Indonesian Journal of Maritime Technology (ISMATECH)
Vol. 03, Issue 01, June 2025
eISSN: 3025-518X
DOI: https://doi.org/10.35718/ismatech.v3i1.1334

Risk Analysis and Mitigation of Occupational Safety Accidents in the Maintenance Process of Units

Luh Putri Adnyani[1,2*], Rimeily[1], Destyariani Liana Putri[1], Nurmawati[1], Muhammad Khaisar Wirawan[1]

[1]Department of Ocean Engineering, Kalimantan Institute of Technology, Balikpapan, 76127, Indonesia
[2]Department of Civil, Environmental and Mining Engineering, The University of Western Australia, Crawley, 6009, Australia

KEYWORDS
Occupational safety
Risk assessment
Hazard mitigation
Maintenance operations
Personal protective equipment
Risk matrix

ABSTRACT – The maintenance process involves the use of various equipment, machinery, and workspaces, all of which inherently present occupational hazards. If these risks are not adequately addressed, they may lead to workplace accidents. Ensuring worker protection remains a critical concern due to the persistent occurrence of occupational incidents and the presence of workplace hazards that pose significant risks to employees. Therefore, this study aims to identify and assess occupational accident risks during unit maintenance, develop strategies to mitigate these risks, and enhance occupational safety and health (OSH) practices at company. This study identified 27 potential workplace accidents arising from six major hazard categories. These hazards were incorporated into a structured questionnaire, which was then distributed to relevant workers to gather empirical data. The collected responses were analyzed and systematically classified using a risk matrix framework, categorizing risks from low to high levels to prioritize appropriate mitigation measures. The risk assessment identified several high-risk incidents, particularly those categorized under accident codes A1, A3, B3, B4, B5, C3, C4, D1, D5, E1, E2, E3, E4, and E5. Following the risk assessment, targeted mitigation strategies were implemented to address workplace hazards across various job functions. These measures included the mandatory use of personal protective equipment (PPE) tailored to specific tasks, alongside strict adherence to established safety protocols and warning systems to prevent occupational accidents. The findings highlight the necessity for continuous safety monitoring, employee training, and a proactive risk management approach to ensure a safer working environment.

*Corresponding Author | Luh Putri Adnyani | ✉ (luhputria@lecturer.itk.ac.id)

INTRODUCTION

The protection of workers remains far from ideal, as occupational accidents and workplace hazards continue to pose significant risks to employees. To address the issue of occupational safety, companies implement management systems designed to safeguard workers from workplace accidents and mitigate substantial financial losses. One essential management system that must be adopted is Occupational Safety and Health (OSH) [1, 2]. During maintenance processes, all equipment, machinery, and work environments used for unit repairs inherently contain certain risks. If not adequately addressed, these risks can lead to workplace accidents. Maintenance is conducted to prevent performance deterioration, which could negatively impact both the productivity and efficiency of units and workers. As a response to these risks, the use of Personal Protective Equipment (PPE) by field workers has become an essential safety measure.

A review of the literature on occupational safety and health within corporate environments highlights the economic, moral, and legal significance of OSH. Occupational safety and health have become critical issues, particularly as companies strive to maintain profitability in an increasingly competitive global economy. The implementation of OSH policies is essential to ensure the sustainability of business operations. For many large corporations, safety, health, and environmental programs serve as crucial measures to protect the well-being of their workforce [3].

Occupational accidents refer to undesirable events that result in harm to workers, damage to property, or disruptions to operational processes [4]. Such accidents may arise due to various factors, primarily classified as environmental and human factors. Environmental factors include aspects such as equipment quality, policies, supervision, regulations, and OSH implementation procedures. Conversely, human factors encompass unsafe behaviors, lack of knowledge, and unsafe work habits [5]. The most significant contributors to occupational accidents include technical equipment failures, workplace conditions, and worker-related factors.

For instance, within industrial settings, accidents may occur due to inadequate safety equipment, poorly designed machinery lacking sufficient protective mechanisms, or hazardous working environments. High noise levels can impair workers' ability to perceive danger signals, while poor room temperature regulation may lead to worker fatigue, reducing concentration and increasing accident risks. Furthermore, inadequate air circulation can lead to the accumulation of toxic fumes, which ultimately contribute to workplace incidents [6].

Employees who suffer from work-related injuries may require extended leave for recovery, leading to financial strain, particularly if their sick leave is not fully compensated [7]. According to Idroes [8], risk is both a hazard and an opportunity. It is considered a hazard because it represents a threat or an event that may have negative consequences, conflicting with intended objectives. However, risk is also seen as an opportunity because it presents the possibility of achieving specific goals. Risk mitigation is a strategy implemented by companies to minimize the likelihood of risk occurrence and reduce its potential impact [9]. Analysis risk assessment was also investigated for loading and unloading activities at vehicle carriers [10].

In this study, an analysis was conducted on high-risk workplace accidents that may occur within the company. Furthermore, mitigation measures were proposed to prevent occupational accidents during unit maintenance. Thus, ensuring effective occupational safety and health measures is crucial for both employees and organizations. Companies must continuously develop and implement preventive measures, such as regular risk assessments, safety training programs, and strict enforcement of safety regulations, to create a secure and productive work environment.

METHOD

This study employs data from Job Safety Analysis (JSA), focusing on general hazards encountered by workers in the field and tasks that share similar risk potentials. The JSA data for maintenance unit operations is utilized to identify, analyze, and control hazards and risks associated with specific tasks, ensuring worker safety and health while preventing workplace injuries [11]. Maintenance is a must so that work can run smoothly, just like a vehicle such as a motorbike or car, the engine must be routinely maintained to keep it quiet [12]. A study focused on analyzing the risk of work accidents during the pipe welding process on utility boats, addressing the issue of high potential hazards due to confined workspaces and heat exposure. This research provides an important contribution to improving workplace safety through risk identification and appropriate control recommendations [13].

The questionnaire was developed based on an analysis of JSA data and was subsequently processed into a structured survey. The study identifies high-risk tasks, including lifting and installation of pump hoses & hydraulic BOP hoses, high-pressure testing of pump hoses, fluid pumping to BOP, nipple-up riser spool, wellhead preparation, unit maintenance, and wire removal from telescopic units. These six tasks were further assessed through a questionnaire designed to capture hazard perceptions from field workers.

The questionnaire was distributed to four HWU (Hydraulic Workover Unit) personnel, consisting of two HWU supervisors, one assistant operator, and one operator. The collected responses were compiled, structured into readable tables, and subsequently incorporated into a risk matrix. This process allowed for an evaluation of hazard risk levels, facilitating the identification of critical safety risks and enabling the development of effective mitigation strategies to prevent workplace accidents.

The study relies on primary data obtained from the distributed questionnaires and secondary data collected from company documents, literature reviews, previous studies, company profiles, and other relevant sources. These data sources serve as the foundation for analyzing workplace risks and developing recommendations for improving occupational safety within maintenance unit operations.

Identification of Occupational Accidents

To assess the risk of occupational accidents, it is essential to first identify the types of incidents that have previously occurred at company. This identification process is conducted using data from the Job Safety Analysis (JSA), which serves as a tool to recognize and control workplace hazards. The JSA also functions as an assessment to determine whether work activities adhere to the Standard Operating Procedures (SOPs) established by the company [14]. The results presented in Table 1 are derived from JSA data, outlining the identified general hazards and occupational accidents.

Table 1. Identification of Workplace Hazards and Occupational Accidents

Work Activity	Code	Hazard	Potential Consequences
Lifting and Installing Pump Hose & Hydraulic BOP Hose (A)	A1	Slippery work surface, working at height	Worker slips, falls from height, physical injury, fatality
	A2	Lifting/bending/twisting/stretching	Worker suffers back injury, health

			issues (e.g., hemorrhoids)
	A3	Uneven road/work surface	Worker trips, slips, falls, physical injury
	A4	Pinch point	Worker's fingers caught and injured
High-Pressure Hose Testing and Fluid Pumping to BOP (B)	B1	Slippery work surface, working at height	Worker slips and falls from height
	B2	Lifting/bending/twisting/stretching	Worker suffers back injury
	B3	Uneven road/work surface	Worker trips, falls
	B4	High-pressure fluid	Worker struck/thrown by fluid pressure (in pipes), falls from height, fatality
	B5	Pinch point	Worker's fingers caught and severed
Nipple Up riser spool (C)	C1	Lifting/bending/twisting/ stretching	Worker suffers back injury
	C2	Uneven road/work surface	Worker slips, falls
	C3	Noise exposure	Worker experiences hearing impairment, loss of balance
	C4	Pinch point	Worker's fingers caught and injured
Well Head Preparation (D)	D1	Lifting/bending/twisting/ stretching	Worker suffers back injury
	D2	Uneven road/work surface	Worker slips or falls, sustaining injuries
	D3	Noise exposure	Worker experiences hearing impairment
	D4	Extreme hot/cold surfaces	Worker suffers heat stress, heat stroke, fatality
	D5	Pinch point	Worker's fingers caught and injured
Maintenance / Unit Servicing (E)	E1	Slippery work surface, working at height	Worker slips and falls from height
	E2	Lifting/bending/twisting/ stretching	Worker suffers back injury
	E3	Noise exposure	Worker experiences hearing impairment
	E4	Moving/rotating equipment parts	Worker's fingers caught/severed
	E5	Pinch point	Worker's fingers caught and injured
Wire Extraction from Telescopic Equipment (F)	F1	Slippery work surface, working at height	Worker slips and falls from height
	F2	High pressure	Worker thrown off balance, suffers physical injury
	F3	Moving/rotating equipment parts	Worker's fingers caught/severed
	F4	Pinch point	Worker's fingers caught and injured

Table 1 presents work-related accidents that may occur in various onshore operations. The table indicates that a total of 27 accidents can arise from six identified hazards in onshore work environments. By utilizing JSA data, companies can implement occupational health and safety measures within their operational areas, which is crucial for fostering a safe work environment and reducing accident rates. Moreover, these measures contribute to the prevention of workplace accidents and occupational diseases [15]. Consequently, Table 1 provides a more specific explanation, highlighting that 27 accidents may occur due to six hazards in maintenance unit operations.

RESULTS AND DISCUSSION

Identification of Occupational Accidents

The assessment of occupational accident risks is a crucial process in ensuring workplace safety, particularly in high-risk environments such as offshore operations. This evaluation involves identifying potential hazards, analyzing the likelihood of accidents occurring, and assessing their potential consequences. The risk assessment framework follows established methodologies, integrating both qualitative and quantitative approaches to determine the level of risk associated with specific work activities.

Key parameters considered in this assessment include the frequency of incidents, severity of consequences, and existing control measures. Data collection methods encompass historical accident records, workplace observations, and expert judgment to enhance the accuracy of risk evaluations. Furthermore, risk categorization is conducted using a standardized risk matrix, aligning with industry best practices and regulatory guidelines.

The findings from this risk assessment serve as the foundation for implementing targeted mitigation strategies, aiming to reduce accident probabilities and minimize occupational hazards. Recommendations derived from the analysis include improvements in safety protocols, enhanced worker training, and the adoption of advanced monitoring technologies. Ultimately, a comprehensive and systematic risk assessment process contributes to fostering a safer and more resilient work environment.

Table 2. Occupational Accident Risk Assessment

	Negligible(1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very Likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Possible (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Very Unlikely (1)	1	2	3	4	5

The risk level assessment is categorized as follows: Very unlikely (occurring once in more than five years); Unlikely (occurring once in two to five years); Possible (occurring once every one to two years); Likely (occurring several times per year); and Very likely (occurring weekly or monthly). The risk impact assessment is classified as follows: Negligible – No injury; Minor – Minor injury that can be managed with first aid; Moderate – Moderate injury requiring long-term medical treatment; Major – Severe injury, including disability, paralysis, or irreversible loss of motor, sensory, psychological, or intellectual function; Catastrophic – Fatality not associated with pre-existing medical conditions. In the risk matrix table, green indicates a very low occupational hazard risk, yellow represents a moderate risk, orange signifies a high-moderate risk, and red highlights a high-risk category that requires immediate mitigation measures.

Following the risk level assessment and the identification of hazardous tasks based on JSA data, six key activities were identified as having potential risks, namely: Lifting and installation of pump hoses & Hydraulic BOP hoses; High-pressure pump hose testing; Fluid pumping to BOP; Nipple-up riser spool installation; Wellhead preparation; Unit maintenance; and Wire removal from the telescopic system

Table 3 presents the risk assessment for lifting operations and the installation of pump hoses & Hydraulic BOP hoses (A).

Table 3. Occupational Accident Risk Assessment

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)				A4,	A1
Likely (4)		A3,	A1, A1,A2, A4	A2, A3,	A3,
Possible (3)		A4,		A2,	
Unlikely (2)		A2, A4,	A1,		
Very Unlikely (1)					

Code Descriptions:

A1: Risk level of occupational accidents related to lifting, bending, twisting, or stretching.

A2: Risk level of occupational accidents due to uneven walking or working surfaces.

A3: Risk level of occupational accidents associated with pinch points.

A4: Risk level of occupational accidents caused by slippery work floors and working at heights.

Table 4. High-pressure hose pump testing and fluid pumping to the BOP (B).

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)				B5	B5
Likely (4)			B2	B1, B2, B4, B5	B3, B4
Possible (3)		B3, B4	B1, B4	B1, B2, B5	
Unlikely (2)	B1		B2		
Very Unlikely (1)					

Code Descriptions:

B1: Level of occupational accident risk when working on slippery floors and at heights.
B2: Level of occupational accident risk when lifting, bending, twisting, or stretching.
B3: Level of occupational accident risk due to uneven road or workplace surfaces.
B4: Level of occupational accident risk due to exposure to high pressure.
B5: Level of occupational accident risk due to pinch points.

Table 5. Nipple Up Riser Spool

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)					C4
Likely (4)			C1	C1, C2	C3, C4, C4
Possible (3)		C2	C1, C3, C3	C2, C3	
Unlikely (2)		C2			
Very Unlikely (1)		C1			

Code Descriptions:
C1: Risk level of workplace accidents during lifting, bending, twisting, or stretching.
C2: Risk level of workplace accidents due to uneven surfaces on roads or work areas.
C3: Risk level of workplace accidents due to noise exposure.
C4: Risk level of workplace accidents at pinch points.

Table 6. Preparation Well Head (D)

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)				D5	
Likely (4)			D1	D1, D2, D3, D4, D5, D5	
Possible (3)		D1	D2, D2, D4,D4, D4	D3, D3,	D5
Unlikely (2)			D3	D2	
Very Unlikely (1)					D1

Code Descriptions:
D1: Risk level of occupational accidents related to lifting, bending, twisting, and stretching.
D2: Risk level of occupational accidents due to uneven walking or working surfaces.
D3: Risk level of occupational accidents caused by noise exposure.
D4: Risk level of occupational accidents due to contact with hot or cold surfaces.
D5: Risk level of occupational accidents related to pinch points.

Table 7. Maintenance Work on Units (E)

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)		E2		E4	
Likely (4)			E3, E5	E1,E1,E1, E2, E2, E3, E3, E4,E5,E5	
Possible (3)		E2	E1	E4, E4	
Unlikely (2)			E5		
Very Unlikely (1)					E3

Code Descriptions:
E1: Risk level of occupational accidents when working on a slippery floor or at height.
E2: Risk level of occupational accidents during lifting, bending, twisting, or stretching movements.
E3: Risk level of occupational accidents due to exposure to high noise levels.
E4: Risk level of occupational accidents associated with moving or rotating equipment parts.
E5: Risk level of occupational accidents at pinch points.

Table 8. Occupational Hazards in Wire Removal from Telescopic (F) Operations.

	Negligible 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very Likely (5)					
Likely (4)				F1, F2, F3, F4, F4	F3, F4
Possible (3)	F3	F1	F2	F2	F1, F2
Unlikely (2)			F3, F4		
Very Unlikely (1)					F1

Code Descriptions:
F1: Risk level of workplace accidents due to slippery work surfaces and working at heights.
F2: Risk level of workplace accidents related to pressure hazards.
F3: Risk level of workplace accidents involving moving or rotating equipment.
F4: Risk level of workplace accidents related to pinch points.

Workplace Accident Risk Mitigation

A. Lifting and Installation of Pump Hoses and BOP Hydraulic Hoses

To ensure safety during lifting and installation of pump hoses and hydraulic hoses for the Blowout Preventer (BOP), strict adherence to safety protocols is essential. Workers must use Personal Protective Equipment (PPE), such as safety harnesses or lanyards, particularly when working at heights. Work areas should be kept clean and free from slippery surfaces, and lifting aids should be used when feasible. Additionally, workers should avoid sudden bending or twisting movements and wear safety footwear to navigate uneven surfaces. Areas prone to pinch point hazards must be clearly marked, and workers should wear appropriate protective gloves. Furthermore, training should be provided to enhance awareness of working at heights, pinch point hazards, and preventive measures.

B. High-Pressure Testing of Pump Hoses and Fluid Pumping to BOP

The process of high-pressure testing for pump hoses and fluid pumping to the BOP presents various workplace hazards, including slippery surfaces, falls from heights, back injuries, uneven terrain, fluid pressure hazards, and pinch points. To mitigate these risks, floors must be kept clean and dry, anti-slip mats should be installed, and slippery areas should be clearly marked. PPE, such as safety harnesses, must be used by workers operating at heights, and platforms and ladders should be stable. Proper lifting techniques should be taught to prevent back injuries, and lifting aids like trolleys or forklifts should be used. Uneven surfaces must be leveled, and workers should wear anti-slip safety footwear. Additionally, all pipe and hose connections should comply with technical specifications, and PPE such as helmets and eye protection must be worn. Warning signs should be placed in high-pressure areas, and to prevent pinch point injuries, hazard areas must be identified, gloves should be worn, and workers must receive appropriate training. Implementing these measures aims to minimize workplace accident risks and ensure worker safety.

C. Nipple Up Riser Spool Operations

Nipple up riser spool operations involve several workplace hazards, including back injuries due to lifting, bending, twisting, or stretching; slip hazards due to uneven surfaces; excessive noise exposure that may affect hearing and balance; and pinch point hazards that pose a risk of finger injuries. To reduce these risks, workers should be trained in proper lifting techniques, utilize lifting aids, and perform stretching exercises before work. Uneven surfaces must be leveled, and workers must wear anti-slip safety shoes. Noise hazards should be mitigated by providing hearing protection, using noise dampeners, and restricting access to high-noise areas. Pinch points should be clearly marked, and workers must wear protective gloves and receive specific training on hazard prevention. Implementing these safety measures is crucial to preventing accidents and maintaining a safe work environment.

D. Wellhead Preparation Phase

The wellhead preparation phase presents various workplace hazards that must be anticipated, including back injuries due to lifting, bending, twisting, or stretching. These risks can be mitigated through proper lifting techniques and the use of lifting aids. Uneven work surfaces can lead to slips and falls; thus, regular inspections, repairs, and the use of anti-slip mats or footwear are necessary. Noise hazards affecting workers' hearing should be addressed by

providing hearing protection. Risks from exposure to hot or cold surfaces can cause heat stress, which should be prevented by using protective clothing and ensuring rest areas are available. Pinch point hazards can be mitigated through proper identification, warning signs, and training programs.

E. Maintenance of Equipment and Units

Maintenance activities pose various risks, such as slippery floors and working at heights, which may lead to slips or falls. To minimize these risks, work surfaces must always be clean and dry, anti-slip mats should be installed, and warning signs must be placed in hazardous areas. Workers at heights must use PPE such as harnesses and safety lanyards, and work platforms and ladders should be kept stable. The risk of back injuries due to lifting or bending can be reduced by teaching proper lifting techniques and using lifting aids. Noise hazards should be controlled through hearing protection and restricted access to high-noise zones. Moving or rotating equipment should have appropriate safety guards, and workers should wear protective gloves while following safe operational procedures. Pinch point hazards must be identified and mitigated through training and the use of proper PPE.

F. Wire Removal from Telescopic Systems

Wire removal from telescopic systems involves risks such as slippery floors and working at heights, which can result in slips or falls. To prevent these incidents, work areas must be kept clean and dry, anti-slip mats should be installed, and warning signs should be placed in hazardous areas. Workers at heights must use PPE, including harnesses and safety lanyards, while ensuring that platforms and ladders are stable. High-pressure hazards that may cause physical injuries must be minimized by ensuring all equipment meets specifications, using PPE, and providing specialized training. Moving or rotating equipment should have protective guards, and workers must wear safety gloves to prevent pinch point injuries. Additional training and warning signs are necessary to ensure a safe working environment.

CONCLUSION

Based on the analysis conducted over a two-month period at company, the following conclusions have been drawn. The results indicate that several tasks require risk mitigation measures due to their classification in the high-risk category (red zone) within the risk matrix table. These tasks, identified as requiring immediate mitigation, include the following activities: Lifting and installation of pump hoses and hydraulic BOP hoses: (A1 – Slippery work surfaces, working at height; A3 – Uneven work surfaces); High-pressure testing of pump hoses and fluid pumping to BOP: (B3 – Uneven work surfaces; B4 – High pressure; B5 – Pinch points); Nipple-up riser spool operations: (C3 – Noise exposure; C4 – Pinch points); Wellhead preparation: (D1 – Lifting, bending, twisting, stretching; D5 – Pinch points); Maintenance and servicing of units: (E1 – Slippery work surfaces, working at height; E2 – Lifting, bending, twisting, stretching; E3 – Noise exposure; E4 – Rotating/moving equipment parts; E5 – Pinch points); and Wire removal from telescopic equipment: (F1 – Slippery work surfaces, working at height; F2 – High pressure; F3 – Rotating/moving equipment parts; F4 – Pinch points). Following the occupational accident risk analysis, mitigation measures have been developed for high-risk tasks, particularly in lifting and installation of pump hoses and hydraulic BOP hoses, high-pressure hose testing, fluid pumping to BOP, nipple-up riser spool operations, wellhead preparation, unit maintenance, and wire removal from telescopic equipment. The recommended risk mitigation measures include: Establishment of an emergency response team; Availability of first aid equipment (P3K kits); Mandatory use of Personal Protective Equipment (PPE) in accordance with safety regulations; Implementation of hazard warning signs in high-risk areas; Conducting pre-use inspections of all equipment involved.

REFERENCES

[1] J. H. Andersen, P. Malmros, N. E. Ebbehoej, E. M. Flachs, E. Bengtsen, and J. P. Bonde, "Systematic literature review on the effects of occupational safety and health (OSH) interventions at the workplace," *Scandinavian journal of work, environment & health*, vol. 45, no. 2, pp. 103-113, 2019.

[2] B. Endroyo, B. E. Yuwono, and D. Mardapi, "Model of learning/training of Occupational Safety & Health (OSH) based on industry in the construction industry," *Procedia Engineering*, vol. 125, pp. 83-88, 2015.

[3] R. S. V. Kaligis, B. F. Sompie, J. Tjakra, and D. Walangitan, "Pengaruh implementasi program keselamatan dan kesehatan kerja (K3) terhadap produktivitas kerja," *Jurnal Sipil Statik*, vol. 1, no. 3, pp. 219-225, 2013.

[4] S. Piri, B. F. Sompie, and J. A. Timboeleng, "Pengaruh kesehatan, pelatihan dan penggunaan alat pelindung diri terhadap kecelakaan kerja pada pekerja konstruksi di Kota Tomohon," *Jurnal ilmiah media engineering*, vol. 2, no. 4, 2012.
[5] P. Suma'mur, "Higiene perusahaan dan kesehatan kerja (HIPERKES)," 2017.
[6] E. Aswar, P. Asfian, and A. F. Fachlevy, "Faktor-Faktor Yang Berhubungan Dengan Kecelakaan Kerja Pada Pekerja Bengkel Mobil Kota Kendari Tahun 2016," Haluoleo University, 2016.
[7] E. M. Zeinda, "Risk assessment kecelakaan kerja pada pengoperasian boiler di PT. Indonesia Power Unit Pembangkitan Semarang," *Indonesian Journal of Occupational Safety and Health*, vol. 5, no. 2, pp. 183-191, 2017.
[8] F. N. Idroes, *Manajemen risiko perbankan: Pemahaman pendekatan 3 pilar kesepakatan basel II terkait aplikasi regulasi dan pelaksanaannya di Indonesia*. Rajawali Pers, 2011.
[9] B. Wijayantini, "Model pendekatan manajemen risiko," *Jurnal Ekonomi Akuntansi Dan Manajemen*, vol. 11, no. 2, 2012.
[10] A. F. Usman, S. Asmarita, A. Murtafiah, and A. Ningrat, "Vehicle Loading and Unloading Activities at MV Aishakamilah, Hazard Identification, Risk Assessment and Risk Control," *Indonesian Journal of Maritime Technology*, vol. 2, no. 2, 2024.
[11] Suardi S, Setiawan W, Alamsyah A, Wulandari AI, Hidayat T. Reliability and Risk Analysis of Lubrication System on Sabuk Nusantara 43. *International Journal of Offshore and Coastal Engineering (IJOCE)*. 2023 Nov 1;7(2):56-62.
[12] Suardi S, Pawara MU, Mahmuddin F, Klara S. Enhancing Community Self-Sufficiency: A Case Study of Motorcycle Maintenance Training in North Balikpapan. *Indonesian Journal of Maritime Technology*. 2024 Jun 30;2(1)
[13] Rachmianty A, Armay NG, Ningrat A, Usman AF, Shauqy MA. The Analysis of Work Accident Risk in Welding Process for Pipe Repair on Utility Boat PT LSM. *Indonesian Journal of Maritime Technology*. 2024 Dec 15;2(2).
[14] A. Z. Abidin and N. A. Mahbubah, "Pemetaan risiko pekerja konstruksi berbasis metode job safety analysis di PT BBB," *Jurnal Serambi Engineering*, vol. 6, no. 3, pp. 2111-2119, 2021.
[15] S. Balili and F. Yuamita, "Analisis Pengendalian Risiko Kecelakaan Kerja Bagian Mekanik Pada Proyek PLTU Ampana (2x3 MW) Menggunakan Metode Job Safety Analysis (JSA)," *Jurnal Teknologi dan Manajemen Industri Terapan*, vol. 1, no. 2, pp. 61-69, 2022.