JURNAL VENUS
Vol. 13, No. 2, September 2025, pp. 80-94
p-ISSN 2338-4611 | e-ISSN 2798-0995

Analysis of the Procedure for Entering a Closed Space at KM SK 3

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ARTICLE INFO

Article history
Received: 13 June 2025
Revised: 23 June 2025
Accepted: 20 August 2025
Published: 10 September 2025

Keywords
Enclosed space; entry procedures; ship safety; ballast tank; qualitative research

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ABSTRACT

Entering enclosed spaces on ships poses significant safety risks due to inadequate ventilation, oxygen deficiency, and the potential presence of toxic gases and hydrocarbon vapors. These hazards can endanger crew members if appropriate safety procedures are not followed. This study aims to analyze the procedures for entering enclosed spaces aboard KM SK 3, particularly ballast tanks, and identify the importance of implementing appropriate safety measures. The study employed a descriptive qualitative research design using primary and secondary data. Data were collected through direct observation, interviews with respondents aboard KM SK 3, and a literature review. The collected data were analyzed descriptively to examine the implementation of enclosed-space entry procedures and the safety considerations involved. The findings highlight the importance of improving and consistently implementing entry procedures before personnel enter enclosed spaces. These procedures are essential to ensure that potential hazards are identified and controlled, thereby reducing the risk of accidents and protecting crew members' safety. This study emphasizes the practical importance of procedural compliance in enclosed-space operations aboard ships. Its contribution lies in focusing on the implementation of enclosed-space entry procedures on KM SK 3, providing operational insights that may support improvements in onboard safety practices and strengthen awareness of the hazards associated with enclosed spaces.

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How to cite: Susanto, R., Setiawan, H., Rahim, M. (2026). Analysis of the Procedure for Entering a Closed Space at KM SK 3. *Jurnal Venus*, *13*(2), 80-94. https://doi.org/10.48192/vns.v13i2.783

1. INTRODUCTION

Maritime transportation plays a vital role in national and international trade by facilitating the movement of goods through global supply chains. Its capacity to transport large volumes of cargo efficiently makes shipping an essential component of international logistics. However, shipboard operations involve various occupational hazards, particularly during cargo handling, maintenance, inspection, and other activities requiring crew members to enter enclosed spaces. Ensuring the safety of seafarers during these operations is essential for protecting human life, maintaining operational continuity, and supporting the implementation of international maritime safety standards.

Enclosed spaces aboard ships, including ballast tanks, cargo holds, and other compartments with restricted access and inadequate ventilation, present significant risks to personnel. These spaces may contain oxygen-deficient atmospheres, toxic or flammable gases, and other hazardous conditions that cannot always be detected through human senses. Consequently, entering such spaces requires systematic hazard identification, risk assessment, atmospheric testing, adequate ventilation, appropriate

personal protective equipment (PPE), entry authorization, and emergency preparedness. The International Maritime Organization (IMO, 2025), through Resolution MSC.581(110), provides revised recommendations for entering enclosed spaces aboard ships, emphasizing the importance of identifying hazards, establishing safe entry conditions, and preparing for emergencies. These principles demonstrate that enclosed-space entry must be treated as a controlled safety operation rather than a routine inspection activity.

The importance of these preventive measures is also supported by research on human factors in maritime safety. Hetherington et al. (2006) examined the human element in shipping safety and highlighted the relevance of human performance to maritime accident prevention. More recent research by Hasanspahić et al. (2021) discussed the role of human factors in marine accidents, while Zaib et al. (2022) applied fuzzy fault tree analysis to investigate the contribution of human factors to maritime transportation accidents. Together, these studies provide a basis for understanding how individual actions and other contributing factors may influence the occurrence of accidents. In enclosed-space operations, the existence of safety regulations alone is insufficient if crew members do not understand the hazards or fail to comply with the prescribed procedures.

The significance of this issue is illustrated by an incident involving KM SK 3 at the anchorage of Tri Sakti Port, Banjarmasin, in January 2024. While the vessel was preparing for cement bag loading operations, the crew encountered technical difficulties during ballast water discharge. Although the ballast pump had been operated, the water level in several tanks did not decrease as expected, causing the vessel to develop a list. In response, the captain instructed the crew to inspect ballast tanks two and three. During this process, the bosun entered a tank without adequate preparation and appropriate personal protective equipment. The bosun subsequently experienced shortness of breath and dizziness and had to be evacuated and provided with emergency assistance using breathing apparatus.

This incident illustrates how an operational problem involving a ship's ballast system can develop into a personnel safety emergency when the inspection process is not accompanied by adequate precautions. Although the initial problem was technical, the subsequent entry into the ballast tank raises concerns regarding hazard recognition, procedural compliance, supervision, and emergency preparedness. The incident therefore provides an opportunity to examine enclosed-space safety not merely as a technical or regulatory issue, but as an operational process involving the interaction of equipment-related problems, human behavior, and safety management practices.

From a practical perspective, the issue is relevant to ship operators, ship officers, safety personnel, and maritime education and training institutions. At the national level, improving compliance with enclosed-space entry procedures can contribute to strengthening occupational safety practices within Indonesia's maritime transportation sector. At the international level, enclosed-space hazards represent a broader maritime safety concern because potentially dangerous atmospheres and restricted access are common characteristics of shipboard compartments across different vessel types. Examining how safety

procedures are implemented in a specific operational incident may therefore provide practical insights that are relevant beyond the vessel under investigation.

Human factors constitute an important theoretical foundation for analyzing the implementation of enclosed-space entry procedures. Hetherington et al. (2006) discussed the human element in shipping safety, while Hasanspahić et al. (2021) examined the role of human factors in marine accidents. These studies support the view that maritime safety cannot be understood solely through equipment reliability or technical conditions. Individual decisions, competence, communication, and compliance with safety requirements must also be considered. In the case of KM SK 3, this perspective is relevant because the technical difficulty experienced during ballast water discharge was followed by a decision to enter a ballast tank without adequate preparation.

More specifically, Soner and Celik (2021) examined human reliability in enclosed-space entry operations aboard ships. Their work provides a relevant basis for considering human error and the reliability of safety-related actions during entry operations. Soner (2021) also investigated accidents in enclosed spaces aboard ships using the fuzzy DEMATEL method, demonstrating the relevance of examining relationships among contributing factors rather than treating accident causes as isolated events. Similarly, Zaib et al. (2022) used fuzzy fault tree analysis to investigate human factors in maritime transportation accidents. These studies support an analytical approach that considers the potential interaction between human actions, operational circumstances, and preventive controls. However, their findings should not be interpreted as direct evidence of the causes of the KM SK 3 incident without examination of the relevant field data.

Risk assessment is another essential component of enclosed-space safety. The IMO (2025) emphasizes the importance of identifying hazards and establishing appropriate controls before personnel enter an enclosed space. The International Labour Office (1996), through its code of practice on accident prevention aboard ships, also provides a foundation for understanding the importance of systematic accident prevention in shipboard operations. In addition, the International Safety Management (ISM) Code provides a framework for establishing safety management responsibilities, procedures, and safeguards within shipping operations (IMO, 2015). These principles are relevant to ballast tank inspection because an unexpected technical problem should prompt a structured assessment of the risks associated with the proposed inspection rather than an immediate entry without adequate precautions.

Atmospheric testing and ventilation are particularly important because oxygen deficiency and hazardous gases may be present even when a compartment appears safe. The IMO's guidelines on portable atmosphere-testing instruments address the selection of instruments for enclosed-space entry in accordance with SOLAS regulation XI-1/7 (IMO, 2014). The IMO's revised recommendations further emphasize the need to establish safe atmospheric conditions and implement appropriate precautions before entry (IMO, 2025). As a comparative occupational-safety reference, the United States Occupational Safety and Health Administration's permit-required confined-spaces standard, 29 CFR 1910.146, addresses atmospheric testing, entry permits, protective measures, and rescue arrangements.

The National Institute for Occupational Safety and Health (NIOSH, 1986) also documented the importance of preventing fatalities associated with confined spaces. Although these occupational-safety references are not substitutes for maritime-specific regulations, they provide complementary principles for understanding the control of atmospheric hazards and the importance of systematic entry procedures.

Personal protective equipment and emergency preparedness are also central to the prevention of enclosed-space accidents. Protective equipment must be selected according to the hazards identified during risk assessment and used in accordance with applicable procedures. It should not be regarded as a substitute for atmospheric testing, ventilation, entry authorization, or other preventive controls. Similarly, emergency arrangements must be established before entry because an incident inside an enclosed space may create additional risks for personnel attempting a rescue. The IMO (2025) provides relevant guidance on emergency preparedness for enclosed-space operations, while the ISM Code establishes a broader framework for emergency planning and safety management (IMO, 2015). These principles are particularly relevant to the KM SK 3 incident, in which the bosun required evacuation and emergency assistance using breathing apparatus.

Risk management theory provides an additional framework for examining the implementation of enclosed-space entry procedures. According to the International Organization for Standardization (ISO, 2018), risk management involves the systematic identification, analysis, evaluation, treatment, monitoring, and communication of risks. This approach emphasizes that operational decisions should be based on an assessment of potential hazards and the effectiveness of available controls. Applied to KM SK 3, this framework can be used to examine whether the ballast water discharge problem was followed by an adequate assessment of the risks associated with entering the ballast tanks. It also provides a basis for evaluating whether preventive measures were established before the inspection took place.

Safety management is another relevant perspective for understanding the relationship between organizational procedures and individual actions. The International Maritime Organization's International Safety Management (ISM) Code establishes a framework for safe ship operation, pollution prevention, the identification of risks to ships and personnel, and the implementation of appropriate safeguards (IMO, 2018). From this perspective, safety depends not only on the availability of written procedures but also on the clarity of responsibilities, effective supervision, crew awareness, and consistent implementation. In the context of KM SK 3, this framework supports an examination of how shipboard safety responsibilities and established procedures were applied when the technical problem required further inspection.

Furthermore, the IMO's Casualty Investigation Code emphasizes the systematic investigation of marine casualties and incidents to identify contributing factors and derive lessons that may prevent recurrence (IMO, 2008). This approach distinguishes accident investigation from simply identifying the individual who performed an unsafe action. Instead, the investigation should consider the circumstances surrounding the event, relevant human factors, operational decisions, and the adequacy of preventive

arrangements. Applied to the KM SK 3 incident, this perspective supports an evidence-based analysis of the circumstances preceding the bosun's entry into the ballast tank, the implementation of required safety measures, and the lessons that can be drawn to improve future enclosed-space operations.

Crew competence and training provide another important dimension of enclosed-space safety. The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), including its Manila Amendments, establishes international requirements concerning seafarer competence and training (IMO, 2010). The application of these principles to enclosed-space entry involves ensuring that personnel understand the relevant hazards, recognize unsafe conditions, follow established procedures, and respond appropriately to emergencies. In practice, the effectiveness of training should be examined alongside the availability of safety equipment, clarity of responsibilities, supervision, and compliance with shipboard procedures.

The relationship between technical problems and safety procedures is particularly important in the case of KM SK 3. The failure of ballast water levels to decrease as expected created an operational need to investigate the ballast system. Nevertheless, a technical problem does not eliminate the requirement to assess the hazards associated with entering a tank. Instead, it increases the importance of establishing whether the space can be entered safely and whether the necessary precautions, authorization, equipment, and emergency arrangements are in place. This perspective allows the incident to be examined as a safety-management problem involving both the operational circumstances and the implementation of preventive measures.

Previous studies have examined human factors in maritime accidents, human reliability during enclosed-space entry, and methods for identifying relationships among contributing factors (Hetherington et al., 2006; Hasanspahić et al., 2021; Soner, 2021; Soner & Celik, 2021; Zaib et al., 2022). International maritime regulations and guidelines also establish principles for hazard identification, risk assessment, atmospheric testing, protective measures, and emergency preparedness (IMO, 2014, 2015, 2025). These studies and regulatory frameworks provide an important foundation for understanding enclosed-space safety.

However, the available literature cited in this study does not, by itself, establish how these safety requirements were implemented during ballast tank inspection following a ballast water discharge problem aboard KM SK 3. In particular, the relationship between an unexpected ballast-system operational problem, the decision to enter a ballast tank, and compliance with the required safety procedures requires examination in the context of the incident. The extent to which supervision, crew competence, risk assessment, entry authorization, and emergency preparedness influenced the implementation of the procedures must be established through the research data.

Accordingly, the research gap addressed in this study concerns the practical implementation of enclosed-space entry procedures during a ballast-system operational problem aboard KM SK 3. Rather than assuming that the incident resulted from a single cause, the study examines the implementation of safety measures and identifies aspects of procedural compliance that require improvement. This focus

provides a context-specific contribution to the discussion of enclosed-space safety in maritime operations.

The novelty of this study lies in its contextual analysis of enclosed-space entry procedures during ballast tank inspection following a ballast water discharge problem aboard KM SK 3. Unlike studies that examine human factors in maritime accidents more broadly or investigate enclosed-space safety through general reliability and risk-analysis approaches, this study focuses on the implementation of safety procedures under a specific operational circumstance in which an unexpected technical problem prompted tank inspection. Its intended contribution is to connect established maritime safety principles with the practical application of entry procedures, crew actions, and preventive controls in the case under investigation.

Practically, the findings are expected to provide evidence-based recommendations for improving hazard assessment, entry authorization, atmospheric testing, PPE compliance, supervision, crew training, and emergency preparedness. The scope of these recommendations will depend on the evidence obtained from the research and should be consistent with the applicable maritime safety requirements.

This study aims to analyze the implementation of enclosed-space entry procedures during ballast tank inspection aboard KM SK 3, identify factors affecting compliance with the required safety measures, and formulate practical recommendations to prevent similar incidents during shipboard operations.

2. METHODS

This study employed a qualitative descriptive approach to examine the implementation of enclosed space entry procedures on board a ship during the field practice period. This approach was selected to obtain a detailed understanding of the preparedness, behavior, and compliance of ship crew members in implementing occupational safety procedures during high-risk operations. The study focused on the implementation of safety measures before and during enclosed space entry, including hazard identification, atmospheric testing, ventilation, communication, and the use of appropriate safety equipment, where applicable. An enclosed space was defined as a shipboard area with limited access and inadequate natural ventilation that may expose personnel to hazardous atmospheres, including oxygen deficiency and toxic or flammable gases. The research focused on understanding actual safety practices and identifying potential gaps between established procedures and their implementation.

The vessel served as the research setting because enclosed space entry operations require compliance with established safety procedures and coordination among crew members. The observations focused on the preparation and implementation of enclosed space entry procedures under the vessel's applicable safety requirements.

The research informants consisted of the First Officer (Chief Mate/Mualim I), the boatswain (bosun), and other crew members directly involved in or responsible for enclosed space entry procedures. Informants were selected using purposive sampling based on their duties, experience, and

involvement in the relevant safety operations. This technique was appropriate because the study required information from personnel with direct knowledge of the procedures being examined. The final sample size should be reported based on the actual number of participants interviewed.

The primary research instruments consisted of an observation guide, a structured interview guide, and a documentation checklist. The observation guide was used to examine crew preparedness and the implementation of safety procedures before and during enclosed space entry. The interview guide covered crew members' understanding of safety requirements, assigned responsibilities, operational challenges, and compliance with established procedures. The documentation checklist was used to review relevant safety documents, including enclosed space entry permits, risk assessments, atmospheric testing records, safety meeting records, and applicable standard operating procedures, where available.

The principal analytical focus was the implementation of enclosed space entry procedures. This was examined through observable indicators, including pre-entry risk assessment, isolation of relevant systems, ventilation, atmospheric testing, authorization to enter, communication arrangements, availability of rescue equipment, and emergency preparedness, as applicable to the operation and governing procedures. Interview and observation instruments were reviewed for their relevance to the research objectives before data collection. Any formal validity or reliability assessment should be reported only if it was actually conducted. Given the qualitative design, credibility was supported through comparison of observation findings, interview responses, and documentary evidence.

Data were collected through direct observation, structured interviews, and documentation. First, the researcher observed the preparation and implementation of enclosed space entry procedures, focusing on crew readiness, compliance with safety requirements, and coordination during the operation. Second, structured interviews were conducted with the selected informants to clarify observed practices, understand their responsibilities, and identify factors affecting procedural compliance. Third, relevant documents and literature were examined to provide additional context and compare actual practices with applicable safety requirements.

Primary data consisted of information obtained from observations and interviews, while secondary data were derived from relevant safety documents, regulations, technical guidance, and literature. Data collection was conducted with the necessary authorization from the vessel's responsible authority and in accordance with applicable safety requirements. The researcher did not enter an enclosed space solely for observation without the required authorization, risk assessment, and safety precautions.

The data were analyzed descriptively using a qualitative process of data condensation, data display, and conclusion drawing and verification, following the framework of Miles, Huberman, and Saldaña (2014). First, the observation notes, interview responses, and documentary records were organized and reviewed. Second, relevant information was coded and grouped into themes corresponding to the research objectives, such as pre-entry preparation, atmospheric testing, procedural

compliance, communication, and emergency preparedness. Third, the findings from different data sources were compared to identify consistencies, discrepancies, and potential gaps in the implementation of safety procedures. Finally, conclusions were drawn by interpreting the findings in relation to the research questions and applicable safety requirements.

The research was conducted with due consideration for participant confidentiality and operational safety. Informants were informed of the purpose of the study and the intended use of the data, and their informed consent was obtained before interviews. Personal identities were kept confidential in the research report unless explicit authorization for identification had been provided. Photographs, internal documents, and other operational information were included only where the necessary permission had been obtained.

3. RESULTS AND DISCUSSION

Brief History of PT. Berlian Trasindo Kencana The history of the establishment of PT Berlian Trasindo Kencana began with the father of the director of the Berlian Trasindo Kencana Company, namely Mr. Antonius, who founded this Company in 2008 where the first ship was a Tug Boat named Pinang Jaya and then added several cargo ships, one of which was KM SK 3 which became my place in carrying out Sea Practice. Until now the ship from PT. Berlian Trasindo Kencana already has 5 general cargo ships. All of these ships operate in Indonesian territory by transporting various kinds of cargo. KM SK 3 is a cargo ship that has 2 hatches with one crane crane which can load up to 3000 tons. The cargo that is often loaded is cement and building construction materials which usually load in Jakarta and then dismantle in Banjarmasin or Balikpapan. KM SK 3 also contains bulk cargo, one of which is corn where the corn is loaded in Badas, NTT and then the corn cargo is unloaded in Cirebon.

During the implementation of sea practices on board the KM SK 3 ship which lasted from September 2023 to August 2024, the author conducted research related to safety procedures for entering closed spaces on ships, focusing on ballast tanks as one of the closed spaces that have high risks. Ballast tanks on ships are narrow and airtight rooms, so they require special and structured procedures to ensure the safety of the crew working on them.

In January 2024, when KM SK 3 docked at Trisakti Port, Banjarmasin, an incident occurred when the ship was discharging ballast water in preparation for cargo operations. During the process of discharging water on the left ballast tank 2, it was found that the water could not come out completely. Further examination through sounding showed that the water in the left 2nd ballast tank was still left, while the water in the left 3rd ballast tank was reduced. After the water was discharged in all tanks, it was found that there was a leak in the bulkhead wall between the left 2nd and 3rd left ballast tanks.

To repair the leak, the crew had to enter the ballast tank 2 left to weld the leaking bulkhead wall. The initial check process was carried out by Bosun and AB (Crew of the Ship) by coding each other using the light of a flashlight under the supervision of a guard officer. However, in the execution, Bosun who entered the left ballast tank 2 without preparing safety procedures and without using a breathing

apparatus, experienced dizziness and shortness of breath due to inadequate air conditions in the tank. He was immediately evacuated out of the tank and after receiving help, his condition improved.

This incident is an important lesson that entering an enclosed space such as a ballast tank must follow strict safety procedures, such as atmospheric testing to ensure oxygen levels and the absence of toxic gases, the use of personal protective equipment and breathing apparatus, and supervision by authorized officers. This experience confirms that negligence in safety procedures can be fatal, and it is important for all crew to always adhere to standard operating procedures in every activity in an enclosed space to prevent work accidents on board.

Based on the results of observations made by researchers on the occurrence of crew entry into the ballast tank without adequate preparation, it was found that most safety procedures were not carried out according to standards. The observation checklist showed that there was no identification of hazards before entry, the entry permit form was not filled out and briefings were not carried out, the room ventilation was not prepared, and atmospheric testing was not carried out to ensure air quality. In addition, the crew did not use appropriate personal protective equipment (PPE), the completeness of safety equipment was not checked in advance, and rescue plans and emergency communication were also not prepared. These findings confirm that negligence in implementing safety procedures can increase the risk of work accidents in closed spaces, so it is very important to always comply with the procedure checklist before carrying out work in high-risk areas such as ballast tanks.

Based on the events that occurred when the crew entered the enclosed space, various deficiencies and errors were found in the implementation of occupational safety procedures that should have been carried out. One of the main shortcomings is the lack of attention to the risks that exist before entering the ballast tank. The bosun, as the crew on duty, did not identify the hazard and immediately entered the enclosed space without taking into account the potential risks that existed around it. This caused the bosun to almost faint due to exposure to unsafe air in the tank, which could have been avoided if the risk assessment had been carried out first.

In addition, the entry permit system, which is one of the main procedures for entering a closed space, is also not properly executed. The Enclosed Space Permit form is not filled out and there is no safety briefing before the work begins. Bosun only verbally asks permission from the captain without any adequate documentation or preparation. In fact, the correct procedure requires an entry permit form signed by the relevant officials and a briefing to all crew involved, to ensure that all parties understand the hazards and the safety measures that must be taken.

The conditions around the enclosed space are also less noticed. Adequate ventilation is not prepared before the bosun enters the tank. The bosun relies solely on air vents from the manhole, which is obviously not enough to lower carbon dioxide levels or remove harmful gases inside the enclosed space. In fact, the use of a blower or other ventilation device is essential to ensure that the air inside the enclosed space is safe to breathe before the work is done.

Atmospheric checks or tests were also ignored. No measurements were taken of oxygen and carbon dioxide levels in the tank before the bosun entered. The bosun only opened the manhole in the hope that the air in the tank would improve, but without adequate measuring instruments, atmospheric conditions in the enclosed space remained unknown and very risky. As a result, the bosun experienced shortness of breath and almost lost consciousness.

The use of personal protective equipment (PPE) is also not in accordance with safety standards. Bosun only wears wearpacks and safety shoes, without using respirators, helmets, gloves, body harnesses, or other protective equipment that should be mandatory when entering an enclosed space. Underestimating the risk by reasoning that it will only check briefly is very dangerous, as exposure to toxic gases or lack of oxygen can endanger lives in a short time.

In addition, the completeness of safety equipment is also not checked before work begins. In fact, the inspection of safety equipment such as communication devices, portable lighting, and evacuation equipment is very important to ensure readiness in dealing with emergency situations. The absence of a clear rescue plan is also a serious weakness. Bosun only relies on experience and courage without the preparation of a rescue plan, so that in the event of an accident, the evacuation process will be slow and uncoordinated.

Lack of rescue training and simulation is also a major factor in the occurrence of this incident. Without regular training, the crew of the ship does not have sufficient understanding and awareness of the dangers in closed spaces. This is exacerbated by the lack of communication and coordination between the crew. At the time of the incident, there are only a few crew members involved, so in the event of an emergency, the available assistance is very limited and the communication process becomes ineffective.

From all these findings, it can be concluded that the implementation of work safety procedures in closed spaces in this incident is still very lacking. Every important stage such as hazard identification, entry clearance, ventilation, atmospheric testing, use of PPE, preparation of safety equipment, rescue training, and communication must be carried out consistently and disciplined. Failure to implement these procedures can increase the risk of work accidents that can endanger the safety and lives of the ship's crew. Therefore, it is very important to increase the awareness, knowledge, and discipline of the entire crew in carrying out each safety procedure before entering the enclosed space on the ship.

This study examines the working safety conditions of the ship crew, especially when entering a closed room at KM SK 3. From the data on work accidents and the causative factors collected, it was found that there is still a high risk of accidents due to the crew's lack of understanding and compliance with the Standard Operating Procedures (SOP) for occupational safety. The existing SOPs have not been fully implemented by the entire work team, including company owners and organizations, thus creating accident-prone working conditions. Workers' awareness of potential dangers is also still low, which allows accidents to occur at any time.

To overcome this, the author establishes work safety principles that are in accordance with the SOPs that must be met by all crew members. In addition, the enforcement of sanctions for those who do not comply with the SOPs is proposed as an effort to improve welfare and safety on board. The author also compiles several procedures and solutions based on research data to improve the understanding and implementation of SOPs by the KM SK 3 crew, so that it is expected to create a safer work environment and reduce the risk of work accidents on the ship.

Based on the above, the author solves all the problems that have resulted from the research on procedures that are still not understood by *the* KM SK 3 crew when entering the closed room and the solutions made by the author through several procedures or (SOP) for the KM SK 3 crew with the data that the author has found including the following:

1) General information in the implementation of entering a closed room.

Table 1. The table of general information enters a closed room.

General This permit concerns entry into any enclosed space and must be filled out by the Master or designated responsible person, as well as by all individuals entering the space.		
Vessel		KM SK 3
Work to be performed		Repair of ballast tank bulkhead walls
Location/name of enclosed space		Ballast Tank
Authorized person in charge		Chief Officer
Name(s) of personal involved		Crew KM SK 3
This permit is valid	From (date/time)	15 January 2024/09:00 am
	To (date/time)	16 January 2024/09:00 am

2) Checking breathing apparatus *and other equipment*.

Table 2. Table of breathing apparatus entering an enclosed space

No.	Enclosed space-related tools	Ada	None
1.	Pressure gauge	√	-
2.	Personal Oxygen Analyzer	√	-
3.	CO2 Detector	√	-
4.	Blower	√	-
5.	Center	√	-
6.	Helmet	√	-

7.	Gloves	√	-
8.	Body Harness	√	-
9.	Safety Boot	√	-
10.	Hand Gloves	√	-
11.	Wearpack	√	-
12.	Life line	√	-
13.	Sufflied air respirator	√	-

3) The data of the person in charge and participants entered the closed room.

Table 3. Table Person in charge enters a closed room

Certificate of Inspection To be signed after completing the previous checklist I confirm that all necessary precautions have been observed and that safety measures will be upheld throughout the duration of the work**.**				
Who	**Name/Rank**	**Date**	**Time**	**Signature**
Master or nominated responsible person	AIDI/MASTER	15 JAN	09:00	
Waiting	AHMAD/CO	15 JAN	09:00	
Person entering the space	TODY/2E	15 JAN	09:00	
Person entering the space	IBRA/OILER	15 JAN	09:00	

4) Completion of Job

Table 4. Job completion table entering the enclosed space

Certificate of Completion To be signed after the previous section is completed The task has been finished, and all personnel, materials, and equipment under my supervision have been removed from the area.			
Item to be checked		Yes	No
Job completed		√	
Area secured against entry		√	
The fficer of the watch notifiedoffic		√	
Responsible person overseeing entry	Chief officer	**Signature**	
Date	16 January 2024	**Time**	

5) Efforts to overcome the shortcomings and mistakes of the KM SK 3 crew

Efforts to improve work safety and awareness of the KM SK 3 crew are carried out through several strategic steps. First, regular training or drills are held every month to increase the crew's understanding of hazard risks and familiarize them with the implementation of safety procedures and the use of personal protective equipment. Second, attention to the welfare and health of the crew is very important, including setting fair working hours and listening to crew complaints to avoid stress that can reduce alertness.

Third, the provision of adequate safety equipment is a priority so that work can be carried out safely and efficiently without obstacles due to less suitable equipment. Fourth, regular evaluations of each work are carried out to learn from mistakes and prevent repetition, as well as strengthen communication between crews so that safety information is conveyed properly. With the implementation of these measures, it is hoped that mistakes and crew shortages can be minimized so that work safety at KM SK 3 can be significantly increased

4. CONCLUSION AND RECOMMENDATIONS

This study concludes that the implementation of safety procedures for entering enclosed spaces on board KM SK 3 was inadequate, as the eight prescribed stages of the procedure were not properly followed by the crew during the activity examined. The main obstacle identified was crew fatigue, particularly that experienced by the bosun after performing port duties during loading and unloading operations. This condition contributed to rushed inspections and the neglect of essential safety measures, as the crew member sought to complete the task quickly and obtain rest. These findings highlight the importance of addressing both procedural compliance and human factors in preventing occupational accidents during enclosed-space operations.

Based on these findings, it is recommended that the shipping company, shipowner, and ship management strengthen the implementation and supervision of enclosed-space entry procedures through regular safety training, socialization, and practical drills. Crew work schedules and rest periods should also be managed appropriately to minimize fatigue-related risks, while compliance with every stage of the safety procedure must be verified before entry. This study is limited to the conditions examined on KM SK 3 and the specific circumstances surrounding the activity; therefore, the findings may not represent practices on other vessels. Future research should involve a wider range of vessels and crew members to investigate the relationship between fatigue, safety awareness, procedural compliance, and the effectiveness of safety training in enclosed-space operations.

DECLARATIONS

Author contributions: All authors contributed to the preparation of this manuscript. All authors have read and approved the final manuscript.

Conflict of interest: The authors declare no conflict of interest. If any author is a member of the Jurnal Venus editorial board or reviewer team, state it here; the manuscript is then handled by another editor, and the author is excluded from all editorial decisions on it.

AI usage statement: During the preparation of this manuscript, the authors used tool name and version for purpose, e.g., language editing. The authors reviewed and edited the output and take full responsibility for the content. Generative AI was not used to produce data, analyses, findings, or references. If no AI tool was used: "The authors did not use generative AI tools in preparing this manuscript."

Ethical approval: Not applicable.

Funding: This research received no external funding.

Data availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors would like to express their gratitude to all individuals and institutions who supported this research. (Include this statement only if applicable and with the consent of those acknowledged.)

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