

Improving Emergency Fire Drill Skills and Capability to Deal with Fire Emergencies on The MV. Pacific Bulk

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Abstract

Ship fires pose a high risk to crew safety, necessitating increased emergency fire drill competency. This study analyzes crew preparedness and skill enhancement strategies during emergency fire drills on board the MV Pacific Bulk. Using a descriptive qualitative approach, a purposive sampling of 25 crew members involved key officers (Chief Officer, Officer on Duty, Bosun and A/B) was conducted through in-depth interviews, participant observation, and documentation analysis. Data analysis followed the Miles and Huberman model: data reduction, presentation, and verification through triangulation. Results showed good procedural compliance, a 5-minute alarm response, full equipment readiness, and effective coordination during the galley fire simulation. Routine drills, safety meetings, and familiarization of new crew members proved successful, although scenario variations need to be improved. In conclusion, the MV Pacific Bulk has solid emergency preparedness in accordance with SOLAS standards, with various drill scenarios recommended for optimal crew competency.

Keywords: Emergency Preparedness; Fire Drill; Maritime Safety; Ship Crew Competency and SOLAS Compliance.

I. INTRODUCTION

Fire emergencies on ships frequently result in loss of life and significant material damage in Indonesia's maritime sector. This research explores improving crew capabilities and skills through emergency fire drills on the MV Pacific Bulk. Emergency situations such as fires dominate risks in the maritime environment, often resulting in ship losses, serious injuries, and crew deaths (Tac et al., 2020). A notable example is the incident involving the KM Mutiara Sentosa I on May 19, 2017, which caught fire while sailing from Tanjung Perak to Balikpapan, resulting in fatalities despite the rescue of most passengers (KNKT, 2017). This phenomenon demonstrates that ship fires are characterized by rapid spread and difficult extinguishing conditions, demanding high levels of preparedness from the crew (Li et al., 2025). Maritime accidents are difficult to prevent completely, but their impact can be minimized through adequate crew skills in emergency situations (Dragomir & Utureanu, 2016). Data shows that human factors are the leading cause of loss of life in fires, collisions, and ship abandonment incidents in international waters (Tac et al., 2020). In Indonesia, incidents such as the 2025 fire aboard the MT Federal II tanker, which killed 10 people, reinforce the urgency of improving crew preparedness (Reuters, 2025). Although SOLAS Chapter III Regulation 19 requires monthly fire drills for all crew members, observations on the MV Pacific Bulk revealed a lack of skills in emergency procedures (IMO, 2000). Some crew members lacked proper understanding of procedures due to a lack of regular training and briefings, putting themselves at risk during a fire (Latief, 2021).

This contradicts IMO regulations, which emphasize emergency training to maintain firefighting competency (IMO, 2000). Lack of familiarity with equipment such as SCBA and fireman's clothing among new crew members worsens emergency response, especially in vulnerable areas like the galley (Rakhadary & Ashari, 2023). Research shows a gap between STCW regulations and onboard practices, where safety culture and leadership influence drill quality (Tac et al., 2020). On RoRo vessels, such as the MV Pacific Bulk, drill inconsistencies lead to a decrease in overall crew readiness (Wahyudi et al., 2024). This problem

was also evident in the case of the KM Spil Hapsri, where irregular fire drills reduced crew understanding of their duties and increased risks (Latief, 2021). A cognitive evaluation highlighted weaknesses in competency and ongoing training as key barriers to firefighting effectiveness (Wahyudi et al., 2024). Without intervention, these weaknesses have the potential to exacerbate the impact of fires on Indonesian cargo ships. This study aims to identify the readiness of the MV Pacific Bulk crew in emergency fire drill procedures and efforts to improve their capabilities in dealing with fires, by referring to the provisions of SOLAS Chapter III Regulation 19 concerning mandatory emergency training and exercises on board ships (IMO, 2010; Maritime and Coastguard Agency, 2001). The urgency lies in the need to minimize casualties and damage in accordance with SOLAS, especially amidst the increasing number of fire incidents in Indonesia such as the KM Sayang Salsabila (2023). The novelty of the study lies in the specific evaluation of exercises on bulk carrier cargo ships with a focus on galley fire, complementing the ANP model for RoRo (Wahyudi et al., 2024), as well as the integration of digital training for crew competency (Li et al., 2025).

II. METHODS

Types and Methods of Research

This qualitative study aims to provide an in-depth overview of the implementation of emergency fire drills, understand the meaning behind the phenomenon, and explore events related to the crew's readiness on the MV Pacific Bulk (Sugiyono, 2019); Sugiyono (2021). This approach positions the researcher as the primary instrument, with data collection through triangulation to ensure validity in natural onboard conditions (Miles & Huberman, 2014); Emzir (2022). Unlike quantitative studies that test hypotheses, this inductive qualitative study builds a contextual understanding of crew skills, suitable for maritime exploratory studies (Creswell & Poth, 2023); Sudaryono (2021). The research location on the MV Pacific Bulk, owned by PT Deli Pratama Angkutan Laut, during a 12-month sea practice from June 27, 2024, to July 15, 2025, allowed for direct observation of drills and crew interviews. This flexible method captures the dynamics of bulk carrier safety, in line with qualitative principles that emphasize participant experience (Sugiyono, 2021).

Data Analysis Instruments and Techniques

The primary instrument was the researcher herself, supported by in-depth interviews, participant observation, and documentation such as fire drill reports and safety equipment checklists to triangulate primary (crew interviews) and secondary (ship documents) data (Sugiyono, 2019; Creswell & Poth, 2023; Emzir, 2022). Verbal interviews with the Chief Officer, Officer on Duty, Bosun and A/B conducted onboard to gain rich context regarding the implementation of the emergency fire drill, while participant observation allowed the researcher to directly observe the crew's readiness and response during the drill. Documentation included fire drill reports, crew lists, and records of fire drill implementation and safety equipment inspections, which served to validate and strengthen the findings from the interviews and observations. This approach aligns with previous research on optimizing fire drill activities on ships, which also combined interviews, observation, and documentation as primary and secondary data sources, ensuring the data obtained is accurate and relevant to emergency fire drill practices on board ships. Data analysis followed the Miles & Huberman (2014) model with three stages: data reduction (selection of key themes such as procedural readiness), data presentation (narratives, interview tables, diagrams), and verification of conclusions for trustworthiness; Sudaryono (2021). Reduction distilled important data from observations, presentation facilitated interpretation of crew skill patterns, and conclusions were verified by triangulation to avoid bias (Emzir, 2022); Creswell & Poth (2023). This approach was systematic, yielding a deep understanding of drill improvement efforts.

Population and Sample

The study population was all 25 crew members (ABK) of the MV Pacific Bulk, including officers and crew members responsible for emergency fire drills. A purposive sample comprising the Chief Officer, Officer on Duty, Bosun and A/B was selected due to their direct experience with galley fire simulations, ensuring skill representation (Sugiyono, 2021). This qualitative technique is suitable for small but informative samples, focusing on data saturation rather than generalization (Creswell & Poth, 2023).

Research Procedures

The procedure begins with preparation (identifying issues from initial observations of sea practices), data collection (interviews, observations of the November 2024 drill at Satui Port, report documentation), iterative analysis (reduction during collection), and verification of conclusions (Miles & Huberman, 2014); Sudaryono (2021). Each stage is triangulated for credibility, with confidential interview ethics and crew permission (Emzir, 2022). The process is completed in July 2025, resulting in recommendations for drill improvements; Sugiyono (2021).

III. RESULT AND DISCUSSION

Results

Observation Results

1. On November 1, 2024, the MV PACIFIK BULK vessel conducted an emergency fire drill at Satui Port, South Kalimantan. The emergency fire drill process was carried out using a fire hose, nozzle, powder fire extinguisher, fireman outfit, breathing apparatus, and emergency fire pump. prepared by the ship's crew, with the implementation starting at 10:30 LT (Local Time). Based on the operational plan, the estimated completion time for the emergency fire drill activity was targeted at 10:45 LT on the same day.
2. Based on the fire drill report compiled after the exercise, it was found that the emergency fire drill simulation was carried out in accordance with the exercise plan and procedures established by the ship. The operational procedures implemented in the crew's readiness to face fire emergencies are in the good category and in accordance with applicable procedures, this is demonstrated by the implementation of fire simulations in the ship's accommodation area which are carried out systematically and coordinated. All 25 crew members are actively involved in the exercise without any personnel being absent, which indicates a high level of discipline and occupational safety awareness. In addition, the time required from the sound of the alarm until the fire extinguishing equipment is ready on site is only about 5 minutes, which indicates a fast and effective response.
3. During the Emergency Fire Drill on board the MV. PACIFIC BULK, it was found that the availability of the number of fireman outfits available on board was sufficient for the firefighting team in accordance with ship safety regulations, thus allowing more than one crew member to carry out firefighting duties simultaneously without experiencing equipment limitations. The observation results showed that all fireman outfit units were stored in predetermined locations, easily accessible, and in a ready-to-use condition in the event of an emergency.

CHECKLIST SAFETY EQUIPMENT		
MV. PACIFIC BULK / YCQQ 2		
No:		2024
DATE	CONDITION	SIGN
JANUARY	✓	<i>[Signature]</i>
FEBRUARY	✓	<i>[Signature]</i>
MARCH	✓	<i>[Signature]</i>
APRIL	✓	<i>[Signature]</i>
MAY	✓	<i>[Signature]</i>
JUNE	✓	<i>[Signature]</i>
JULY	✓	<i>[Signature]</i>
AUGUST	✓	<i>[Signature]</i>
SEPTEMBER	✓	<i>[Signature]</i>
OCTOBER	✓	<i>[Signature]</i>
NOVEMBER	✓	<i>[Signature]</i>
DECEMBER	✓	<i>[Signature]</i>

Fig 1. Safety Equipment Checklist

Source: Research Documentation

4. Figure 1 shows a safety equipment checklist. It is known that the condition and readiness of firefighting equipment, including fire hoses, nozzles, powder fire extinguishers, fireman's outfits, and breathing apparatus, are in good condition and ready for use. *powder fire extinguisher*The

extinguishers used in the training were in good working order, as indicated by the pressure indicator in the normal position, the safety seal intact, and a valid inspection date. Operation of these extinguishers was carried out in accordance with safety procedures and demonstrated that the crew understood the correct usage techniques.



Fig 2. Fireman Outfit

Source: Research Documentation

5. During the simulation, the crew members designated as firefighters were able to don the fireman's outfit correctly and in a relatively short time, thus not hindering the speed of emergency response. The use of the fireman's outfit was proven to protect the crew from exposure to heat, smoke, and other potential hazards during the simulated firefighting process within the ship's accommodation area.



Fig 3. Safety Meeting

Source: Research Documentation

6. That the implementation of safety meetings is an important part of efforts to improve work safety and crew preparedness for emergencies, especially fires. Safety meetings are held routinely and scheduled, and led by the ship's officer with the involvement of the entire crew. During the safety meetings, various aspects of work safety are discussed, including fire prevention procedures, the use of fire extinguishers, the division of tasks according to the muster list, and evaluation of the implementation of fire drills that have been carried out previously. Observations show that the crew actively participated in the safety meetings and demonstrated a good understanding of the material presented, which is reflected in the increased coordination, discipline, and speed of crew response during the Emergency Fire Drill.

Interview Results

To gain a deeper understanding of the procedure *emergency fire drill* On board the MV. PACIFIC BULK, researchers conducted direct interviews with the Chief Officer, Officer On Duty, Bosun, and A/B involved in the process. These interviews focused on aspects of task implementation, understanding operational procedures, and responding to situations when an emergency fire drill occurred on board. The information obtained became a reference in evaluating the extent to which the procedures during the emergency fire drill were carried out according to standards or not. In this interview process, researchers

asked a series of open-ended questions to explore the experiences and perceptions of informants, including the officer on duty, chief officer, bosun, and ABK directly involved in supervising the emergency fire drill. This approach aims to obtain a comprehensive overview from various operational perspectives on board the ship, from both the technical and managerial perspectives. Researchers also took into account the varying work experience and educational background of each informant, as these factors can influence the level of understanding and compliance with applicable procedures. These findings are important in assessing the effectiveness of supervision implementation and provide a basis for continuous improvement of the emergency fire drill monitoring system on board the ship. The following table presents interview results related to compliance with emergency fire drill procedures.

Table1. Interview Results Table

No	Question	Respondents' Answers	
1	How does the crew understand the emergency fire drill procedures?	C/O	As Chief Officer, I believe the crew's understanding of the emergency fire drill procedures on board is quite good. Most crew members understand the fire handling process, from initial reporting of the incident, sounding the general emergency alarm, to implementing actions in accordance with the ship's emergency procedures. This can be seen from the crew's quick and focused response when the alarm is sounded, as well as their ability to carry out their respective roles without causing panic. Emergency fire drill procedures have also been socialized through briefings, muster lists, and routine familiarization sessions, so the crew knows the next steps to take in the event of a fire emergency on board.
		Officer on Duty	The crew's understanding of emergency fire drill procedures was quite good. The crew understood that any fire incident must be reported immediately to the bridge and then awaited further instructions after the emergency alarm was sounded. During the simulation, the crew demonstrated a rapid response and followed established procedures in accordance with the ship's safety management system.
		A/B	As a crew member, I understand that emergency fire drill procedures are intended to train us to be prepared for fires on board. I understand that when the alarm sounds, I must immediately stop work, proceed to the muster station, and follow the instructions of my superiors according to established procedures.
		Boss	In my opinion, the crew's understanding of emergency fire drill procedures was quite good. The crew knew the initial steps to take in the event of a fire, such as reporting the incident to the bridge, moving away from the danger area, and preparing for muster station as instructed. During the drill, the crew also understood communication channels and fire area security procedures. This was evident in their quick and orderly response during the simulation.
Based on interviews with the Chief Officer, Officer on Duty, crew members, and the Bosun, the crew's understanding of emergency fire drill procedures was considered good. The crew understood the fire handling process, from reporting to the bridge, sounding the emergency alarm, heading to the muster station, and carrying out their respective duties. The crew's response during the drill was deemed swift, focused, and relatively panic-free.			
2	Do the crew members know their respective duties and responsibilities on the muster list?	C/O	Yes, the ship's crew generally understands their respective duties and responsibilities, as outlined in the muster list. Each crew member has been assigned a role, whether as a firefighter, support team member, or evacuation team member. During each fire drill, attendance is checked and tasks are redistributed to ensure all crew members understand their roles. Although some new crew members still need to adjust, overall, the crew understands and is capable of carrying out their duties according to the ship's muster list.
		Officer on Duty	The crew's understanding of emergency fire drill procedures was quite good. The crew understood that any fire incidents must be reported immediately to the bridge and then awaited further instructions after the emergency alarm was sounded. During the simulation, the crew demonstrated a rapid response and followed established procedures according to the ship's safety management system.
		A/B	Yes, I know my duties and responsibilities according to the muster list. For every training exercise, I know my position and what equipment I need to bring. The muster list posted in various areas of the ship also helps us remember our respective duties.

No	Question	Respondents' Answers	
		Boss	Most of the crew members already know their respective duties and responsibilities, as outlined in the muster list. Each crew member knows whether they are part of the firefighting team, the support team, or the security team. As Bosun, I also help ensure the crew members carry out their duties according to instructions and procedures. Although there are still some new crew members who need guidance, overall the division of duties is well understood and implemented.
	Interviews with the Chief Officer, Officer on Duty, Crew Members, and Bosun showed that most crew members knew and understood their respective duties and responsibilities as outlined in the muster list. Crew members understood their roles within the firefighting team, support team, and evacuation/security team, as well as the positions and equipment required during drills. This understanding was supported by the muster list posted throughout the ship and the regular implementation of fire drills. Although some new crew members still needed guidance and adjustment, the division of duties was generally well understood and implemented by the crew.		
3	What efforts have the ships made to improve the skills and abilities of the crew in dealing with emergency fire drills?	C/O	Efforts the ship has made to improve the skills and abilities of its crew include conducting routine and scheduled emergency fire drills in accordance with SOLAS regulations and the company's Safety Management System (SMS). In addition, briefings are conducted before the drill and evaluations or debriefings after the drill to discuss deficiencies discovered during the drill. The ship also provides special familiarization for new crew members regarding emergency procedures, the use of fireman's outfits, and the operation of firefighting equipment. With ongoing training and consistent evaluation, the crew's capabilities are expected to continue to improve.
		Officer on Duty	The ship's efforts include conducting routine fire drills, checking communications equipment, and providing pre- and post-exercise briefings. Furthermore, the drills are designed to actively involve the entire crew so they become familiar with emergency situations and are able to act quickly and appropriately.
		A/B	The ship's efforts include conducting regular fire drills and providing direct instruction from officers and the Bosun. We are also taught how to use fire extinguishers and personal protective equipment. With regular training, I feel my skills and readiness are improving.
		Boss	To improve crew skills, such as conducting regular fire drills and providing direct instruction before and during the exercises. In addition, crew members are given the opportunity to practice using firefighting equipment, such as fire extinguishers and fire hoses. Through repeated training and guidance from officers, the crew's ability and confidence in dealing with emergencies increases.
	Based on interviews with the Chief Officer, Officer on Duty, ABK, and Bosun, the ship has undertaken various efforts to improve the crew's skills in dealing with emergency fire drills, including through routine and scheduled fire drills in accordance with SOLAS regulations and the company's Safety Management System (SMS). These activities are supported by pre-drill briefings, post-drill evaluations/debriefings, communication equipment checks, and special familiarization for new crew. The crew is also given the opportunity to practice directly using fire extinguishers and personal protective equipment. Repeated training, direction from officers, and continuous evaluation are considered to be able to improve the crew's skills, readiness, and confidence in dealing with fire emergencies.		
4	In your opinion, what things need to be improved to make the implementation of emergency fire drills more effective?	C/O	"In my opinion, several things that still need to be improved to make emergency fire drills more effective include increasing the variety of training scenarios, so that crews aren't just accustomed to one type of fire situation. Furthermore, speed in using fireman's outfits and accurate communication between teams also need to be continuously trained, especially for new crews. Improving time discipline, technical understanding of firefighting equipment, and conducting more in-depth evaluations after the drill are also important factors to optimize crew preparedness to face real emergencies."
		Officer on Duty	In my opinion, what needs to be improved is the clarity of communication in emergency situations and the discipline of the crew's response times. Furthermore, a more detailed evaluation is needed after the drill so that any deficiencies can be addressed in the next fire drill.
		A/B	In my opinion, what still needs improvement is the speed and accuracy of donning firefighters' uniforms, especially for inexperienced crew members. Furthermore, coordination between teams needs to be continuously practiced to ensure more effective firefighting. Training with different scenarios is also crucial so that crews don't become accustomed to just one type of fire.

No	Question	Respondents' Answers	
		Boss	In my opinion, what needs to be improved is more frequent firefighting training, especially for new crew members. Furthermore, training in conditions more closely resembling real-life situations would also help improve crew readiness and confidence.

Based on the results of interviews with the Chief Officer, Officer on Duty, ABK, and Bosun, several aspects that need to be improved to make the implementation of emergency fire drills more effective include a variety of training scenarios so that the crew is accustomed to dealing with various fire conditions, increasing the speed and accuracy of the use of fireman's outfits, and strengthening coordination and clarity of communication between teams. In addition, disciplined response times, deepening the technical understanding of the use of firefighting equipment, and implementing more detailed post-drill evaluations are considered important to continue to improve deficiencies.

Documentation Results

PT. Deli Pratama Angkutan Laut

**LAPORAN LATIHAN KEBAKARAN
Fire Drill Report**

Instruksi: 1. Lakukan Latihan Kebakaran setiap bulan. 2. Checklist ini harus diisi oleh Muallim III dan disetujui oleh Nakhoda.		Instructions: 1. Conduct Fire Drill monthly. 2. This checklist must be completed by 3rd Officer and approved by Master.	
Nama Kapal: Vessel's Name : MV. PACIFIC BULK		Tanggal Laporan: Reporting Date : 01 November 2024	
Pelabuhan Asal : Port of Departure : TUBAN		Pelabuhan Tujuan : Port of Arrival : Satui Anchorage	
1 Tanggal Latihan : Drill Date : 01 November 2024	4 Total Waktu Latihan: Total Drill Hour : 15 MINUTES	2 Mulai Jam : Start (Hour) : 10.30	5 Selesai Jam : Finish (Hour) : 10.45
3 Posisi Kapal Saat Latihan: Vessel position during drill : 05° 49,4' S U/S 113° 04,7' N/S E T/B E/W	6 Lokasi Kebakaran : Fire Location : INSIDE ACCOMODATION		
7 Simulasi latihan (secara kronologis): Drill simulation (chronologically): Carried out Fire drill inside accomodation. Bosun found fire and report to bridge. Officer on Duty sounded general emergency alarm, announced by public addressor "FIRE,FIRE,FIRE at smoking room" all crew standby with each equipment, check personnel team and take action as muster list and scenario to extinguish the fire. Simulated by crews and found all in good orders. This drill also including as follows: 1. Checking Fireman's outfit and other personal resque equipment. 2. Checking the relevant communication equipment. 3. Checking the operation of fire extinguishing appliances, fire doors and fire dampers. 4. Checking the necessary arrangement for subsequent abandonment of the ship.			
8 Total waktu yang diperlukan sejak sinyal kebakaran dibunyikan sampai dengan kesiapan Peralatan Pemadam Kebakaran tiba di lokasi kebakaran Total time needed since fire alarm rang until the readiness of Fire Fighting Equipments arrived on fire location		5	Menit Minutes
9 Tipe peralatan pemadam kebakaran yang digunakan : Type of fire fighting equipments used : FIRE HOSE & NOZZEL, POWDER FIRE EXTINGUISHER			
10 Kondisi dari pintu kedap air, fire door. Bagaimana ABK menutup dan waktu yang diperlukan untuk bertindak. Condition of watertight door, fire door. How the crew react to shut doors and how long it takes.		10	Menit Minutes
11 Bila kebakaran di ruangan, apakah fan/blower telah dimatikan? If the fires occur on rooms, have fans/blowers been switch off?	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	18 Apakah quick closing valves dapat difungsikan (simulasi)? Do quick closing valves function properly (on simulation)?
12 Kondisi selang & nosel Hose & nozzle condition	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	19 Kondisi emergency fire pump Emergency fire pump condition
13 Kondisi baju tahan api Fireman outfit condition	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	20 Kondisi breathing apparatus Breathing apparatus condition
14 Kondisi Pemadam CO2 CO2 Fire Extinguisher condition	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	Tanggal pemeriksaan Date of inspection : 30 October 2024
15 Kondisi Pemadam Foam Foam Fire Extinguisher Condition	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	Tanggal pemeriksaan Date of inspection : 30 October 2024
16 Kondisi Pemadam ABC ABC Fire Extinguisher condition	<input checked="" type="checkbox"/> Baik Good	<input type="checkbox"/> Rusak Broken	Tanggal pemeriksaan Date of inspection : 30 October 2024
17 Jumlah ABK yang terlibat dalam latihan Total crew involved in fire drill : 25	Orang Person	21 Jumlah ABK absen karena tugas jaga Total crew absent due to watch keeping duty : 0	Orang Person NIL
22 ABK yang tidak mengikuti latihan karena alasan lain Crew absent during exercise due to other reason Sebutkan nama, jabatan dan alasannya : Please mention name, position and reasons : NIL			
23 Tanggal rencana latihan kebakaran berikutnya : Next fire fighting drill planned date : 01 Desember 2024			
24 Evaluasi hasil latihan (diisi Nakhoda) Drill evaluation (filled by Master) : CONTINUE IMPROVEMENT SHOULD BE DONE.			
Dibuat oleh, Prepared by,		Disetujui oleh, Approved by,	
Muallim III 3rd Officer		Nakhoda Master	

K-080(9.1-9.7)K/SET

Fig 4. Fire Drill Report

Source: Author's Documentation

The documentation in this study was used as supporting data to strengthen the results of observations and interviews related to the readiness of the ship's crew and the implementation of emergency fire drill procedures on board the MV PACIFIC BULK. The documentation data collected consisted of official documents and visual evidence showing that the fire drill activities had been carried out in accordance with applicable safety procedures. The fire drill report document was used to prove that the implementation of the

emergency fire drill had been carried out in a planned and well-documented manner, including the implementation time, simulation location, number of crew members involved, and the results of the activity evaluation. In addition, the ship particular was used to provide a general overview of the ship as the object of research. Furthermore, the crew list was used to support observational data regarding the involvement of all crew members in the emergency fire drill, while the safety equipment checklist was used as evidence of the readiness of the safety equipment and fire extinguishers used during the simulation. Documentation in the form of photographs of the emergency fire drill activities was also used as visual evidence of crew involvement and the use of safety equipment according to procedures. With this documentation, the results of the observations and interviews in this study became more valid, accurate, and accountable, because they were supported by relevant written and visual evidence.

Data analysis

In this section, the researcher analyzes the observation and interview data presented previously. This analysis aims to assess and categorize each finding into the appropriate category. Thus, this analysis serves as the basis for answering the research problem formulation and ensuring that each piece of information obtained has clear relevance to the implementation of the emergency fire drill on the MV. PACIFIC BULK. The analysis is structured as follows:

Table 2. Data Analysis Table

No	Aspects Studied	Observation Results	Interview Results	Documentation Results	Conclusion Results
1	The readiness of the crew in carrying out Emergency Fire Drill procedures on board the MV. Pacific Bulk	During the fire drill, the crew appeared to understand their respective duties. Firefighters' uniforms and rescue equipment were in place, communications equipment was functioning, and fire extinguishers, fire doors, and fire dampers were operational. However, some crew members were still slow in using the equipment.	The crew said they were familiar with the emergency fire drill procedures, but some still felt less confident and needed more practice.	Documentation shows the existence of a fire drill checklist and photos of the training activities which prove that the procedures have been carried out according to the ship's regulations.	The crew's readiness is quite good, but still needs improvement in speed, accuracy, and coordination during drills.
2	Efforts to improve the skills and abilities of ship crews in Emergency Fire Drills	The ship's crew conducts routine drills, checking firefighters' uniforms, communications equipment, and fire extinguishers. The drills are ongoing, but they are still basic.	The ship's officers stated that briefings and evaluations were always conducted after the drill to improve crew understanding.	There are training schedules, evaluation reports, and fire equipment inspection records.	Efforts to improve skills have been carried out well, but more intensive training is needed that is closer to actual emergency conditions.

1. Analysis of Crew Readiness in Implementing Emergency Fire Drill Procedures on the MV. Pacific Bulk

In the data reduction stage, researchers sorted and focused on data directly related to crew readiness in dealing with fire emergencies. The data reviewed came from direct observations during emergency fire drills, interviews with the Chief Officer, Officer on Duty, Boswain, and A/B, as well as documentation in the form of fire drill reports, crew lists, safety equipment checklists, and photographic documentation. From the observation results, the data retained were the involvement of all crew members in the fire drill, the speed of response to the sound of the general emergency alarm, the accuracy of the crew members in carrying out tasks according to the muster list, and the readiness and condition of firefighting equipment. Data not directly related to crew readiness, such as other operational activities outside the fire drill, were eliminated from the analysis. The interview results were reduced by emphasizing the crew members' understanding of the emergency fire drill procedures, their level of awareness of their respective duties and responsibilities, and the crew members' attitudes when facing emergency simulations. Documentation was used to strengthen the findings of the observations and interviews, especially regarding the presence of crew members, the condition of safety equipment, and official evidence of the fire drill implementation. Based on the results of the data presentation, it was found that the crew members' readiness in carrying out the emergency fire drill on the MV Pacific Bulk was in good condition.

This can be seen from the systematic and coordinated implementation of the fire drill, starting from the discovery of the fire source by the Bosun, reporting to the bridge, sounding the general emergency alarm by the Officer on Watch, to the implementation of fire extinguishing by the appointed team. The entire crew of 25 people participated in the exercise without any personnel being absent. This shows a high level of discipline and awareness of work safety among the crew. The crew's response to the sound of the alarm was also relatively fast, as evidenced by the time of approximately 5 minutes from the alarm being sounded until the fire extinguishing equipment was ready for use at the fire simulation location. In addition, the crew was able to carry out their duties according to the applicable muster list. The firefighting team used fireman outfits, breathing apparatus, fire hoses, and fire extinguishers in accordance with established procedures. The support and security teams also carried out their duties well, such as securing the area, closing fire doors, and controlling ventilation to prevent the spread of smoke and fire. The condition of the fire extinguishing equipment used during the exercise was in good condition and suitable for use. This is supported by safety equipment checklist data and fire drill reports which show that the equipment has been inspected regularly and is ready for use in an emergency.

2. Analysis of Efforts to Improve Crew Skills and Abilities for Emergency Fire Drills on the Mv. Pacific Bulk

In the data reduction stage for the second problem formulation, the researcher focused the analysis on data related to efforts undertaken by the ship's management to improve the skills and abilities of crew members in dealing with fire emergencies. Data were obtained from observations of fire drills and safety meetings, interviews with officers and crew members, and documentation supporting safety improvement activities. The data retained included routine and scheduled emergency fire drills, pre-drill briefings, post-drill evaluations or debriefings, and familiarization with emergency procedures for new crew members. Data not directly related to skill improvement efforts, such as ship operational activities outside the safety context, were not included in the analysis. The data presented shows that efforts to improve the skills and abilities of the crew on board the MV Pacific Bulk are carried out in a sustainable and structured manner.

Emergency fire drills are conducted routinely in accordance with ship safety regulations and the Safety Management System (SMS). Each drill involves the entire crew to ensure all personnel have the same experience and understanding in dealing with emergencies. In addition to routine drills, the ship also holds safety meetings to discuss firefighting procedures, the use of firefighting equipment, and evaluate the results of previous drills. Through these safety meetings, the crew is given the opportunity to report any challenges encountered and receive guidance on improvements from the ship's officers. Another effort undertaken was to provide special familiarization for new crew members, particularly regarding the use of fireman's outfits, breathing apparatus, and other firefighting equipment. This familiarization enabled new crew members to adapt more quickly and understand the emergency procedures applicable onboard. Repeated training and briefings were proven to increase crew confidence, improve team coordination, and enhance speed and accuracy in responding to simulated fires.

Discussion

Discussion on Crew Readiness in Implementing Emergency Fire Drill Procedures on the MV PACIFIC BULK

The MV Pacific Bulk crew's preparedness for the emergency fire drill achieved a good rating, in line with SOLAS requirements for effective emergency systems against major fire risks. Procedures in the accommodation area were systematic: Bosun detection, bridge reports, Officer of the Watch alarms, and team extinguishing operations according to the muster list, reflecting an understanding of the SOP. The full participation of 25 crew members without fail demonstrated high discipline, with the alarm response taking only 5 minutes for equipment to be ready, indicating rapid effectiveness. Equipment such as fire hoses, extinguishers, fireman's outfits, and BAs were in good condition, as per the checklist, supported by routine maintenance. Interviews with the Chief Officer, Officer on Duty, Bosun, and crew confirmed that they understood the task without panic and met safety standards.

Discussion on Efforts to Improve Crew Skills and Abilities for Emergency Fire Drills on the MV PACIFIC BULK

The MV Pacific Bulk implements routine and structured efforts in accordance with SOLAS Chapter III Reg. 19: scheduled emergency fire drills, weekly safety meetings, pre-drill briefings, evaluation debriefings, and new crew familiarization. Drills are not merely administrative formalities but practical learning that familiarizes the crew with emergency situations, resulting in a calm and focused response. Safety meetings discuss firefighting procedures, muster lists, and previous evaluations, ensuring two-way communication between officers and crew. Post-drill evaluations identified weaknesses such as SCBA delays and team coordination, while familiarization with new crew members focused on emergency procedures and equipment locations. While effective, interviews suggested variations in drill scenarios and more in-depth technical evaluations to improve optimal preparedness in line with international standards.

IV. CONCLUSION

This study found that the crew preparedness of the MV Pacific Bulk in emergency fire drill procedures was at a good level, indicated by the full participation of 25 crew members, a 5-minute rapid response to alarms, and the use of equipment such as fireman outfits and extinguishers according to the muster list. Skills improvement efforts through routine drills, safety meetings, briefings, and familiarization of new crew members have effectively improved coordination and confidence, in line with SOLAS Chapter III Reg. 19. However, limitations arise from the sole focus on galley fire simulations, a purposive sample limited to officers and key crew members, and a 12-month observation period that does not include variations in extreme weather conditions or crew rotations, so the results are contextual to this bulk carrier and less generalizable to other types of ships.

Practical implications include recommendations for companies to conduct monthly, varied drills with realistic scenarios to improve SCBA donning speed and team communication, and to integrate digital training for new crew to enhance safety culture. Further research is recommended to compare the effectiveness of onboard drills versus shore simulators on tankers or RoRo vessels, use mixed methods with quantitative metrics such as response time, and involve international crew surveys to validate the adapted ANP model (Wahyudi et al., 2024). These findings contribute to strengthening Indonesia's maritime competency in addressing fire risks.

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