potential contributions of researchers to the company include the provision of understanding regarding the significance of occupational health and safety culture to all company elements. Furthermore, researchers can facilitate understanding of the direct and long-term risks of work accidents. Additionally, they can update personal protective equipment and conduct regular evaluations to mitigate work accidents[18].

C. Integration Into an Electrical Safety Program

According to the standards set out by the Occupational Health and Safety Management Systems (OHSMS), the three areas in the port sector where occupational risks may arise are as follows:

Safe Person

The primary focus of this study is on an individual's level of readiness and competence in performing work in a safe manner. The likelihood of adverse outcomes is amplified in instances where technicians exhibit a paucity of training, neglect to utilize personal protective equipment (PPE), or disregard critical safety procedures, including but not limited to fatigue while operating a vehicle or the imprudent use of sharp instruments.

Safe Place

The emphasis on the importance of a physically and ergonomically safe work environment is a key component of the study. Workplace conditions characterized by slipperiness, disorganization, or the presence of potential physical hazards, including unsafe borders, have been identified as contributing factors to accidents such as slips, bumps, and serious injuries.

Safe System [19]

Work systems and safety procedures must be well designed and executed. Lack of SOPs, supervision, or preventive maintenance can trigger accidents. The six key components of occupational health and safety management systems (OHSMS) and risk management can be integrated into an electrical safety program namely the leadership, policy, plan, do, check, and act[20].

The integration of OHSMS enables the formulation of a policy that delineates three primary approaches for the evaluation of occupational safety risk management: namely, education or training, supervision, and PPE. First, education and training are fundamental to enhancing technicians' awareness and comprehension of safety procedures. This can be achieved through regular training programs, safety briefings, and updating OHS materials according to

field conditions. Secondly, the supervision process must be reinforced in two ways: first, through direct oversight by OHS supervisors, and second, by leveraging central and regional management monitoring systems. This enhanced supervision is crucial for ensuring the proper implementation of SOPs, the thoroughness of safety documents, and the secure state of work equipment. Thirdly, the role of technicians is of paramount importance as the primary implementers on the ground. They are obligated to adhere to stringent safety protocols, meticulously execute work procedures, and proactively report any hazardous conditions. These three aspects are interconnected and must be executed in a consistent manner to establish a secure and competent work environment within the electricity operating system.

CONCLUSION

A case study of three years of Asset Management Contract (AMC) work revealed ten work accidents, the majority of which were attributed to three main factors: the lack of use of Personal Protective Equipment (PPE), inadequate training and implementation of operational standards, and insufficient supervision from OHS supervisors. This finding underscores the pivotal role that human factors and deficiencies in supervisory systems play in the occurrence of incidents, which have repercussions not only for the safety of technicians but also for the operational continuity of the electricity telecommunications network. The results of the risk assessment employing the HIRARC method indicate that 60% of the risks are at a medium level, while the FMEA analysis suggests a low risk level based on RPN, necessitating control through routine monitoring. To mitigate these risks, an integrated policy is necessary that incorporates three primary approaches: the education and training of technicians, the enhancement of supervision by central management and field supervisors, and the fulfillment of PPE in its entirety and in a proper manner. It is anticipated that these three approaches will contribute to the formation of a more robust and resilient safety culture within the context of AMC activities.

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REFERENCES

- [1] D. A. Hillson, "Towards a risk maturity model," *Int. J. Proj. Bus. Risk Manag.*, vol. 1, no. 1, pp. 35–45, 1997.
- [2] K. Bugarová, E. Mošková, and J. Šimíčková, "Increasing the resilience of transport enterprises through the implementation of risk management and continuity management," *Transp. Res. Procedia*, vol. 55, pp. 1522–1529, 2021, doi: <https://doi.org/10.1016/j.trpro.2021.07.141>.
- [3] Y. Y. Haimes, *Risk Modeling, Assessment, and Management*, 3rd ed., USA: John Wiley & Sons, 2009.
- [4] T. Aven, "A semi-quantitative approach to risk analysis, as an alternative to QRAs," *Reliab. Eng. Syst. Saf.*, vol. 93, no. 6, pp. 790–797, 2008, doi: <https://doi.org/10.1016/j.ress.2007.03.025>.
- [5] J. Ridley and J. Channing, *Safety at Work*, 7th ed., USA: Butterworth-Heinemann, 2008.
- [6] A. V. Gkika, O.-A. I. Lympieri, E. A. Varouchakis, A. Pavlides, E. A. Zacharis, and E. L. Lekkas, "A risk assessment methodology for supporting decision making on the climate proofing of electricity distribution networks," *Energy Reports*, vol. 12, pp. 6155–6185, 2024, doi: <https://doi.org/10.1016/j.egyr.2024.11.070>.

- [7] M. N. Iskandar, Qurtubi, and C. Basumerda, "Risk analysis in occupational safety and health (OSH) by using FMEA and FTA method," in 2021 International Conference on Decision Aid Sciences and Application (DASA), 2021, pp. 496–501. doi: 10.1109/DASA53625.2021.9682232.
- [8] D. E. Nordgård, "A framework for risk-informed decision support in electricity distribution companies utilizing input from quantitative risk assessment," *Int. J. Electr. Power Energy Syst.*, vol. 43, no. 1, pp. 255–261, 2012, doi: <https://doi.org/10.1016/j.ijepes.2012.05.018>.
- [9] B. Suhardi, A. A. V. Estianto, and P. W. Laksono, "Analysis of potential work accidents using hazard identification, risk assessment and risk control (HIRARC) method," in 2016 2nd International Conference of Industrial, Mechanical, Electrical, and Chemical Engineering (ICIMECE), 2016, pp. 196–200, doi: <https://doi.org/10.1109/ICIMECE.2016.7910457>.
- [10] A. M. Saedi, J. J. Thambirajah, and A. Pariatamby, "A HIRARC model for safety and risk evaluation at a hydroelectric power generation plant," *Saf. Sci.*, vol. 70, pp. 308–315, 2014, doi: <https://doi.org/10.1016/j.ssci.2014.05.013>.
- [11] C. B. Sijabat and S. Noya, "Application of HIRA and SPAR-H method to control work accident," *J. Tek. Ind.*, vol. 15, no. 1, pp. 70–79, 2014, doi: <https://doi.org/10.22219/JTIUMM.Vol15.No1.70-79>.
- [12] A. Mili, S. Bassetto, A. Siadat, and M. Tollenaere, "Dynamic risk management unveil productivity improvements," *J. Loss Prev. Process Ind.*, vol. 22, no. 1, pp. 25–34, 2009, doi: <https://doi.org/10.1016/j.jlp.2008.07.011>.
- [13] Department of Occupational Safety and Health (DOSH) Malaysia, *Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC)*, Putrajaya, Malaysia: DOSH, 2008.
- [14] Masjuli, A. Taufani, and A. Abu, *Sistem Manajemen Keselamatan dan Kesehatan Kerja Berbasis SNI ISO 45001:2018*. Jakarta, Indonesia: Badan Standardisasi Nasional (BSN), 2019.
- [15] D. E. Nordgård, K. Sand, and I. Wangensteen, "Risk assessment methods applied to electricity distribution system asset management," in *Reliability, Risk, and Safety, Three Volume Set*, US: CRC Press, 2008, pp. 463–470.
- [16] B. Stacho, J. Veleba, and J. Dudek, "Arc flash risk assessment – Overview of scope and different approaches in the US and in the EU," in 2019 20th International Scientific Conference on Electric Power Engineering (EPE), 2019, pp. 1–6. doi: 10.1109/EPE.2019.8778008.
- [17] Y. Thamrin, D. Pisaniello, C. Guerin, and P. Rothmore, "The emerging workforce of international university student workers: Injury experience in an australian university," *Int. J. Environ. Res. Public Health*, vol. 15, no. 3, p. 456, 2018, doi: <https://doi.org/10.3390/ijerph15030456>.
- [18] A. R. Nur Qadri Lutfianto, G. A. Y udhistira, M. A. Febrianti, and Qurtubi, "Management analysis on occupational health and safety in the boiler house using method of hazard identification, risk assessment and determining control," in 2021 Third International Sustainability and Resilience Conference: Climate Change, 2021, pp. 358–361. doi: <https://doi.org/10.1109/IEEECONF53624.2021.9668034>.
- [19] A. Gonçalves, A. Dutra, and C. C. Mussi, "Occupational risks and health and safety management strategies in the port sector: A systematic literature review," *Saf. Sci.*, vol. 184, p. 106767, 2025, doi: <https://doi.org/10.1016/j.ssci.2024.106767>.
- [20] D. Roberts, "Integrating OHSMS, risk management & electrical safety," in 2014 IEEE IAS Electrical Safety Workshop, 2014, pp. 1–8. doi: <https://doi.org/10.1109/ESW.2014.6766912>.

BIOGRAPHIES OF AUTHORS



Adinda Rizki Zuhail is a graduate degree student in the Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia, Jakarta, Indonesia. His concentration is in Power System and Energy Management. His current research focuses on the risk assessment of telecommunication network maintenance at high-voltage substations using HIRARC and FMEA methods. He has been actively involved in the Asset Management Contract (AMC) Project covering the Java, Madura, and Bali regions, with a strong interest in electrical infrastructure reliability and occupational safety in substation operations.



Chairul Hudaya has been a lecturer at the Department of Electrical Engineering at UI since 2009. He also served as the rector of Sumbawa University of Technology from 2020 to 2024. He obtained a Bachelor of Electrical Engineering from the University of Indonesia in 2006, a Master of Engineering in Energy Systems Engineering from Seoul National University in 2009, and a Doctor of Philosophy in Energy and Environmental Engineering from the University of Science and Technology - Korea Institute of Science and Technology in 2016. Prior to assuming the role of rector at UTS, Dr. Hudaya served as head of the Energy System Engineering study program at UI (2018-2020), head of the electrical energy conversion laboratory (2019-2020), and finance and grant manager of SMART CITY UI (2017-2020). He has published over 100 scientific papers in conferences and journals. His research expertise encompasses but is not limited to, energy storage materials, electrical materials for power system engineering, energy system engineering, renewable energy applications, power engineering, energy planning, energy economy and management.