



Analysis Handling Spill Oil On Loading Operation Cargo In Prevent Pollution in the Marine Environment

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Abstract. An oil spill is a highly dangerous disaster for both local fishermen and, especially, the marine ecosystem. Such spills can take thousands of years for the marine environment to recover. Tankers transporting oil are particularly vulnerable to pollution incidents, which may result from collisions, tank cleaning, or offshore drilling. These events lead to significant losses, even when they are not directly caused by ships, and underscore the importance of learning to take preventive measures to avoid oil spills and subsequent pollution.

In collecting data, random sampling was used, focusing on the selectivity and loyalty of the crew members, who provided positive responses regarding the study's issues. The analysis results were then processed and described within a qualitative research framework.

Marine pollution requires skilled, reliable, and professional handling, along with significant costs. Shipping companies (PT) face challenges in compensating for oil pollution losses. However, many companies address this by insuring the ship and its cargo, thus avoiding punitive consequences.

Keywords: Pollution Maritime Environment, Handling Spill Oil, SOPED.

1 Introduction

With the increase in maritime transportation, especially in crowded shipping lanes, it has become essential to protect the marine environment to sustain marine life. Oil spills are particularly disastrous for local fishermen and the marine ecosystem, often taking thousands of years for full recovery. These spills can result from various causes, such as tanker collisions, improper tank cleaning, and offshore drilling. Although not always caused directly by vessels, oil spills highlight the importance of vigilance and prevention to protect the sea from pollution.

Past incidents underline a need for greater caution and alertness in preventing oil spills. However, there are still gaps in supervision, as noted by Indra (2020), who observed that officers responsible for checking SOPEP (Shipboard Oil Pollution Emergency Plan) equipment often lack adequate oversight. This insufficient oversight means crews may not be fully prepared to effectively handle oil spills when they occur.

This highlights the serious issue of maritime environmental pollution, as seen in incidents such as the oil spill in Balikpapan on March 31, 2018. This disaster occurred when the MV Ever Judger attempted to anchor in Balikpapan Bay without properly

observing designated anchorage areas. The vessel's anchor struck an oil pipeline belonging to PT Pertamina, causing a leak that led to extensive pollution, severely impacting local fishermen's livelihoods and resulting in substantial economic losses for the state.

Similarly, in July 2019, PT Pertamina's oil field in Karawang encountered a major spill when the YYA-1 well in the Offshore North West Java (ONWJ) block leaked. This incident caused significant pollution in surrounding waters and along Karawang Beach, underscoring the ongoing threat of oil spills to the maritime environment.

In August 2020, an oil spill occurred near Pari Island in the Thousand Islands archipelago, polluting a 2-kilometer stretch of beach. This incident led to the death of various marine species and damaged seagrass cultivated by local residents. PT Pertamina Hulu Energi (PHE) indicated that the spill could have resulted from a leak at a drilling site or from negligence by an oil carrier, possibly due to illegal tank washing by a passing vessel.

The investigation results on May 4, 2021, from the Head of the Coastal and Marine Resource Management Center (BPSPL), along with the Sea Operations Research Center, confirmed through satellite imagery and laboratory tests that the oil residue found on Purnama Beach, Gianyar, Bali, originated from ships illegally discharging oil, washing residual cargo, and engaging in other activities that violate regulations.

Tankers carrying large amounts of oil are highly susceptible to causing marine pollution. Over the past five years, numerous incidents have led to oil spills in Indonesian waters, resulting in both material and non-material losses (Wahyudi, 2022).

High sanctions on vessel owners for marine pollution often lead to situations where the responsible company may struggle to pay the fines. In such cases, the Indonesian government is obligated to support the maritime company and seek solutions based on Government Regulation No. 29 of 2014 on Marine Environmental Pollution Prevention (Article 8). This regulation mandates that a pollution damage compensation fund be established, holding shipowners, operators, or guarantors accountable by requiring them to insure their vessels and cargo. This insurance coverage ensures that, in the event of pollution, liability can be addressed through insurance rather than direct fines. Such regulations not only safeguard the company but also protect the economic stability of those reliant on maritime activities. Preventing pollution must be a priority, with ship crews actively implementing concrete measures to protect the marine environment, as failure to do so results in serious sanctions for the maritime company.

2 Literature Review

According to the United Nations Convention on the Law of the Sea (UNCLOS) 1982, marine pollution refers to substances introduced into the marine environment due to human activities, either intentionally, unintentionally, or as a result of poor waste management practices. UNCLOS III further clarifies that marine pollution impacts the environment, including river estuaries, leading to harmful consequences. These effects can damage marine resources, pose risks to human health, disrupt sea-based activities

like fishing, degrade seawater quality, and reduce the sea's overall usability and benefits.

Law No. 4 of 1982 defines environmental pollution as the introduction of living organisms, substances, energy, or other components into the environment, or any alteration caused by human activities or natural processes, resulting in a degradation of environmental quality. This degradation reaches a level where the environment becomes insufficient or unable to function effectively for its intended purposes.

According to Regulation Government Republic of Indonesia Number 21 of 2010 Concerning Protection Maritime Environment :

1. Protection The Maritime Environment is every effort to prevent and overcome pollution environment waters that originate from from related activities with shipping.
2. The prevention of pollution from ships involves proactive measures taken by the captain and crew to avoid or minimize the discharge of harmful substances into the environment. These include oil spills, toxic liquids, hazardous cargo in packaging, sewage, garbage, and exhaust gases released into the water and air. Prevention is a collective effort, whether by individuals or groups, aimed at avoiding undesirable events. As outlined in Ministerial Regulation No. 29 of 2014, it is the responsibility of the ship's captain and crew to take early action to prevent pollution and reduce its impact on the maritime environment.
3. Countermeasures for pollution from ship operations encompass swift, precise, and coordinated actions taken to control, reduce, and clean up oil spills or toxic materials discharged from vessels into the water. The goal is to minimize the harm to society and prevent further environmental damage, particularly to the marine ecosystem. These measures are crucial for mitigating the immediate and long-term impact of pollution on the sea and surrounding communities.
4. Countermeasures for pollution from port activities involve rapid, precise, integrated, and coordinated actions aimed at controlling, reducing, and cleaning up oil spills or toxic substances released from harbors into the water. The objective is to minimize harm to society and protect the marine environment from further destruction. Pollution is defined as the introduction of harmful substances or energy into the environment by human activities, leading to a decline in environmental quality to the point where it can no longer function as intended (Law on Environmental Management No. 23 of 1997). Specifically, marine pollution refers to the entry of harmful substances or energy into the sea environment due to human activities, causing a decline in water quality and impairing its natural functions (Government Regulation No. 19 of 1999).
5. Oil, as defined by Ministerial Regulation Number 29 of 2014, refers to petroleum in its various forms, including raw oil, refined oil, contaminated oil, and by-products of the refining process such as asphalt, crude oil, gasoline, refined oil, naphtha, and similar substances.
6. According to Government Regulation No. 19 of 1999, the sea is defined as an oceanic area that forms a unified geographical system along with its related elements. The limits and systems of the sea are determined based on its functions or

specific surface parts. The Earth's surface is largely covered with water, and the sea is characterized by its salinity levels.

7. According to the Constitution of the Republic of Indonesia Number 17 of 2008, a ship is defined as a watercraft with a shape and type that is propelled by wind power, mechanical power, or other forms of energy. It includes vessels that are towed or pushed, as well as dynamic support vehicles, submersible vehicles, floating platforms, and non-moving floating structures.
8. According to the Constitution of the Republic of Indonesia Number 17 of 2008 concerning Shipping, a crew member (or seafarer) is a person who works or is employed by the ship's owner or operator to perform tasks aboard the vessel in accordance with their position as specified in the ship's certificate.

In Protocol 1992 International Convention on Civil Liability for Oil Pollution Damage (CLC) 1969 determined boundaries for compensation to marine water pollution caused spill oil that is:

1. For a boat with heavy No exceeding 5,000 GT, liability the answer No exceeding 3 million Special Drawing Rights (SDR).
2. For boats with weight 5,000 GT to 140,000 GT responsibility the answer is limited to 3 million SDR plus 420 SDR for each additional unit tonnage.
3. For boats with heavy exceeding 140,000 GT responsibility the answer is limited to 59.7 million SDR.

SOPEP (Ship Oil Pollution Emergency Plan) equipment must be available on every ship to ensure compliance with maritime environmental regulations. The SOPEP drill is a crucial training activity conducted to prepare the crew for preventing or managing oil pollution in the sea. During this drill, all crew members must participate to gain knowledge and skills in responding to potential oil spills and to understand how to prevent them effectively.

The SOPEP drill should be carried out at least once a month, organized by the First Mate, under the leadership of the Skipper. This regular training ensures that the crew is well-prepared to handle oil pollution emergencies and is familiar with the procedures and equipment needed to minimize environmental impact.

Table 1. List of SOPED Equipment on Ships. (Data Processed, 2024)

Type Equipment	Location	Amount
Portable pump	Pump room	1 piece
Oil Dispersant	SOPEP locker	700 liters
Saw dust	SOPEP locker	20 sacks
Sand	SOPEP locker	4 sacks
Absorbent mat	Pump room	50 rill
Shovel	SOPEP locker	10 pieces
Buckets	Pump room	10 pieces
Scupper	Pump room	20 pieces
Pillow oilwik	SOPEP locker	3 pieces
Rubber gloves	SOPEP locker	2 pairs

Dustpan	SOPEP locker	5 pieces
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3 Research Methods

The methods used in this study include observation, interviews, and a thorough review of various updated and relevant literature, analyzed scientifically. The literature review was sourced from multiple credible references, ensuring a comprehensive understanding of the topic.

For respondent data collection, a random sampling method was used, focusing on the electability and reliability of the respondents, particularly the crew members on the ship. These individuals provided positive responses related to the issues being investigated in the study. The data collected were then processed and analyzed qualitatively to draw meaningful conclusions based on the findings.

4 Results And Discussion

This study used observation and interviews with crew members of ships docked at Soekarno Makassar Port, specifically at PT Pertamina Terminal Jetty. It focused on how the crew prevents oil spills during cargo loading operations, such as with Petamax, Peralite, Premium, and MGO. The goal was to assess the effectiveness of pollution prevention measures and identify areas for improvement in handling oil spills during these operations.

To handle an oil spill on the boat, the crew should immediately use the available tools to contain the spill. At the same time, they must notify the office about the situation. A request should be sent for additional spill response tools to be delivered quickly, as the current tools may be insufficient. Prompt action is necessary to prevent the situation from worsening, and ensuring that the boat is equipped with the proper tools for handling future oil spills is essential for effective management.

In Table 2, the description presents the results of field observations conducted by the author on ships docked at Soekarno Hatta Port, along with interviews. The interviews were unstructured and focused on the crew members involved in the loading operations on the ship. The questions addressed material issues and problems related to the operation and the handling of tasks during the loading activities.

Table 2. Observations on Ships Indonesian Waters

Ship Name Initials	Observation Field	Information
X1	Procedure mitigation, including Regulations (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.	
X2	Procedure mitigation, including Regulation (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.	
X3		

X4	Procedure mitigation, including Regulation P(SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
X5	Procedure mitigation, including Regulation (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
X6	Procedure mitigation, including Regulations (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
X7	Procedure mitigation, including Regulation (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
X8	Procedure mitigation, including Regulations (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
X9	Procedure mitigation, including Regulation (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.
	Procedure mitigation, including Regulation (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures boat.

Data, Processed 2024.

Information :

Percentage :

50%: no own Procedure countermeasures, equipment supporters, stages the above countermeasures boat so, still happen spill oil.

60%: no own equipment supporters, stages the above countermeasures ship, but implementation handling of ABK has been adequate.

70%: has own Procedure handling, Primary Handling Equipment Pollution and equipment supporters, stages the above countermeasures ship, but drill not yet scheduled.

80%: Procedure mitigation, including Regulations (SOPED and SOP), Main Handling Equipment Pollution, and equipment supporters, stages the above countermeasures ship, but implementation handling of ABK has not been done yet.

90%: Have Procedure mitigation, including Regulations (SOPED and SOP), Main Handling Equipment Pollution and equipment supporters, stages the above countermeasures ship, but Not yet make Regional and Local Contingency Plans.

Table 3. Observation of Location and Number of SOPED on Ships

Type Equipment	Location Observation	Available Quantity
Portable pump	Pump room	1 piece
Oil Dispersant	SOPEP locker	700 liters
Saw dust	SOPEP locker	20 sacks
Sand	SOPEP locker	4 sacks
Absorbent mat	Pump room	50 rill
Shovel	SOPEP locker	10 pieces
Buckets	Pump room	10 pieces
Scupper	Pump room	20 pieces
Pillow oilwik	SOPEP locker	3 pieces
Rubber gloves	SOPEP locker	2 pairs
Dustpan	SOPEP locker	5 pieces

In the process of activities demolishing the load on the ship, there is communication No two directions to ensure coordination so that still there is:

A leak in the connecting pipe (hose connection) or loading arm, which links the terminal to the boat for oil distribution during cargo unloading, can occur. In such cases, the boat's Chief Officer will communicate with the loading master regarding the readiness of the connecting pipes, perform tests on the pipes, and use wind pressure to check for leaks. Afterward, the valve is closed, and the pipes are rinsed with water mixed with detergent. If bubbles appear, it indicates a leak. During the unloading process, the boat's crew must regularly check the cargo pipe, either every 30 minutes or once an hour, to ensure there are no leaks. Leak in the pipe above deck main (main deck) due to among others :

1. If the pipe pressure is too high, it must be confirmed that the pressure is within the agreed limits. If the pressure exceeds the conditions specified in the certificate, it can cause the cargo pipe to become dangerous and potentially burst.
2. Leakage in the cargo pipe connection can occur due to inadequate maintenance, particularly at the connection points between pipes, where bolts and rubber packing are used to ensure a watertight seal. If the Planned Maintenance System (PMS) set by the company is not properly implemented, a leak may occur during cargo loading operations.
3. The tank cleaning procedure is not yet in accordance with internationally recognized standards. The implementation of cleaning varies each year depending on the type of cargo. As a result, the waste from tank cleaning is still being discharged directly into the sea, when it should be directed to the slop tank first before being properly disposed of at the terminal (harbor).
4. The procedure for disposing of tank cleaning waste into the sea does not yet comply with marine pollution regulations. According to the regulations, the vessel must be equipped with an Oil Discharge Monitoring (ODM) system, which ensures that the maximum allowed oil discharge is 15 ppm. The ODM should be programmed following the Standard Operating Procedure (SOP).

In some cases that result in the occurrence spill oil in the sea, lots caused by factors regulations, people, ships, terminals, and regulators.

Table 4. Interview Results To Respondents on Board.

Initials of Name	Quote Interview Respondents	Information
JM	Knowledge will pollution already understood, but not yet implemented fully Because limitations equipment. boat No have SOPED,	Knowledge SOPED
AB	Have known equipment main in countermeasures spill oil consisting of <i>Oil Boom</i> (tool localizer/confinement oil in water), <i>Oil Skimmer</i> (tool sucker oil), <i>Temporary Storage Tank</i> (place storage temporary), <i>Oil Absorbent</i> (material absorber oil, and <i>Oil Spill Dispersant</i> (material decomposer oil).	Main Equipment
ML	It has been implemented procedure preparedness and response to reporting incident spill oil, exercise done with use telephone or tool communication other with referring to <i>Oil Spill Contingency Plan</i> .	Procedure Readiness Countermeasures
JC	Not yet implemented drill, for test system communication, readiness and availability personnel, need carry out study to ability carry out the drill that is carried out in a way periodic every 3 (three) months.	Drill
HD	Have understood equipment used For to overcome spill oil, namely Equipment Countermeasures Spill Oil (PPTM) or <i>Oil Spill Response Equipment</i> (OSRE).	Equipment Countermeasures
NT	ABK fully own knowledge will pollution and already have SOPED,	ABK
OS	It has been implemented drill, for test system communication, readiness and availability personnel, need carry out study to ability carry out the drill that is carried out in a way periodic every 3 (three) months.	Readiness Personnel
BD	Have understood Equipment Supporter namely <i>Towing line</i> (used) For pulling oil boom in water), <i>Power pack</i> (source power mover equipment, using diesel engine for move pump hydraulic), <i>Boom winder</i> (place storage oil boom, usually used For fence boom and inflatable boom type oil boom), <i>Transfer pump</i> (pump For move oil from oil skimmer to storage tank).	Equipment Supporters
NL	Have known equipment main in countermeasures spill oil consisting of <i>Oil Boom</i> (tool) localizer / confinement oil in water), <i>Oil Skimmer</i> (tool sucker oil), <i>Temporary Storage</i>	Equipment Main

DR	<p><i>Tank</i> (place storage temporary), <i>Oil Absorbent</i> (material absorber oil), <i>Oil Spill Dispersant</i> (material decomposer oil).</p> <p>An implementation has been implemented, for test system communication, readiness, and availability personnel, need to carry out a study to ability carry out the drill that is carried out in a way periodic every 3 (three) months.</p>	Drill
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Data Processed, 2024

SOPEP drills, or Countermeasures Prevention Pollution (PPP), are training activities conducted on ships to prevent or minimize oil pollution in the sea. These drills require all crew members to participate to gain the knowledge and skills necessary to prevent oil spills. The drills must be carried out once a month, organized by the First Mate under the supervision of the Skipper. Typically, the practice occurs during breaks in daily operations, though some crew members may miss the drills due to fatigue from regular duties. Additionally, there is a shortage of adequate SOPEP equipment on board. As a result, if an oil spill occurs, the crew may not be equipped to handle the spill effectively.

When an oil spill occurs on a boat, the crew must immediately inform the office about the situation. It is essential to request additional spill response equipment, as the available tools may be insufficient or in poor condition. The office should be notified promptly so that the necessary equipment can be sent as soon as possible to properly handle the oil spill.

There is a lack of knowledge and awareness among the crew, especially those on duty on deck, about the consequences of oil spills and the proper use of SOPEP tools to handle them. This lack of understanding affects the performance of SOPEP tools in responding to oil spills. Additionally, there is an issue with the procurement of SOPEP tools on board, as checks on the quantity and availability of spare parts for these tools are rarely conducted. This results in an insufficient supply of necessary equipment to effectively manage oil spills on the ship.

In reality, many of the SOPEP (Ship Oil Pollution Prevention Emergency Plan) tools on board are in poor condition and are no longer suitable for use. These tools are rarely properly maintained by the officer in charge. Reports regarding the condition of SOPEP equipment are rarely submitted to the company, which means the company is unaware of the actual situation on the ship. This lack of communication and oversight hampers the efforts to prevent and manage oil spill incidents. The damage to the equipment, caused by neglect, has led to several essential SOPEP tools being unavailable, despite being listed in the written inventory.

5 Closing

5.1 Conclusion

1. Sea pollution is an extraordinary event that is not common, so handling it requires skilled, reliable, and professional crew members, as well as significant financial resources.

2. Shipping companies (PT), as ship owners, face significant challenges in replacing losses caused by oil pollution. However, many companies mitigate this by insuring the ship and its cargo, which helps avoid penalties.

5.2 Suggestion

1. It is recommended that the Technical Implementation Unit (UPT) make a contribution and give training-related importance to guard the pollution environment in the maritime.
2. It is recommended that shipping companies are committed together or agree on child fruit boats in a guarded environment maritime.

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