Implementation of Marine Pollution 73/78 Annex V on the Meratus Benoa Ship to Prevent Marine Pollution

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Abstract
Indonesia ranks second globally in ship-generated marine debris pollution, driven by 32,587 vessels producing unmanaged plastic and food waste that harms ecosystems and human health. This study analyzes MARPOL 73/78 Annex V implementation on MV. Meratus Benoa to identify constraints and recommend improvements. Employing a qualitative case study approach during 12-month sea practice (July 2024–July 2025), the population comprised 20 crew members, with purposive sampling of Chief Officer and Boatswain as key informants. Instruments included observation guidelines, semi-structured interviews, and documents such as Garbage Management Plan; data analysis followed interactive iterative reduction, display, and verification models. Findings reveal principled compliance through waste segregation, Garbage Record Book logging, and supervision, yet suboptimal due to absent incinerator, limited storage, short port stays, and inconsistent crew discipline despite safety meetings enhancing adherence. Conclusions recommend onboard facility upgrades, routine training, and port coordination to achieve 70% plastic pollution reduction targets, informing national maritime sustainability.
Keywords: *Annex V, Garbage Management, Marine Pollution, MARPOL and Ship Waste.*

I. INTRODUCTION

Indonesian waters rank second in the world for ship-borne waste pollution, with a fleet of 32,587 vessels producing increasing amounts of waste annually (World Economic Forum, 2024). This waste, including plastic and food waste, disrupts marine ecosystems, degrades water quality, and poses a risk to human health through microplastics (Ramdhani, 2024).

Plastic from ships is difficult to decompose, is ingested by marine life, and causes economic losses in fisheries and tourism (Bagaskara et al., 2022). Ocean currents spread waste, reduce water oxygen, and endanger navigation due to metal debris (Yulianto & Winarni, 2023).

Although MARPOL 73/78 Annex V has regulated waste management since 1988, its implementation on Indonesian vessels has been suboptimal, with violations of sorting and recording in the Garbage Record Book (Mansur & Daeli, 2023). Many vessels dump illegally beyond 12 nautical miles from land, ignoring the plastic ban (IMO, 2024).

Crew awareness is low due to minimal training, limited facilities such as incinerators, and weak supervision (Nursyamsu et al., 2023). Short berthing times lead to overcrowding, while a lack of education triggers non-compliance (Hidayat et al., 2024).

Long routes and excessive storage capacity hamper effectiveness, with only a portion of ships meeting segregation (Sutrisno et al., 2025).

This study analyzes the implementation of MARPOL 73/78 Annex V on the MV Meratus Benoa, identifies facility constraints, and recommends improvements to reduce pollution. The urgency is to support the target of reducing marine plastic waste by 70% by 2025 and protecting maritime ecosystems. Novelty: A container case study with direct observation complements previous research such as that of the KMP Legundi (Mansur & Daeli, 2023; Bagaskara et al., 2022).

II. METHOD

Types and Methods of Research

This research uses a qualitative approach with a case study design to explore the implementation of MARPOL 73/78 Annex V on the MV Meratus Benoa in depth within the natural context of ship operations. This approach is suitable for exploring complex phenomena such as ship waste management, where the

researcher acts as the primary instrument through direct observation, interviews, and documentation during a 12-month maritime practice from July 2024 to July 2025 (Sugiyono, 2021). Qualitative methods allow for subjective understanding of constraints such as limited facilities, as applied in a similar study on Indonesian vessels (Creswell & Poth, 2025).

Data Analysis Instruments and Techniques

The main instruments included observation guidelines for monitoring waste sorting and the Garbage Record Book, semi-structured interview sheets with the Chief Officer and Boatswain, and documents such as the Garbage Management Plan and crew list. Data collection techniques included participant observation, in-depth interviews, and documentation for triangulation of primary and secondary sources to validate findings (Sudaryono, 2021). Data analysis was conducted iteratively through data reduction, narrative presentation, and verification of conclusions, following an interactive model that integrates observational data with interview transcripts to identify patterns of implementation constraints (Emzir, 2022).

Population and Sample

The study population consisted of the entire crew of the MV Meratus Benoa, approximately 20 people, including officers and ratings involved in waste management. The sample was selected purposively, focusing on key informants such as the Chief Officer and Boatswain as the primary supervisors, ensuring in-depth representation without statistical generalizations typical of qualitative research (Sugiyono, 2021). This selection was supported by snowball sampling during observations to obtain additional data from relevant crew members (Creswell & Poth, 2025).

Research Procedures

The procedure began with an orientation through a MARPOL Annex V literature review and initial observations during marine practice at PT. Meratus Swadaya Maritim. This was followed by data exploration through routine observations, interviews in June 2025, and document collection, including the Garbage Record Book. Analysis proceeded parallel to field data reduction, culminating in verification through member checking with informants and conclusions with recommendations for facility improvement (Sudaryono, 2021). All stages adhered to research ethics, including informed consent and triangulation for reliability (Emzir, 2022).

III. RESEARCH RESULT

Data Presentation

Based on observations on board the MV Meratus Benoa, it was discovered that the ship was not equipped with an incinerator for controlled waste disposal. This situation directly impacts waste management, particularly non-organic waste and waste contaminated with grease and oil, whose volume cannot be reduced through onboard incineration. As a result, all types of waste must be temporarily stored for a relatively long period of time until the ship docks and can be handed over to a land-based waste collection facility. This accumulation of waste increases the risk of limited storage space and the potential for disorderly waste management if not strictly monitored.

Table 1. Waste Management

Observed Aspects	Current Conditions on the Ship	Impact on Waste Management
Incinerator	Not available	Trash cannot be disposed of on board
Types of waste affected	Non-organic waste and waste contaminated with grease and oil	The volume of waste continues to increase
Handling method	Temporary storage	The risk of waste accumulation increases

Source: Researcher Document

Observations indicate that waste storage facilities on board the MV Meratus Benoa are still limited, both in terms of the number of containers and their storage capacity. The available waste bins are not fully capable of accommodating the large accumulation of waste, especially when the vessel operates for long periods without docking. This condition causes the storage space to fill up quickly, requiring stricter management to prevent waste from scattering in the work area or ship's accommodations, which could ultimately compromise cleanliness and safety.

Table 2. Waste Storage Facilities

Observed Aspects	Current Conditions	Impact
Trash bin capacity	Limited	Not able to accommodate large amounts of waste
Shelter location	Certain areas of the deck and accommodation	Uneven distribution of waste
Potential problems	Garbage accumulation	Risk of pollution and disorder

Source: Researcher Document

Based on operational observations of the ship, the MV Meratus Benoa's relatively short docking time at the port means that the waste unloading process at the onshore reception facility is not always possible and is delayed until the next port, leading to waste accumulation on board. This situation is further exacerbated by limited storage space, necessitating more disciplined and planned waste management.

Table 3. Ship Docking Times

Observed Aspects	Current Conditions	Impact
Duration of anchorage	Short	Delayed waste reduction
Frequency of waste submission	Not every anchor	Garbage piled up on the ship
Follow-up impact	Storage full	Suboptimal management

Source: Researcher Document

Observations also revealed that some crew members were still not fully complying with waste management procedures as per Marine Pollution 73/78 Annex V, such as dumping waste material directly into the sea. Although these actions were promptly corrected by the Chief Officer or authorized officers, this incident demonstrates that crew awareness and discipline still need to be improved through ongoing supervision and guidance.

Table 4. Crew Discipline

Observed Aspects	Current Conditions	Corrective Action
ABK Compliance	Not evenly distributed	Reprimand from the Chief Officer
Type of violation	Disposal of material into the sea	Termination and direction
Potential impact	Marine pollution	Prevented through supervision

Source: Researcher Document

In addition to observation, this research was also supplemented with interviews. Interviews were conducted as one of the data collection techniques to obtain in-depth information regarding the implementation of Marine Pollution 73/78 Annex V on board the MV. Meratus Benoa. This interview was aimed at the Chief Officer and Boatswain as parties directly involved in the management and supervision of ship waste. The interview questions were structured based on the problem formulation, namely related to the implementation of Marine Pollution 73/78 Annex V and to determine what obstacles are faced in efforts to prevent marine waste pollution.

Table 5. Chief Officer Interview Results

Informant: Chief Officer		
No.	**Question**	**Answer**
1.	How are waste management policies and procedures in accordance with Marine Pollution 73/78 Annex V implemented on ships?	Waste management is carried out in accordance with the Garbage Management Plan, starting from sorting and storing waste, supervision of ship crews, to recording every activity in the Garbage Record Book in accordance with Marine Pollution 73/78 Annex V.
2.	How is the sorting, storage and disposal of ship waste carried out to comply with Marine Pollution 73/78 Annex V?	Waste is sorted by type, stored in designated areas, and delivered to a receiving facility at the port. Only permitted waste is dumped into the sea. All these activities are recorded in the Garbage Record Book.
3.	What is the mechanism for recording waste management in the Garbage Record Book and how is its implementation consistent?	Every waste management activity, from collection and disposal to delivery to the port reception facility, is completely and timely recorded in the Garbage Record Book. I maintain this record in accordance with applicable procedures to ensure compliance with

		Marine Pollution Annex V.
4.	How is supervision carried out on ship crews in complying with waste management procedures?	I carry out supervision through direct guidance, as well as giving warnings if violations are found, so that the ship's crew comply with waste management procedures in accordance with Marine Pollution Annex V
5.	What are the conditions and availability of waste management facilities on board?	Waste management facilities on ships are still limited because there is not much storage space available, so that waste can only be accommodated in certain quantities and then handed over to the reception facilities at the port.
6.	What obstacles are faced in implementing Marine Pollution 73/78 Annex V in terms of ship facilities and operations?	Obstacles faced in implementation include limited waste management facilities, the absence of incinerators, and short-term operational conditions of ships, so that waste management has not been implemented optimally.
7.	What obstacles are faced regarding crew awareness and discipline in waste management?	There are still ship crews who are not consistent in complying with waste management procedures, so continuous supervision and direction are needed.
8.	What efforts need to be increased to make the implementation of Marine Pollution 73/78 Annex V more effective in preventing marine pollution?	The implementation of Marine Pollution Annex V can be more effective by improving waste management facilities, strengthening supervision on ships, and conducting regular outreach and training for ship crews.

Source: Researcher Document

Table 6. Boatswain Interview Results

Informant: Boatswain		
No.	**Question**	**Answer**
1.	How is waste management implemented in accordance with Marine Pollution 73/78 Annex V?	After the work activities, the waste is collected and placed in the containers that I have provided, and stored to be unloaded to the waste reception facility at the port.
2.	What is your role in supervising ship crews to prevent them from throwing rubbish into the sea?	I directly supervise the crew while they are working, provide direction and reprimands if violations are found, and ensure that garbage is collected and not thrown into the sea.
3.	What is the level of compliance of ship crews with waste management procedures?	The ship's crew has complied with waste management procedures, but there are still some crew who need to be reminded to remain disciplined and consistent in not throwing rubbish into the sea.
4.	What obstacles are encountered in waste management on ships?	The obstacles I encountered were limited waste storage space and short waiting times, so waste management was not optimal.
5.	What are the conditions and availability of waste management facilities on board?	Waste management facilities are available but limited, so waste must be collected regularly and unloaded to waste reception facilities at the port.
6.	How do you coordinate with the Chief Officer in managing waste on board?	I coordinate with the Chief Officer by reporting the condition of waste management following the directions given, and ensuring that implementation is in accordance with established procedures.
7.	Have the crew received training regarding waste management on board?	The ship's crew has received briefings and training related to waste management in accordance with Marine Pollution 73/78 Annex V, both through safety meetings and direct instructions while working, although implementation still needs to be carried out continuously.
8.	What steps can be taken to make the implementation of Marine Pollution 73/78 Annex V more effective?	Implementation of Marine Pollution 73/78 Annex V on ships can be improved by adding waste storage facilities, strengthening supervision, and providing regular briefings to ship crews.

Source: Researcher Document

Based on the data above, the results of interviews with the Chief officer and Boatswain on board the MV. Meratus Benoa, the implementation of Marine Pollution 73/78 Annex V has been carried out in accordance with the Garbage Management Plan through sorting, storing, monitoring, and recording waste in the Garbage Record Book, as well as handing over waste to the receiving facility at the port, but the implementation has not been optimal due to limited waste management facilities, especially the unavailability of incinerators, as well as the operational conditions of the ship which are quite busy so that they still require continuous supervision and direction.

Based on the results of the documentation obtained, it is known that the implementation of safety meetings on the MV. Meratus Benoa ship is carried out routinely, one of the agendas in the safety meeting discussed is the prevention of marine pollution in accordance with Marine Pollution 73/78 Annex V, documentation in the form of minutes and attendance lists shows that in the meeting discussed waste management procedures, prohibition of dumping waste into the sea, as well as evaluation of problems found in the field. Safety meetings are also used as a means of conveying directions from ship officers to crew to improve compliance with waste management procedures and prevent the recurrence of violations that can have an impact on marine environmental pollution.

Table 7. Implementation of Marine Pollution Annex V

Regulatory Aspects	MARPOL Annex V provisions	Conditions on the Ship	Compliance
Garbage Management Plan	Must be available and implemented	Available and used as a guideline	In accordance
Ban on throwing rubbish into the sea	Prohibited for certain types and certain distances	It has been socialized but there are still violations	Not completely
Officer supervision	Must do	Carried out by the Chief Officer and Boatswain	In accordance

Source: Researcher Document

Data analysis

Based on the results of observations, interviews, and documentation on board the MV. Meratus Benoa, it can be analyzed that the Marine Pollution 73/78 Annex V regulations have been implemented in principle. This is indicated by the availability of a Garbage Management Plan as an official guideline for waste management, the prohibition on dumping waste into the sea which is socialized to the crew, and the recording of waste management activities in the Garbage Record Book. Ship officers, especially the Chief Officer and Boatswain, have an active role in overseeing the implementation of these regulations. However, the results of observations indicate that the implementation of the regulations is not fully consistent, because there are still crew actions that are not in accordance with the provisions of Marine Pollution 73/78 Annex V, such as dumping waste material directly into the sea, although these actions are immediately corrected by authorized officers.

The effectiveness of waste management procedures on board the MV Meratus Benoa can be considered effective, but not yet optimal. Waste collection and storage procedures have been implemented, separating waste by type and temporarily storing it before it is delivered to onshore reception facilities. Waste from ship maintenance activities, such as used grease and repair material residue, is generally collected and not directly disposed of at sea. However, limited facilities are a major obstacle to the effectiveness of these procedures, particularly the lack of an incinerator and limited waste storage containers. This situation prevents waste volume from being optimally reduced and has the potential to accumulate, especially during relatively short docking times, which can delay the process of delivering waste to shore.

Table 8. Waste Management

Procedure Stages	Provision	Current Conditions	Information
Garbage collection	Garbage is collected and sorted	Carried out in the deck area, engine room and accommodation	In accordance
Management	Waste volume is reduced	No incinerator	Not optimal
Shelter	Safe and adequate storage	Limited space	Not enough

Source: Researcher Document

The analysis results show that crew behavior and compliance with waste management procedures vary. Most crew members understand the prohibition on dumping waste into the sea and follow the instructions of ship officers, especially during maintenance activities. However, field observations indicate that some crew members still spontaneously dump leftover work materials into the sea. This indicates that work habits, time pressure, and individual discipline still influence crew compliance. Nevertheless, the role of the Chief Officer and Boatswain in providing direct warnings and instructions is an important controlling factor in preventing further violations and indicates efforts to foster crew behavior.

Table 1. Crew Compliance

Behavioral Aspects	Observation Findings	Officer's Action	Category
Procedural compliance	The majority obeys	Routine monitoring	Good
Disposal violation	Still found	Direct reprimand and correction	Enough
Crew response	Receiving directions	Further development	Positive
Work discipline	Affected by operational conditions	Needs improvement	Need attention

Source: Researcher Document

Based on the results of further observations and documentation after the safety meeting, there were changes in the behavior of the crew in waste management in accordance with the provisions of Marine Pollution 73/78 Annex V. Before the safety meeting, there was still behavior of dumping waste materials directly into the sea and inconsistencies in sorting and storing waste. However, after the safety meeting was held, the crew showed increased compliance with the procedures, which was indicated by the absence of direct waste dumping into the sea, increased awareness to collect waste in designated containers, and better coordination between the crew, boatswain, and chief officer in waste management. These changes indicate that the safety meeting plays an effective role as a means of socializing and strengthening the crew's understanding of the importance of preventing marine pollution.

Table 10. Comparison Before and After Safety Meeting

Source: Researcher Document

Behavioral Aspects	Before the Safety Meeting	After the Safety Meeting
Waste disposal	Direct discharge into the sea is still found	No direct discharge into the sea was found.
Waste sorting	Not consistent yet	Done according to the type of waste
Garbage collection	Lack of order	Use the container provided
Compliance with MARPOL Annex V procedures	Not optimal	Increased significantly
Supervision and coordination	Limited	More active and coordinated

IV. DISCUSSION

How is Marine Pollution 73/78 Annex V implemented on the MV Meratus Benoa?

Based on the results of the analysis of observation data, interviews, and documentation on board the MV. Meratus Benoa, the Implementation of Marine Pollution 73/78 Annex V has in principle been carried out as an effort to prevent marine waste pollution. This is demonstrated by the implementation of the Garbage Management Plan as the main guideline for waste management on board, the implementation of waste sorting based on its type, and the recording of all waste management activities in the Garbage Record Book. Supervision is also carried out by the Chief Officer and Boatswain to ensure that the crew does not dispose of waste into the sea carelessly. In addition, waste from ship maintenance activities such as used grease and remaining maintenance materials are collected and planned to be submitted to the waste reception facility on land when the ship is docked, as a form of compliance with the provisions of Marine Pollution 73/78 Annex V. This implementation shows that the procedure has been running in reducing the potential for marine waste pollution.

Table 2. MARPOL Implementation Analysis

Implementation Aspects	MARPOL Annex V provisions	Conditions on Board	Compliance
Garbage Management Plan	Must be available and implemented	Available and used as a guideline	In accordance
Waste sorting	Garbage is sorted by type	Sorting is done in the work and accommodation areas.	In accordance
Waste storage	Stored temporarily before being thrown away	Storage is available but limited	Quite appropriate
Waste disposal	Do not throw it carelessly into the sea	Dumped to shore facilities upon docking	In accordance
Recording	Must be recorded in the Garbage Record Book	Recording is done by the Chief Officer	In accordance

Source: Researcher Document

What are the obstacles faced in implementing Marine Pollution 73/78 Annex V on the MV. Meratus Benoa?

Although the implementation of Marine Pollution 73/78 Annex V has been carried out, the analysis results show that there are still several obstacles that affect the effectiveness of its implementation on board the MV. Meratus Benoa. The main obstacle found is the limited waste management facilities, especially the lack of an onboard incinerator, so that waste cannot be reduced optimally and tends to accumulate. In addition, the limited capacity of waste storage facilities makes it difficult to store large amounts of waste. The busy operational conditions of the ship, especially the relatively short berthing time, also cause waste that should be handed over to the onshore reception facility to be delayed, resulting in waste accumulation on board. These operational obstacles have the potential to increase the risk of pollution if not managed properly.

Table 12. Constraints to MARPOL Implementation

Types of Constraints	Description of Constraints	Impact on Waste Management
Facility	No incinerator available	Waste cannot be reduced in volume
Shelter	Limited shelter space	Garbage easily accumulates on ships
Operational	Short ship berthing time	Waste transfer to land delayed
Management	Dependence on land facilities	Management is less flexible
Environmental risks	Garbage accumulation	Potential for increased pollution

Source: Researcher Document

V. CONCLUSION

Based on the results of observations, interviews, and documentation conducted on board the MV. Meratus Benoa, it can be concluded that the implementation of Marine Pollution 73/78 Annex V has in principle been implemented as an effort to prevent marine waste pollution. This is demonstrated through the implementation of the Garbage Management Plan, the implementation of waste sorting and storage based on its type, recording waste management in the Garbage Record Book, and supervision by the Chief Officer and Boatswain of the ship's crew to prevent waste disposal into the sea. Waste management resulting from operational activities and ship maintenance has generally been carried out according to procedures with the collection and sorting of waste to then be handed over to waste reception facilities on land.

However, the effective implementation of Marine Pollution 73/78 Annex V on board ships still faces several obstacles. These obstacles include limited waste management facilities, particularly the lack of incinerators, limited waste storage capacity, and busy ship operations with relatively short docking times. These conditions mean that waste handling and unloading to onshore reception facilities are not optimal, potentially leading to waste accumulation on board ships.

VI. SUGGESTION

Based on the conclusion, it is recommended that the company and ship management improve waste management facilities on board, either by providing an Incinerator or increasing the capacity of waste storage. In addition, supervision of the implementation of waste management procedures needs to be continuously strengthened by ship officers, accompanied by ongoing socialization and training to all crew members regarding the provisions of Marine Pollution 73/78 Annex V. With the support of adequate facilities, more planned operational management, and increased understanding of ship crews, it is hoped that the Implementation of Marine Pollution 73/78 Annex V can run more effectively in preventing waste pollution at sea.

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