Optimizing Workplace Accident Prevention During Loading and Unloading on the Mv. Red Rock

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Abstract:
Loading and unloading activities on ships are high-risk work activities because they involve heavy equipment, dynamic working conditions, and human factors. The incident that occurred on the MV. Red Rock vessel shows that there are still weaknesses in the implementation of work safety procedures. This study aims to analyze the factors causing work accidents and formulate safety optimization strategies in the loading and unloading process on the MV. Red Rock vessel. This study uses a qualitative descriptive approach carried out during sea practice from August 7, 2024 to August 8, 2025. The study population included ship crew and stevedoring workers (TKBM), while the sample was determined by purposive sampling consisting of the captain, deck officers, crew members, and TKBM. Research instruments included observation sheets, semi-structured interviews, documentation, and field notes. Data analysis used the Miles, Huberman, and Saldaña model through data condensation, data presentation, conclusion drawing, and triangulation. The results of the study indicate that work accidents are caused by low human resource competency, inadequate equipment conditions, and non-compliance with Standard Operating Procedures (SOPs). Furthermore, miscommunication between ship and shore personnel and time pressures increase operational risks, while the implementation of safety meetings, regular equipment inspections, and strict supervision have been shown to improve occupational safety and reduce potential hazards. This study concludes that optimizing occupational safety on the MV Red Rock requires the implementation of integrated SOPs, ongoing training, and strengthened supervision to minimize workplace accidents during the loading and unloading process.

Keywords: *Cargo Handling Safety, Maritime Safety, Occupational Safety, Risk Management and Standard Operating Procedure.*

I. INTRODUCTION

Loading and unloading on ships is a high-risk activity in the maritime industry due to the heavy equipment, cargo, and dynamic working conditions involved. In recent years, the increase in global maritime trade has increased occupational safety concerns. Previous research has shown that poor compliance with safety procedures and weak operational supervision are the main factors contributing to workplace accidents during loading and unloading (Purwanto *et al*., 2023; Akbar *et al*., 2023).

In Indonesia, the increasing distribution of goods by sea has also increased the risk of workplace accidents during loading and unloading processes. Factors such as negligence in the use of personal protective equipment, ineffective work communication, and weak implementation of standard operating procedures (SOPs) are still frequently encountered in the field. Research by Dharmawan *et al*. (2026) and Sya'ban *et al*. (2025) indicates that loading and unloading activities carry a high level of risk, requiring more optimal safety supervision.

Various previous studies have examined loading and unloading safety using methods such as Job Safety Analysis (JSA) and Hazard and Operability Study (HAZOP). The results indicate that workplace accidents are influenced by human factors, work methods, environmental conditions, and operational equipment readiness (Akbar *et al*., 2023; Nurbaiti *et al*., 2022).

However, most previous research has focused on loading and unloading activities at ports and has not specifically addressed efforts to optimize occupational accident prevention on ships. Furthermore, previous research generally emphasizes risk identification without developing preventive strategies integrated with crew behavior and compliance with safety SOPs.

Based on these conditions, there is still a research gap regarding optimizing occupational accident prevention during loading and unloading processes on ships. This research focuses on identifying the factors

causing workplace accidents and developing a safety strategy on board the MV Red Rock to minimize the risk of accidents during operations.

This study aims to analyze the factors causing work accidents and formulate a strategy to optimize work safety during the loading and unloading process on the MV. Red Rock. The novelty of this study lies in the integration of crew behavior, SOP compliance, and operational evaluation as the basis for developing a more effective and applicable work accident prevention strategy.

II. METHODS

This study uses a qualitative descriptive approach to analyze the optimization of occupational accident prevention during the loading and unloading process on the MV Red Rock. This approach was chosen because it provides an in-depth understanding of occupational safety conditions based on real-world phenomena, particularly regarding crew behavior and the implementation of occupational safety standard operating procedures (SOPs) (Creswell & Creswell, 2023; Sugiyono, 2022).

The research was conducted during sea practice on the MV Red Rock owned by PT Meratus Line from August 7, 2024, to August 8, 2025. Research data was obtained through direct observation during loading and unloading activities on the ship and at several ports of call to obtain a more comprehensive operational picture (Emzir, 2021).

The study population included the ship's crew and stevedoring personnel involved in loading and unloading activities on the MV Red Rock. The research sample was determined using a purposive sampling technique by selecting informants deemed to understand the loading and unloading process and the implementation of occupational safety, such as the captain, deck officers, crew members, and stevedoring personnel (Sudaryono, 2021).

The primary research instrument was the researcher herself, supported by interview guidelines, observation sheets, documentation, and field notes. Data collection techniques included direct observation, semi-structured interviews, literature review, and documentation to obtain in-depth and valid data on occupational safety during loading and unloading processes (Sugiyono, 2022; Creswell & Creswell, 2023).

The data analysis technique used the Miles, Huberman, and Saldaña (2014) model, which includes data condensation, data presentation, and conclusion drawing. Data from observations and interviews were analyzed systematically through data reduction, theme grouping, narrative presentation, and data verification using triangulation to ensure more accurate research results and reflect field conditions.

III. RESULTS AND DISCUSSION

Overview of Research Results

This research was conducted on board the MV. Red Rock, a general cargo ship used to transport heavy-duty containers and support domestic logistics distribution. This ship was built in 1998 by Jiang Dong Shipyard, China, with a length of 99.97 m, a width of 18.20 m, a depth of 8.40 m, and a maximum draft of 6,715 m. MV. Red Rock has a Gross Tonnage (GT) of 4,447 tons and a Deadweight Tonnage (DWT) of 5,230.5 tons, and is registered in Surabaya and owned by PT. Meratus Line.

As a container ship, MV. Red Rock has a carrying capacity of up to 514 TEUs or 238 FEUs, allowing for the transportation of 20-foot and 40-foot containers. The vessel is also equipped with a 92/65 reefer plug with 400 Volts/50 Hz power to support the transportation of refrigerated containers, such as food, seafood, and pharmaceutical products. In its operation, containers are the primary means of transporting cargo of various types and sizes, tailored to the characteristics of the goods being carried.

Fig. 1 MV. Red Rock

Data Presentation

1. Incident at Ende Port, NTT

Based on direct observation during sea practice on MV.Red Rock, the author recorded a specific incident on February 4, 2025 at Ende Port, NTT. Due to the limitations of inadequate port facilities, loading and unloading operations were completely dependent on the weather. However, the lack of understanding of the loading and unloading workforce regarding the characteristics of operations during unfavorable weather, coupled with a rushed work method, caused operational failure. This resulted in the container being lifted hitting the ship's railing which triggered fatal damage to the side of the ship's hull. The results of the author's interview are as follows:

Writer	:	Sir, at that time, how did the container hit the ship's railing?
TKBM	:	The weather is a bit bad, the wind is strong. We are in a hurry because the ship must quickly finish loading and unloading. So the crane wobbles, doesn't fit properly, ends up hitting the railing.
Writer	:	What about the ship's side? Was there a warning?
First Class Officer	:	Of course there was. We immediately recorded it in the port log and then prepared a chronological report. This isn't just about ship damage, but also an insurance claim. So everything must be properly managed.
Writer	:	Bosun, whose crane was moving at that time?
Boss	:	*Crane*I manage the ship, but I have to coordinate with the onshore crane. The problem is, the onshore crane crews don't understand the standard operating procedures (SOPs), so they sometimes don't sync up. That's why collisions can occur.
Writer	:	From the captain's perspective, what steps were taken?
Captain	:	Let me reiterate the importance of safety. All crew members must wear complete PPE. Helmets, safety shoes, gloves—all must comply with SOP. Because if a work accident occurs, the ship is ultimately responsible.
Writer	:	What is the SOP at the port itself?
TLBM	:	Here, the SOP is simply posted on a poster: wearing a helmet, vest, and shoes. But the technical details aren't given to us, they say, in an internal company document. So, we just work based on our experience.

Based on interviews regarding the challenges at Ende Port, it was clear that the primary factors contributing to the risk of accidents were a lack of discipline in following safety instructions and the influence of unpredictable weather. This indicates that the optimization of accident prevention on the MV Red Rock has not been optimally implemented according to safety management theory. Stricter oversight by the watch officer is needed to ensure that all personnel on deck comply with SOPs.

2. Incident at Teluk Lamong Port

Based on Operational Incidents at Teluk Lamong Port, the author noted an incident on May 28, 2025, which despite having complete facilities, did not rule out the possibility of a work accident. The author observed negligence on the part of the TKBM during the unlashing process. Due to impatience in meeting the time target, safety procedures were ignored, resulting in one of the work tools falling from the height of the hold. This incident resulted in damage to the ship's deck and created a dangerous situation for workers in the lower area (working zone), which should be sterile from activity during the loading and unloading process. The results of the author's interview are as follows.

Writer	:	Sir, why did the work equipment fall from the hatch at that time?
TKBM		Yes, because we were in a rush. Loading and unloading deadlines were tight, so procedures were sometimes skipped. During unlashing, the equipment wasn't secured properly, and it ended up falling to the deck.

Writer	:	What was the response from the ship's side?
First Class Officer	:	We immediately record it in the port log and create a chronological report. This is important because, in addition to the ship damage, there's the insurance claim aspect. So, the administration must be neat.
Writer	:	Bosun, was there any coordination with the land crane at that time?
Boss	:	There is, but the problem is at the TKBM. They're impatient, and standard operating procedures (SOPs) are being bypassed. According to procedure, the area below should be sterile. But in reality, there are still people there.
Writer	:	From the captain's perspective, what steps were taken?
Captain	:	Let me reiterate the importance of safety. All crew members must wear complete PPE. Helmets, safety shoes, gloves—all must comply with SOP. Because if a work accident occurs, the ship is ultimately responsible.
Writer	:	What is the SOP at the port itself?
TLBM	:	The SOP here is just posted on a poster: "Wear a helmet, a vest, and boots." But the technical details weren't given to us, according to an internal company document. So, we work based on our experience.

Based on research conducted during the MV. Red Rock's operations at Teluk Lamong Port, the authors analyzed that despite the port's use of advanced semi-automated technology, the risk of workplace accidents remains and should not be ignored. This is due to the rapid and precise work required when interacting with modern port equipment.

Further analysis shows that the effectiveness of accident prevention at this location is highly dependent on the speed at which the ship's crew adapts to the terminal's procedures. The authors found that potential hazards arise when there is miscommunication between the officer on duty and the shore crane operator. Therefore, the optimization strategy that must be implemented is to increase vigilance through safety meetings that specifically address the characteristics of the Teluk Lamong pier. This demonstrates that sophisticated port facilities must be supported by manual supervision in accordance with ISM Code standards to ensure maximum safety of life and cargo.

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IV. DISCUSSION

Based on the data analysis presented, the author concludes that the implementation of occupational safety on board the MV Red Rock during the loading and unloading process is still suboptimal. The tendency to underestimate safety aspects is often the main trigger for workplace accidents. This condition is exacerbated by the lax implementation of safety SOPs and the inadequate adequacy of ship facilities to support safe operational activities. Therefore, the author attempts to find ways to optimize the handling of the issues raised regarding workplace accidents during the loading and unloading process on the MV Red Rock, namely:

1. Triggering Factors for Loading and Unloading Work Accidents.

Based on observations, interviews, and documentation during the maritime practice on the MV Red Rock, it was found that work accidents occurring during the loading and unloading process were caused by interrelated factors. These factors directly impact worker safety, smooth ship operations, and cargo security. In general, there are three main factors causing work accidents: the quality of human resources (HR), inadequate facilities and equipment, and disregard for Standard Operating Procedures (SOPs).

a. Lack of Human Resources (HR) Quality.

The primary factor contributing to workplace accidents is the quality of human resources, both crew members and stevedoring workers (TKBM). Lack of training, limited work experience, weak technical understanding, and a lack of awareness of occupational safety can increase the potential for human error during the loading and unloading process. Common errors resulting from this include miscommunication between workers, crane operation errors, improper load placement, and hasty actions due to operational

target pressures. These conditions demonstrate that the quality of the workforce is crucial for maintaining a high level of occupational safety in the field.

b. Inadequate Facilities and Equipment.

The second factor is limited port facilities and the substandard condition of loading and unloading equipment. Poorly maintained equipment such as wire ropes, slings, and spreaders carries a high risk of technical failure during use. Furthermore, limited port facilities often require ships to rely on more demanding operations. If the equipment used does not meet safety standards, the risk of accidents such as cargo falls, container collisions, or ship structural damage increases.

c. Neglect of Standard Operating Procedures (SOP).

The third most dominant factor is disregard for occupational safety standard operating procedures (SOPs). In operational practice, workers are found not wearing personal protective equipment (PPE), ignoring equipment inspection procedures, rushing, and failing to properly follow safety instructions. SOP disregard generally occurs due to time pressure, lack of supervision, or undisciplined work habits. SOPs are the primary guideline for creating a safe and structured loading and unloading process. Non-compliance with SOPs directly increases the risk of workplace accidents.

2. Analysis of the Impact of Losses Due to Work Accidents.

Workplace accidents during loading and unloading operations not only pose safety risks to workers but also have a wide impact on ship operations, workers' psychological well-being, and company financial losses. Based on observations during sea practice on the MV Red Rock, the impact of workplace accidents falls into three main categories: material losses, psychological impacts, and lost operational time.

a. Material Loss to Ship's Cargo and Equipment.

Workplace accidents during loading and unloading often result in physical damage to containers, cargo, loading and unloading equipment, and the ship's structure itself. Containers colliding with ship railings, equipment falling from a height, or lifting equipment failure can cause damage to the ship's hull, deck, crane, and even the cargo within the container. These material losses directly impact repair costs, equipment replacement, and potential claims from cargo owners or insurance companies. In addition to increasing the company's financial burden, technical damage can also disrupt the ship's operational stability on subsequent voyages.

b. Psychological Impact and Decreased Sense of Worker Security.

In addition to physical losses, workplace accidents also have a psychological impact on ship crews and stevedoring workers. Dangerous work incidents can cause trauma, fear, anxiety, and reduced worker confidence when returning to work in the loading and unloading area. Disturbed psychological well-being can reduce work focus, increase operational tension, and potentially trigger further work errors. Therefore, occupational safety aspects serve not only to protect workers physically but also to maintain mental stability and a sense of security while working.

c. Loss of Time and Disruption of Operational Efficiency.

Workplace accidents also significantly impact the efficiency of ship operations. When an incident occurs, loading and unloading operations typically have to be temporarily halted for evaluation, evacuation, equipment repair, safety inspections, or administrative completion of incident reports. These delays can lead to delayed ship departures, increased port dwell times, and disruption to the logistics distribution chain. In the long term, operational delays can impact shipping company productivity and lead to greater economic losses.

3. Efforts and Role of Ship Owners to Minimize Work Accidents During the Loading and Unloading Process.

To minimize workplace accidents during loading and unloading operations, the ship's management plays a crucial role in implementing planned preventative measures. Based on field observations, three main measures are implemented: conducting safety meetings, inspecting and maintaining equipment, and actively monitoring safety discipline.

a. Implementation of Safety Meeting Before Loading and Unloading Activities.

One of the main preventive measures is to conduct safety meetings, starting before loading and unloading activities begin. Safety meetings are usually led by the Chief Officer or officer on duty responsible for cargo operations. During these meetings, all ship crew and stevedoring workers are briefed on the division of tasks, safe work procedures, use of PPE, potential hazards in the work area, and emergency response steps in the event of an incident. Safety meetings serve to improve work coordination, strengthen safety awareness, and reduce errors due to miscommunication. With proper briefings, all personnel can work more safely and in an organized manner.

b. Periodic Inspection and Maintenance of Loading and Unloading Equipment.

The second step is to conduct routine inspections of all loading and unloading equipment before use, such as ship cranes, wire ropes, hooks, slings, spreaders, and other auxiliary equipment. The ship's management is required to ensure that all equipment is in operational condition and meets safety standards. Inspections and maintenance aim to prevent technical problems that could trigger accidents, such as broken wire ropes, crane damage, or lifting equipment failure. If damage is found, the equipment must be immediately repaired or replaced before operations can resume. This step is crucial in reducing the risk of accidents due to technical factors.

c. Active Supervision and Work Safety Discipline.

The ship's management is also responsible for direct supervision during the loading and unloading process. Supervision is carried out by ship officers to ensure all activities are carried out according to established safety procedures. Supervision includes the use of complete PPE, the regulation of hazardous work areas, compliance with standard operating procedures (SOPs), and the monitoring of worker activities during the loading and unloading process. Furthermore, enforcing work discipline is essential to prevent accidents. If safety violations are discovered, the ship's management must issue a warning or temporarily suspend operations until conditions are safe.

V. CONCLUSION

This study shows that work accidents during the loading and unloading process on the MV. Red Rock are influenced by several main factors, namely the low quality of human resources, limited operational facilities and equipment, and neglect of Standard Operating Procedures (SOPs) for occupational safety. The results of the study indicate that operational target pressure, lack of coordination between workers, and weak supervision are the main causes of human error during loading and unloading activities. In addition to impacting worker safety, work accidents also cause material losses, psychological disturbances for workers, and delays in ship operations. Therefore, optimization of work accident prevention needs to be carried out through the implementation of routine safety meetings, inspection and maintenance of loading and unloading equipment, and stricter supervision of work safety discipline in accordance with ISM Code standards and shipping safety procedures.

Although this study successfully provides an overview of the implementation of occupational safety on board the MV. Red Rock, the study still has limitations because it was only conducted on one vessel and used a qualitative descriptive approach, so the results cannot be generalized widely to all types of ships or ports. In addition, this study focused more on the operational aspects of loading and unloading without quantitatively measuring the level of occupational accident risk. Therefore, further research is recommended to use mixed methods or a quantitative approach with a broader scope of research objects to produce a more comprehensive risk analysis. Practically, the results of this study are expected to serve as evaluation material for shipping companies, ship crews, and stevedoring workers in improving occupational safety culture and strengthening compliance with SOPs to minimize the risk of accidents during the loading and unloading process.

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