International Journal of Industrial Innovation and Mechanical Engineering

E-ISSN: 3047-4515
P-ISSN: 3047-4507

Research Article

The Role of ODM (Oil Discharge Monitoring) in Preventing Oil Pollution Referring to MARPOL Rules 73/78 Annex I

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Abstract: Oil spills in the sea are events that release oil directly or indirectly into the marine environment from shipping activities, the oil and gas industry, and other activities. To prevent and overcome marine pollution due to oil spills, the International Maritime Organization (IMO) has established various regulations, one of which is MARPOL 73/78 Annex I which regulates the prevention of oil pollution from ships. In the implementation of these regulations, each ship is required to be equipped with an Oil Discharge Monitor (ODM), which is a device that functions to monitor and control the process of discharging oil waste into the sea. ODM ensures that the disposal is not carried out beyond the permissible limit and records operational data as evidence of compliance with international standards. This study aims to examine the role of ODM in preventing marine pollution and assess its effectiveness in supporting the implementation of MARPOL 73/78 Annex I in international shipping activities. The results of the study are expected to provide a more comprehensive understanding of the contribution of this monitoring technology to the safety of the marine environment and global efforts to maintain the sustainability of maritime ecosystems.

Keywords: Marine Pollution Prevention; MARPOL Annex I; Oil Discharge Monitor; Oil Spill; Ship Waste Management

Received: July 18, 2025
Revised: August 01, 2025
Accepted: August 15, 2025
Online Available: August 30, 2025
Curr. Ver.: August 30, 2025

1. Introduction

With the increasingly advanced development of the maritime world and the increasing number of ships, this will greatly influence the level of marine pollution, due to waste thrown from ships, especially waste containing oil. It cannot be denied that every ship produces sewer water, especially in the engine room. Starting from previous times, conventions were held, for example in early 1970 in Paris, known as the Paris Convention, in early October 1971 in Oslo, an agreement was held regarding the Prevention of Marine Pollution by Dumping for Ship and Crapt, and in 1973 a regulation was issued regarding oil, dirt and rubbish not being allowed to be thrown into the sea, better known as MARPOL 1973, and on July 15, 1977, a conference was established in New York. environmental problems. One of the organizations in the world, namely IMO, has established regulations relating to procedures and procedures for disposing of ship waste along with sanctions for ships that violate them so that to support and implement the regulations that have been set and prevent sanctions that have been given to ships that violate which will bring losses to ships and shipping companies, now the prospect of ships being equipped with equipment or aircraft that can clean sewer water from oil content so that it has an oil content that is in accordance with MARPOL 1973 provisions, namely 15 ppm.

In its operations, the ship will fill and discharge ballast water for ship stability. On the other hand, ships also release or dispose of waste in the form of sewer water (bilge water) originating from the engine room, such as from leaks in pipes, pumps or machinery components that use liquid substances, in this case oil, grease or water. To be safely thrown into the sea, before being thrown into the sea, this sewer water must first be processed so that it is safe and does not damage the marine environment. Sewer water must be processed through an Oil Water Separator (OWS) to separate oil and water below 15 ppm so that it is safe to be discharged into the sea (over board) and must be recorded in the oil record book. In the process of disposing of waste into the sea, sewer water is monitored by an ODM (Oil Discharge Monitor) and recorded according to the time of implementation and must also include the position of the ship from start and stop. Meanwhile, the discharge of sewer water at the port must be permitted and facilitated by the local port authority.

Damage that occurred to the oil discharge monitoring equipment components resulted in the inability to dispose of waste remaining from cleaning the cargo tank. Quality components and good maintenance will greatly support the smooth operation of oil discharge monitoring equipment. If one of the components is damaged, the operation will not automatically run optimally. When this happened, the ship reported the damage to the company to call a special technician and send new oil discharge monitoring equipment components.

The role of the ship's crew itself is also very influential and important in preventing and overcoming environmental pollution. The lack of discipline and understanding of ship officers in operating oil discharge monitoring equipment will result in frequent errors occurring during operation resulting in improper unloading. As a result of failure to dispose of using oil discharge monitoring equipment and the remaining tank having to be emptied immediately, the first captain decided to dispose of the remaining water for tank cleaning directly without using oil discharge monitoring equipment. Officer discipline in operating oil discharge monitoring equipment must be maintained as an effort to prevent marine pollution and from sanctions given to ships that violate waste disposal regulations. However, in reality, officers are still found who are undisciplined and do not comply with regulations regarding waste disposal without using ODME, so it is impossible to know the amount of oil content contained in the oil mixture and the amount of liquid that will be disposed of into the sea.

2. Preliminaries or Related Work or Literature Review

Oil Discharge Monitoring Equipment (ODME)

Oil Discharge Monitoring Equipment (ODME) is a device that monitors the discharge of oily ballast or other oil-contaminated water from cargo tank areas into the sea. ODME monitors and controls the discharge of any effluent through an overboard outlet to meet the operational requirements of the tanker. Discharge of dirty ballast water or other oil-contaminated water from cargo tanks into the sea through an outlet not controlled by a monitoring system is a violation of the Convention (Resolution MEPC.108(49), 2003).

The requirements of Annex I of MARPOL 73/78 relating to the monitoring of oil content in oil tanker ballast and tank wash water are set out in regulation 15(3)(a), which stipulates that oil tankers of 150 gross tons and above must be equipped with an approved monitoring system and that the system must continuously record :

a. Oil discharge in liters per nautical mile.
b. Total amount of oil discharged, or alternatively, the oil content of the waste and the discharge rate.
c. Records must be identifiable by time and date and must be retained for at least three years.

In MARPOL 73/78 rule 15 also stipulates that the system must start operating when there is a discharge of waste into the sea and must be such that it will ensure that any discharge of oil mixture can be stopped automatically when the instantaneous rate of oil release exceeds that permitted by regulation 9(1)(a) (Resolution MEPC.108(49), 2003). In MARPOL Annex I rule 34 it is stated that any discharge of oil or oily mixture into the sea from the cargo area of an oil tanker shall be prohibited unless all the following conditions are met: the tanker is not within a special area, the tanker is more than 50 nautical miles from the nearest land, the tanker is underway, the instantaneous discharge rate of oil content does not exceed 30 liters per nautical mile, the total quantity of oil to be discharged into the sea does not exceed for tankers delivered on or before 31 December 1979, as specified in regulation 1/15,000 of the total quantity of the specified cargo of which the residue forms part, and for tankers delivered after 31 December 1979, as specified in regulation 1/30,000 of the total quantity of the specified cargo of which the residue forms part and the tanker has a system for monitoring and controlling the discharge of oil and slop tank arrangements.

Discipline

Discipline is an attitude, behavior, and actions that comply with company regulations, both written and unwritten (Hasibuan, 2009:212). Work discipline can be defined as an attitude of respect, appreciation, obedience, and adherence to applicable regulations, both written and unwritten, as well as the ability to implement them and not to shirk sanctions if one violates the duties and authority assigned to him (Sastrohadiwiryo, 2003:291). Discipline is the desire and awareness to comply with organizational regulations and social norms. Therefore, discipline is an important means to achieve goals, so fostering discipline is a very important part of management. Any management in its implementation requires discipline from all members of the organization.

Working on a ship demands a high degree of self-discipline. If officers and crew members do not comply with regulations, disciplinary action is necessary. This disciplinary action can range from warnings to dismissal if the situation is truly dangerous and detrimental, and the violation has been repeated. However, both owners and crew members, who are responsible, must equally uphold good work discipline. The ship's owner must be disciplined in procuring supporting equipment, and the crew must comply with the specified provisions. On board a ship, the work process requires discipline and skills from the crew regarding the work. In Law No. 17 of 2008 concerning Shipping, Article 40, point 1, crew members are people who work or are employed on a ship by the ship's owner or operator to carry out duties according to their positions listed in the certificate. Ship crewing requires continuous supervision and guidance in terms of protection, welfare, knowledge, discipline, and the placement or formation of officers on board to ensure safe navigation.

3. Proposed Method

The research was conducted at Tanjung Priok Port, where the tanker was docked and discharged overboard using Oil Discharge Monitoring Equipment. This research was conducted by collecting basic data regarding the ODME operating system and how the crew carried out the ODME process.

4. Results and Discussion

From the observation results on the KM Karya Citra 8 ship, the SOPEP equipment on board still does not meet the requirements. One example is the OSD (Oil Spill Dispersant) liquid which is useful for breaking down oil particles so that they can be spread with the help of OSD. SOPEP equipment is very important for handling the prevention of oil spill pollution on board so that if the number of requirements on the ship is insufficient, it will have a negative impact on handling oil spill pollution.

Table 1. SOPEP Inventory List.

TYPE	LOCATION	QUANTITY ON BOARD MINIMUM	ACTUAL
Scupper Plugs	On deck	Full set + 2 spare	Full set + 3 spare
Air Driven pumps with Air Hose, Suction and Discharge Hoses (Non-sparking)	Port side of compressor room	1	1
Drums to Contain Oil/Recovered Waste Material	Port side of compressor room	2000 ltrs capacity (200 ltrs x 10 drums, or Oil Spill kit bags –1000 ltrs. x 2 bags)	2000 ltrs
Scoops/Shovels (PlasticNon-sparking)	Port side of compressor room	3 PCS	6 PCS
Brushes	Port side of compressor room	3pcs	4 pcs
Plastic Buckets	Port side of compressor room	2 pcs	5 pcs
Squeegees	Port side of compressor room	4 pcs	4 pcs
Sorbent Pads	Port side of compressor room	500 pcs (43x48 cms) or (2 Pck U94200 of Wilhelmsen spill kit)	600
Sorbent Booms	Port side of compressor room	8 Pck U94410S of Wilhelmsen or equivalent	10
Sorbent Rolls	Port side of compressor room	1 Pck U94150S of Wilhelmsen spill kit or equivalent	1
Oil Spill Dispersant (Onboard Use Only)	Port side of compressor room	50 liter	40 liter
Appropriate Protective Clothing as below:	Port side of compressor room		
a) Disposable Gloves		6 pcs every part	6 pcs every part

b) Disposable coverall (suit) – Tyvec or equivalent	
c) Safety Boots	
d) Protective Goggle	

The SOPEP drill on the KM Karya Citra 8 has not been implemented optimally and according to the schedule established by the company. This has resulted in the crew on duty not yet fully understanding the duties and responsibilities of their respective job descriptions in the event of an oil spill on board. The SOPEP drill on the KM Karya Citra 8 was not implemented properly due to:

a. The ship's heavy cargo load meant that the entire crew had limited time to conduct the drill.
b. Lack of coordination with the existing crew before the new crew member's handover.
c. The handover between the existing crew and the new crew was so short that they had no time or no knowledge of their duties and responsibilities in the event of an oil spill on board.

Handling Procedures

Successful oil spill response requires adequate and sufficient equipment and a skilled and knowledgeable crew, as well as disciplined procedures and procedures. Oil spills often occur due to the condition of the ship and its equipment. Older ships, or those lacking adequate control systems, and manual controls contribute to uncontrolled oil spills and discharges, leading to pollution. The ship observed by the researchers had a control room, but due to its age and extensive damage, much of the equipment was operated manually. The statement above reveals the condition of the ship that contributed to the oil spill. In practice, as in the oil spill response triangle, in addition to available equipment and crew skills, procedures and procedures for handling it are also crucial.

Sewage or liquid waste management on board

The sewage or liquid waste management on the KM Karya Citra 8 utilizes an OWS (Oil and Gas Separation System) to separate water and oil. Sewage or liquid waste is sucked up by a bilge pump and then directed to a bilge separator. In the bilge separator, heavy waste is separated from light waste. Due to the density difference between the sewage and dirty oil, the dirty oil is thrown to the top. The dirty oil is collected in the KM Karya Citra 8's sludge tank. The company then provides a boat for sludge disposal, with a storage tank installed on the boat.

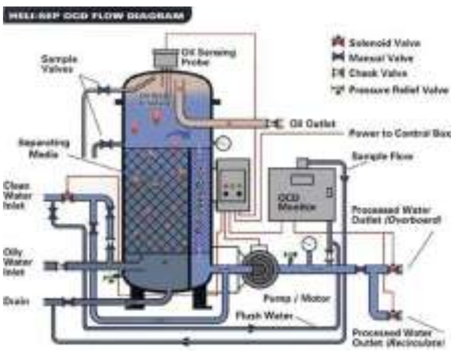

Figure 1. OCD flow.

Interview Data

The information obtained from the interviews covered the implementation of oil pollution prevention measures based on MARPOL 73/78 Annex I regulations. The author used an unstructured interview technique, allowing the author to expand the questions based on the answers provided by the interviewees. This interview was conducted with the captain and all crew members on the KM Karya Citra 8. The interview results revealed that the implementation of oil pollution prevention using ODM, based on MARPOL 73/78 Annex I regulations, had not been optimally or properly implemented on the KM Karya Citra 8. The reasons for the suboptimal performance of the Oily Water Separator, resulting in oil content from the Oily Water Separator process, were due to its operation not being in accordance with the manual or Instruction Manual and the Coalescer filter being too dirty.

Operation not in accordance with the manual or instruction manual.

This type of operation is often performed by ship crews, resulting in many crew members paying little attention to proper handling of this equipment. The manual on the ship is simply a display piece attached to the machine. When operating the oily water separator, the crew simply operates it according to their own habits without referring to the instruction manual. They simply operate the oily water separator according to its intended function: separating sewage from oil.

The coalescer filter is too dirty.

Ship crew sometimes do not pay attention to the collescer filter found in the Oily Water Separator which is very dirty so that the process of separating oil and water in the Oily Water Separator is less than optimal. The clean Coalescer filter on the Oily Water Separator will absorb oil dirt so that the Oily Water Separator works optimally in separating water from contaminated oil, and if the Coallescer filter has absorbed too much mud/dirt. When the sewer pump is started the pressure will gradually increase beyond the normal limit that has been set.

Discussion

The problem-solving process discussed here concerns the consequences of the abnormal operation of the Oily Water Separator, which resulted in sewage containing more than 15 ppm of oil on board the KM Karya Citra 8:

Operation not in accordance with the instruction manual.

Many crew members fail to properly handle the Oily Water Separator. They are only aware of its function but not its proper operation according to the instruction manual. They operate the OWS solely for its intended purpose, separating sewage from oil and sludge. The Oily Water Separator operating instructions recommend that all crew members familiarize themselves with the piping system before operating the machine.

To address this issue, always use an oily water separator. Its operation must be in accordance with the Instruction Manual, namely:

a. Ensure the oily water separator piping is aligned with the factory piping layout.
b. Ensure the oily water separator's power source and alarm signal are in place.
c. The oily water separator is first filled with seawater by the bilge pump.
d. Ensure there are no leaks in the pump before operating the oily water separator.
e. Turn on the power supply for the automatic oil discharge device.
f. Rinse the oily water separator by running the bilge pump and opening the bypass valve to circulate water to the bilge tank.
g. Once the oily water separator is clean, this can be seen from the spout on the oily water separator's spout. If water comes out, the oily water separator is clean.
h. Then, open the bilge tank drain valve and close the seawater valve.
i. Open the overhead valve on the oily water separator.

j. Close the bypass valve according to the water pressure coming out of the oily water separator.

The Coalescer Filter is Dirty

When the Oily Water Separator is first operated, the sump pump will begin pumping water from the engine room sump, causing the pressure in the tank to gradually rise and exceed the set normal limit. If this occurs, the sump pump must be stopped, the separator suction valve closed, and the drain valve at the bottom of the tank opened to allow the sediment that has settled at the bottom of the tank to drain and restore normal pressure.

Whether the filter is dirty or not can be seen by looking at the manometer whether it shows the same pressure before and after. If before and after are the same then the indicator will show a green mark, and if not the same it will show a red mark. If the mark changes to red this indicates that the filter in the tube is dirty. The pressure in the separator tube will be high if this incident is not quickly addressed and allowed to continue will cause the bottom filter to enter the filter housing and will change shape. If this is not quickly addressed the following will occur.

a. The manhole filter hole in the engine room is too large.

   This hole allows all debris to enter the coalescer tank, and due to seawater corrosion, the hole causes the filter to easily tear and rip.

b. The large amount of mud being sucked in.

   Because of the large amount of dirt in the form of mud, it is always sucked in, causing the coalescer filter to quickly become dirty and the pressure in the manhole pump to be too high when starting.

The desiccator is not functioning properly.

The desiccator ensures the humidity in the measuring cell is below 40% to prevent condensation in the HSL glass tube, ensuring accurate measurements. The desiccator should be replaced every six months, or in cases where a new replacement occurs when the monitor panel displays a warning that "desiccant worn out" appears. OWS operation causes the desiccator to become damp due to water entering due to engine crew error in operating the OWS (Oil Water Separator). Crew error when opening the sampling line during the Oil Discharge Monitor (ODM) can cause water to build up and not be collected, thus wetting the desiccator. Cleaning the desiccator when it is not completely dry can cause moisture to accumulate in the desiccator. When the desiccator is damp, it can cause incorrect oil content readings, which can exceed 15 ppm.

The electric valve (solenoid valve) is not operating optimally

A blockage in the solenoid valve can cause the three-way valve that supplies samples to the ODM to not open fully or become stuck. This can cause the ODM to malfunction, which is indicated by a warning on the monitor. A malfunctioning solenoid valve is generally caused by dirt on one side, which can be caused by prolonged operation or inadequate checking and cleaning of the solenoid valve.

Feed pump problems due to operating without coolant or running dry.

During the initial engine start-up, the engine crew must operate the feed pump's cooling water. Cooling water cools the rotor and stator. In other words, it acts as a coolant and a lubricant for mechanical seals. Problems with the feed pump include forgetting or failing to fully open the cooling water manually, or damage or blockage of the cooling water, which disrupts the feed pump's operation and can cause overheating of the rotor and stator, which can ultimately lead to fire.

The constant pressure modulating valve is not functioning properly.

The constant pressure modulating valve contains a membrane that maintains a constant water sample pressure at the valve outlet. The system immediately reacts to any pressure changes and position changes to maintain the pressure. When the constant pressure modulating valve is not functioning properly, it cannot maintain the preset pressure properly. The system is not airtight, allowing air leaks or air to enter the system, which can cause the valve plug to move too quickly or become unstable.

5. Conclusions

Based on the previous discussion on optimizing oil pollution prevention training to mitigate the oil spill on the KM Karya Citra 8, as the final section of this thesis, the author presents several conclusions drawn from the research and data analysis regarding the issues discussed in this thesis. These conclusions are as follows: The pollution prevention equipment on the KM Karya Citra 8 could not be used optimally during the oil spill. This was due to inadequate preparation prior to ship operations. Furthermore, the inspection and maintenance of the pollution prevention equipment were not carried out correctly and regularly by the responsible ship's officers. The ship's crew was unable to optimally mitigate the oil spill that occurred on board, and the oil spill drill on board was not carried out in accordance with applicable regulations.

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