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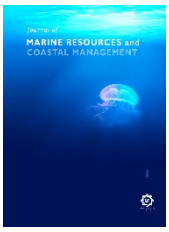

Implementation of MARPOL 73/78 Annex I on the prevention of oil spills at Nilam Terminal, Port of Tanjung Perak Surabaya

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ABSTRACT

The increase in shipping activities is directly proportional to the threat of oil spills in the ocean, both from operational activities and ship accidents. Port of Tanjung Perak Surabaya has heavy traffic and continues to increase every year. This condition can pose a threat of increasing the risk of oil spills. Appropriate actions are needed to minimize the percentage of oil spill threats, one of which is by enforcing MARPOL 73/78 regulations which are intended for tankers. Specifically, MARPOL 73/78 Annex 1 is a regulation regarding marine pollution caused by oil or its derivatives from ship operational activities or accidental discharge of oil. This problem is the basis for the need to carry out research regarding the study of the implementation of MARPOL 73/78 Annex I to prevent oil spills at the Tanjung Perak Port, Surabaya, especially at the Nilam Terminal. Through distributing questionnaires, it was discovered that the prevention of oil spills at the Nilam Terminal-Tanjung Perak Port, Surabaya, carried out by 5 tankers, had an average assessment score of 18.4 or 92%, which means that the majority of oil tankers were very good at implementing international standards. MARPOL regulation 73/78 Annex I at Tanjung Perak Port, Surabaya.

Keywords: MARPOL Annex 1, oil spills, Tanjung Perak Port, tanker

INTRODUCTION

In the development of the maritime economy, sea transportation has a very important role in the Indonesian economy, including services such as shipping services for basic or strategic materials. Nearly 90 percent of the total world trade transportation uses sea transportation services as a support for world industrial distribution [1]. Total development of loading and unloading volumes at strategic ports has increased in 2021 compared to the previous year, for domestic shipping by 11.46% for loading and 8.73% for unloading, while for foreign shipping by 23.96% for loading and 31.07% for unloading, respectively [2].

The increase in shipping activities will also be directly proportional to the increase in the threat of marine pollution. One source of marine pollution is caused by shipping activities in the form of oil spills either from operational activities or ship accidents [3]. The volume of oil spills each year is estimated at 3 to 4 million tons of petroleum that pollute marine waters in various parts of the world [4]. This oil pollution is very detrimental to the environment because it can cause pollution that will disrupt the survival of organisms and reduce environmental productivity [5].

Tanjung Perak Port, Surabaya has heavy traffic and continues to increase every year. According to data recorded by PT.Pelindo III, in 2017 it started from 2,375 units to 3,297 units in 2018 with a ship flow growth of 39 percent. In Gross Tonnage (GT) units, it increased by 56 percent from 16.9 million GT in 2017 to 26.5 million GT in 2018. While the flow of containers in units of Twenty-foot Equivalent Units (TEUs) increased by about 9 percent from 140,361 TEUs to 152,769 TEUs in 2018.

The high traffic conditions that continue to increase significantly at the Tanjung Perak Port can pose a threat of new problems, namely the increasing volume of ships in and out, which will also increase the risk of oil spills from routine ship operations, spilled ship cargo, or ship fuel that has an accident. It should be underlined that oil spills originating from routine ship operations carried out every day, will cause indirect marine pollution impacts on the sea of Tanjung Perak Port. The impact of the pollution will occur either short or long term such as damaging the quality of the waters and the biota in it [6].

The vulnerability of sea continues to be threatened by marine pollution originating from shipping activities which are increasing every year. Therefore, appropriate action is needed to minimize the percentage of oil spill threats, one of which is by enforcing MARPOL 73/78 rules aimed at tankers. MARPOL is an international convention on the marine environment developed by the IMO (International Maritime Organization) as an effort to minimize the risk of marine pollution, such as garbage disposal, oil and air pollution originating from ships at sea [7]

The reason for the emergence of this convention is to comprehensively preserve the marine environmental space from pollution by oil and other hazardous substances and minimize the risk of accidental spills of these substances. The regulations in the MARPOL convention are aimed at preventing and minimizing pollution from ships either intentionally or from routine operations, so every ship

is required to have certified systems and equipment to support these regulations [8]. In the MARPOL 73/78 rules, there are seven Annexes that aim to regulate regulations that are preventive against marine pollution originating from ships. One of these Annexes is Annex 1, which is a regulation regarding marine pollution caused by oil or its derivatives from ship operational activities or accidental oil discharges [9]. This regulation needs to be maximally enforced to reduce the risk of oil spills. Therefore, these problems become the basis for the purpose of conducting research on the study of the implementation of MARPOL 73/78 Annex I on the prevention of oil spills at sea, especially in the sea of Tanjung Perak Port Surabaya.

METHODS

This study was conducted in March-April 2023 in Tanjung Perak Port, Surabaya with exact location at the Nilam Terminal (stevedoring terminal specialized for liquid bulk cargo at Tanjung Perak port). The research method used in this research is descriptive method. Descriptive research method is a form of research aimed at describing and interpreting existing phenomena, such as situations and conditions with existing ridges [10]. The descriptive method is used to obtain an overview of the study of the application of MARPOL 73/78 rules at Tanjung Perak Port Surabaya as a form of initial step action to prevent oil spills originating from ships.

Instrument Research

The type of data used is primary data with research instruments in this study, namely by distributing questionnaires/surveys. The data was obtained from respondents directly in the form of questionnaire results regarding the implementation of MARPOL 73/78 Annex 1 (Table-1). Questionnaire is a data collection method that is done by giving a set of questions or written statements to respondents to answer [11].

The research sampling technique (respondents) uses non-probability sampling techniques with a type of purposive sampling technique. Purposive sampling is a way of determining research samples with certain considerations The criteria in this research sample are oil-laden tankers at the Nilam Terminal, Tanjung Perak Port Surabaya. The tanker in question has a gross volume above 150 GT. Researchers chose tankers as research samples because they were in accordance with the scope of tasks from field work practices and had obtained special licenses.

Scoring Technique

The application of the score value to the respondent's data that has been collected after passing the selection process and the data is organized in a table to facilitate further processing. Each answer given by the respondent will be given a score or value through the use of the Guttman Scale). The guttman scale is a measurement scale for data obtained in the form of interval data or dichotomous ratios (two alternatives) [12]. This method is used to get a firm answer to the problem being asked. The type of way of giving value weight, namely for value 1 as a "yes" answer and value 0 as a "no" answer. Answers are only made with the highest score of 1 (one) and the lowest 0 (zero). The statement classification provisions are shown in Equation (1) [13].

Table-1. Questionnaire regarding the implementation of MARPOL 73/78 Annex 1

Regulation	Grading Items	Sub Elements of Regulation
Regulation 12 – Sludge Tank	1	There is a special tank for oil residue/sludge
	2	Adequate oil residue/sludge tank
	3	Oil residue/sludge tank construction complies with standard discharge connection regulations
Regulation 13 – Standard Discharge Connection	4	There is a standard discharge connection
	5	Standard discharge connection in accordance with regulations of oil filtering equipment
Regulation 14 – Oil Filtering Equipment	6	There is oil filtering equipment
	7	There is an alarm on the oil filtering equipment
Regulation 15 – Control of Discharge of Oil	8	Not waste oil in special areas
	9	Not dispose of oil outside special areas
Regulation 17 – Oil Record Book	10	Oil record book available
	11	Record fuel tank cleaning
	12	Clean the fuel tank water
	13	Record the disposal of oil residue/sludge
	14	Record the discharge of oil into the sea
	15	Record machine room activities
	16	Record equipment damage
	17	The oil record book is signed
	18	Oil log book is available for inspection
	19	Has been questioned by the authorities
Regulation 37 – Shipboard Oil Pollution Emergency Plan	20	There is a plan to deal with oil pollution

$$Score = \frac{\sum "Yes"\ Answer}{\sum Questionnaire\ Answer} \quad (1)$$

The general criteria resulting from the estimation are:

1) 0% - 25%, means that respondents are not good at implementing MARPOL 73/78 regulations;
2) 25% - 50%, means that respondents are quite good at implementing MARPOL 73/78 regulations;
3) 50% - 75%, means the respondent is good at implementing MARPOL 73/78 regulations
4) 75% - 100%, means the respondent is very good at implementing MARPOL 73/78 regulations.

RESULTS AND DISCUSSIONS

MARPOL 73/78 Annex I

The regulations MARPOL 73/78 Annex I cover the construction and equipment of ships to prevent pollution by oil coming from ships and if an oil spill occurs, there are ways to handle it in accordance with the Standard Operating Procedure (SOP). MARPOL 73/78

Annex I consists of 39 regulations in 7 chapters and is accompanied by three additional appendixes, i.e. Appendix 1 on the list of oil types, Appendix 2 on the format of the IOPP certificate, and Appendix 3 on the format of the oil record book [9].

Annex I regulations are divided into several categories including: regulations for the prevention of pollution by oil, regulations for the control of pollution by oil, and regulations for the implementation and inspection of pollution by oil. Implementation of MARPOL Annex I is carried out only a few regulations including regulation 12 on sludge tanks, regulation 13 on standard discharge connections, regulation 14 on oil filtering equipment, regulation 15 on control of discharge of oil, regulation 17 on oil record books, and regulation 37 on shipboard oil pollution emergency plans [9].

1. Regulations for preventing pollution by oil
   a. Regulation 12 – Oil Residue (Sludge) Tanks

      Based on this regulation, it is stated that ships of 400 GT or more must be equipped with adequate oil storage tanks and must not be thrown into the sea. Such as fuel refining activities, engine lubricating oil, and oil leaks in the engine room. The tank size is adjusted to the type of engine and the length of the ship's voyage. Piping to or from waste oil storage tanks must not have direct connections to the sea, other than standard discharge connections that connect to waste reception facilities. Tanks for the waste reception facilities in question are located in the following places: ports and terminals where the oil is loaded, all ports that load more than 100 tons of oil per day, and have shipyard and tank cleaning facilities.

   b. Regulation 13 – Standard Discharge Connection

      In accordance with this regulation, every ship with a size of 150 GT or more and 400 GT or more must be equipped with standard exhaust pipes. Installation of ship discharge pipes to easily connect with waste reception facility pipes for residues from ship hull engines and from sludge tanks. Both pipelines must be equipped with standard drain connections that comply with applicable regulations.

   c. Regulation 14 – Oil Filtering Equipment

      In this regulation, every ship with a size of 400 GT or more but less than 10,000 GT must be equipped with oil water separator equipment. Every ship that disposes of ballast water stored in fuel tanks must first pass through oil filtration equipment (oil water separator) before being discharged. Each oil mixture that is discharged after passing through the system has a content not exceeding 15 ppm. If the size of the ship is 10,000 GT or more, it must also be accompanied by an alarm setting (bilge alarm) to indicate a warning that each discharge of the oil mixture does not exceed 15 ppm. Meanwhile, ships of less than 400 GT only need to be equipped with oil storage tanks of adequate volume, which can be disposed of directly under certain conditions.

   d. Regulation 15 – Control of Discharge of Oil

      Based on these regulations, every ship with a size of 400 GT or more is allowed to dispose of the remaining oil mixture with conditions, including: the ship is in transit, the oil content does not exceed 15 ppm, the oil mixture does not come from the oil tanker cargo pump room, and disposes of in a special area or outside the special area except the Antarctic region. Disposal to the sea must not contain chemicals or other substances that are harmful to the environment. If it cannot be disposed of in accordance with regulations, it must be stored on board the ship for further disposal at a waste reception facility.

2. Regulations to overcome oil pollution: Regulation 37 – Shipboard Oil Pollution Emergency Plan

   Based on this regulation, every oil tanker with a size of 150 GT and above and every other ship with a size of 400 GT and above must carry an oil pollution emergency plan on board approved by the government. The plan must be prepared based on guidelines developed by the organization which at least consist of: procedures for reporting oil pollution incidents, a list of parties who must be contacted in the event of an oil pollution incident, and a detailed explanation of the actions that must be taken to control the pollution.

3. Implementation regulations and inspections to prevent oil pollution: Regulation 17 – Oil Record/Register Book

   According to these regulations, every oil tanker with a size of 150 and above and every other ship with a size of 400 must be equipped with an oil register book (machine room operations). Reports that must be recorded every time one of the engine room operations on a ship such as: cleaning of fuel tanks, removal of dirty ballast water from fuel oil tanks, collection and disposal of oil residues, disposal of ship's hull water that has collected in the engine room, and bunkering of materials burn. The oil register book for each completed operation is signed by the responsible official and must be kept in a place that is always available for inspection at any time.

Respondents Profile

There are five respondent tanker ships that have known profiles including ship name, volume size, and cargo type (Table-2). These tanker ships have different loads, namely crude palm oil and RBD palm olein. Crude palm oil is vegetable oil derived from the mesocarp (fruit flesh) of oil palm trees. Palm oil is obtained through the process of extracting or pressing the flesh of the oil palm fruit without a refining process. Meanwhile, Refined, Bleached, Deodorized Olein (RBD Olein) is a product produced through the process of refining and fractionating Crude Palm Oil which is then used as cooking oil. The advantage of RBD Olein lies in its stability against oxidation compared to other vegetable oils because it has a high smoke point [14].

Table-2. Respondents profile

Ship Name	GT Volume	Load Carried
MT. Buana Mas Palmindo	1,559 GT	Crude palm oil
MT. As Marine Dua	2,554 GT	Crude palm oil
MT. Dian Dina	4,704 GT	Crude palm oil
MT. Buana Glory I	2,571 GT	RBD palm olein
MT. Daya Armada 01	2,997 GT	Crude palm oil

All tanker ship respondents are in accordance with the research requirements and regulations in MARPOL 73/78 that the requirements are tanker ships with a volume size of 400 GT or more and loaded with oil. The size of the tanker volume varies from the lowest belonging to MT. Buana Mas Palmindo at 1,559 GT and the highest belonging to MT. Dian Dina reaching 4,704 GT.

Analysis of MARPOL 73/78 Annex I Implementation at Tanjung Perak Port

The results of the questionnaire data that have been obtained in this study regarding the implementation of MARPOL 73/78 Annex I at the Nilam Terminal of Tanjung Perak Port Surabaya are then processed using a guttman scale scoring (Table-3). Table-2 shows the results of respondents' answers when calculated using the guttman scale method, which is for the answer "yes" has a value of 1 and the answer "no" has a value of 0. The total answer "yes" is 92, while the answer "no" is 8. In general, MARPOL 73/78 Annex I rules for each regulation are implemented optimally, but there are several assessment items that get a "no" answer from some respondents such as in regulation 14 regarding oil filtration equipment, regulation 15 regarding oil discharge control, and regulation 17 regarding oil logbooks.

In MARPOL 73/78 Annex I regulation 14, MT. Dian Dina and MT. Buana Mas Palmindo are recorded as not meeting the regulation because they do not have an alarm on the oil filtering equipment. The ship's operational party has realized this, and also stated that they have actually submitted the procurement of alarm spare parts to the ship owner but are still waiting for an answer until now. The provisions of Annex I regulation 14 in MARPOL 73/78 states that every ship with a volume size of 400 GT or more must be equipped with oil filtering equipment accompanied by an alarm. The function of the alarm is to ensure the system that any discharge of oily mixture will stop automatically when the oil content is more than 15 ppm.

Then in Annex I regulation 15, MT. Buana Glory I and MT. As Marine Dua do not appear to have complied with the regulation because they release oil mixture discharges into the sea that exceed the tolerance limit in the regulation. This is also added on the basis of the crew's lack of knowledge in understanding the regulations in Annex I of MARPOL 73/78. In accordance with the provisions of regulation 15 of Annex I of MARPOL 73/78, it is prohibited to discharge oil or oily mixtures originating from ships into the sea with certain records, if the oil residue cannot be discharged into the sea, it is required to be kept on board for disposal to the waste reception facility at the port.

Furthermore, regarding Annex I regulation 17, MT. Buana Mas Palmindo is noted to have not fulfilled one part of the regulation because it does not record engine room activities in the oil record book by the ship's crew as the person in charge. The oil record book is one of the important documents on board which is used to record all activities related to oil and waste oil management in a series of efforts to minimize the impact of oil pollution from ships. In regulation 17 MARPOL 73/78 Annex I explained that every oil tanker with a volume of 150 GT and above must be equipped with an oil logbook (engine room operation), In the book must be recorded every engine room operation activity which includes: ballasting, fuel oil tank cleaning, oil residue disposal, disposal of bilge water that accumulates in the engine room, and fuel bunkering.

From the results of each item of the guttman scale answer assessment, it can then be calculated the total assessment of each respondent regarding the level of implementation of MARPOL 73/78 Annex I on oil spill prevention. The data obtained from the answers with the guttman scale method shows an average score value of 18.4 or with a percentage of 92%, meaning that most of the oil tanker respondents are very good at implementing international regulations for MARPOL 73/78 Annex I at Tanjung Perak Port Surabaya, although there are still some respondents who have not fulfilled these regulations.

These results show that the application of MARPOL 73/78 carried out by tankers will reduce the potential threat of marine pollution originating from ships in the form of oil spills. The awareness of shipping parties by complying with this regulation must be continued from time to time in order to preserve the marine environment as a whole, both biota and ecosystem.

Table-3. MARPOL 73/78 Annex 1 implementation assessment item answers

No	Regulation	Grading Items	Scoring Answer		Percentage
			Yes	No	
1	Regulation 12 – Sludge Tank	1	5	0	100%
		2	5	0	100%
		3	5	0	100%
2	Regulation 13 – Standard Discharge Connection	4	5	0	100%
		5	5	0	100%
3	Regulation 14 – Oil Filtering Equipment	6	5	0	100%
		7	3	2	60%
4	Regulation 15 – Control of Discharge of Oil	8	3	2	60%
		9	2	3	40%
5	Regulation 17 – Oil Record Book	10	5	0	100%
		11	5	0	100%
		12	5	0	100%
		13	5	0	100%
		14	5	0	100%
		15	4	1	80%
		16	5	0	100%
		17	5	0	100%
		18	5	0	100%
		19	5	0	100%
6	Regulation 37 – Shipboard Oil Pollution Emergency Plan	20	5	0	100%

Table-3. Calculation of total score of MARPOL 73/78 Annex 1 implementation assessment

No.	Respondents	Total Score	Percentage	Category
1.	MT. Buana Mas Palmindo	16	80%	Very Good
2.	MT. As Marine Dua	20	100%	Very Good
3.	MT. Dian Dina	18	90%	Very Good
4.	MT. Buana Glory I	20	100%	Very Good
5.	MT. Daya Armada 01	18	90%	Very Good
Ideal Score = 20				
Average = 18.4 (92%)				
Average Category = Very Good				

CONCLUSIONS

The implementation of MARPOL 73/78 Annex I to prevent oil spills at the Port of Tanjung Perak Surabaya, specifically at the Nilam Terminal, on tanker ships received several respondents including: MT. Buana Mas Palmindo, MT. As Marine Dua, MT. Dian Dina, MT. Buana Glory I, and MT Daya Armada 01. The results obtained from the total average score of the assessment obtained using the Guttman scale method were 18.4 or a percentage of 92%, which means that the majority of oil tanker respondents were very good at implementing the rules international for MARPOL 73/78 Annex I at Tanjung Perak Port, Surabaya.

It is necessary to study the implementation of MARPOL 73/78 for other Annexes because basically MARPOL 73/78 consists of seven Annexes which regulate pollution originating from ships, so that it can be seen to what extent MARPOL 73/78 is implemented, especially on oil tankers at Tanjung Perak Port, Surabaya.

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