



## The Compliance of Ship's Crew Toward the International Convention Implementation for the Control and Management of Ship's Ballast Water and Sediment In Offshore Port of Taboneo

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### ABSTRACT

This study aims to analyze the level of compliance of the ship's crew toward The BWM Convention (Ballast Water Management Convention). This research is kind of qualitative using a research design that relates the independent variables and the dependent variable at the same time. The study was conducted in the Offshore Port of Taboneo with a total sample of 54 respondents. The research data is primary data from interview by using questionnaire and secondary data obtained from interview and literature study. The results showed that the compliance of the crew on the ship that has been equipped with Ballast Water Treatment System (BWTS) is 66.67 % of respondents belong to the category approach to compliance and 33.33 % of respondents belong to the category approach to non-compliance. So are the compliance of crew on ship that has not been equipped with BWTS, 60.61 % of respondents belong to the category approach to compliance and 39.39 % of respondents belong to the category approach to non-compliance.

**Keywords:** ballast water management, perception, ship's crew, ballast water

### 1. Introduction

Water transport has an essential role in world trade. According to the UNCTAD (2016), in 2015 the volume of trade by sea (seaborne trade) amounted to 10.047 million tons or more than 80% of the total world trade. The International Maritime Organization (IMO) as an international organization under the United Nations (UN) has a central role in the maritime transportation by issuing internationally enforceable regulations for safe and eco-friendly shipping (IMO, 2017).

One of the remarkable achievements of IMO in its efforts to protect the marine environment due to damage caused by shipping activities of a ship is by the International Convention of Control and Management of Ballast Water and Sediments from Ship in 2004 that better known as BWM Convention (Ballast Water Management Convention) hereinafter referred to as the BWM Convention. The BWM Convention consists of 22 Articles covering obligations agreed by all

parties and 1 appendix (Annex) containing technical regulations.

Legal certainty in protecting the maritime environment of Invasive Alien Species (IAS) or Hazardous Organisms and Aquatic Pathogens (HAOP) caused by ballast water from ships that disposed of without processing first, whether from Indonesian-flagged ships sailing abroad or from foreign flagged ships in Indonesian waters, will be realized by ratifying this Convention (Directorate General of Sea Transportation, 2015).

Research about the compliance of ship's crew on the implementation of this BWM Convention may provide an overview of the compliance of the crew in implementing the rules of the BWM Convention on the ships, especially on trade ships of bulk carriers in the Offshore Port of Taboneo. The results of this research are expected to provide information so that it can be an input and consideration to the relevant parts either government, ship owners, or port managers.

## 2. Materials and Methods

### *Time and location*

This research was conducted for 5 months from October 2017 - February 2018 and has been implemented in the Offshore Port of Taboneo or commonly referred as the Floating Terminal of Taboneo, managed by the Badan Usaha Pelabuhan (BUP) of PT. Indonesia Multi Purpose Terminal (IMPT). The Floating Terminal of Taboneo is a place to Ship to Ship Transfer (STS), that included in the Region of Work Environment (Daerah Lingkungan Kerja/DLKr) and Regional of Interests Environment (Daerah Lingkungan Kepentingan/DLKp) Port of Banjarmasin, Province of South Kalimantan. Taboneo Floating Terminal is located 25 Nm to the South from Trisakti Port, Banjarmasin. Watershed area used for cargoes loading activities of 36 Nm<sup>2</sup> area with a capacity of 61 loading point, which consists of Handysize, Handymax, Panamax and Capesize type of ships (IMPT, 2018).

### *Population and sample*

Based on data from Port Authority (Kantor Kesyahbandaran dan Otoritas Pelabuhan/KSOP) Class I Banjarmasin (2017) in the period of January to September 2017, the amount of ship arrivals on average per month as many as 100 ships with varying deadweight and flags. The minimum number of bulk carrier ships with size above 400 GT is 74 ships, ie in February 2017. While the maximum arrival in April 2017 that is as many as 115 ships.

Determination of the number of samples from the population of bulk carriers in Offshore Port of Taboneo can be determined by using Slovin equation (Umar, 2003), namely:

$$n = \frac{N}{Ne^2 + 1} \quad (1)$$

Annotation:

n = Number of Samples

N = The total population of coal carriers

e = Precision (10%)

If the population of a bulk carrier vessel is 115 ships, then the number of ship samples taken is as follows:

$$n = \frac{115}{115(10\%^2) + 1} = 54 \text{ ships} \quad (2)$$

This research uses purposive sampling method. According to Sugiyono (2013), purposive sampling is one way or method of

sampling which concern to the purpose and consideration of the researcher. Therefore in this research, respondents selected are those with the position of ship officers. This is done with the consideration of ship officers have to know, understand, apply, and take responsibility for the implementation of this BWM Convention.

### *Data analysis*

This research is divided into 2 kinds, ie the level of compliance for ships that have been installed Ballast Water Treatment System (BWTS) and the level of compliance on the ships that have not been installed Ballast Water Treatment System (BWTS). The indicator of crew compliance for ships that have been installed ballast water treatment equipment is as follows:

- The ship has an International Ballast Water Management Certificate
- The ship has The Book of Ballast Water Management Plant
- The ship has a Ballast Water Record Book
- Perform ballast water treatment in each voyage
- Inspection results by port authorities
- Utilization of reception facility of ballast water and sediment in port facilities.

While the indicators for the ship that has not been installed Ballast Water Treatment System (BWTS) is as follows:

- Ballast water exchanging (BWE) in accordance with BWM Convention rules
- The ship has The Book of Ballast Water Management Plant
- The ship has a Ballast Water Record Book
- Inspection results by port authorities
- Utilization of reception facility of ballast water and sediment in port facilities

This research used questionnaires with Guttman Scale because to measure the compliance level required explicit data. Guttman Scale only has two choices of answers which are, "Yes" with a score of 1 and "Not" with a score of 0. The scores of each questionnaire above were then entered into the equation to obtain the value of proportion (percentage) with the following equation:

$$P = \frac{f}{n} \times 100 \% \quad (3)$$

Annotation:

P = Percentage

f = Frequency of each selected answer

n = Amount

100% = Constants

The Guttman scale requires a quantitative approach to facilitate in technical calculations. The mention of the results of operational measurement on the measurement results is approaching compliance – to a non-compliance. Meanwhile, objective criteria categorization are approach to compliance if the total answer score is > median and approach to non-compliance if the total score of answers is < median.

### 3. Results and Discussion

The compliance of the crew is measured through specific questions regarding the completeness of the Ballast Water Management document and the actions in accordance with the BWM Convention. These compliance variables are divided into 2 groups ie crew members on ships that have been equipped with Ballast Water Treatment System (BWTS) and crew members on ships that have been not completed with BWTS

**Table 1.** Distribution of respondents on ships that are BWTS equipped and on ships that are not BWTS equipped

Category	Number of Respondents	Percentage (%)
Ships that have been equipped with BWTS	21	38.89
Ship that has not been equipped with BWTS	33	61.11
Amount	54	100.0

Source: Primary Data Research, 2017

Table 1 shows that as many as 61.11% of ships still not have installed Ballast Water Treatment System (BWTS), and only 38.89% of ships that have been installed this Ballast Water Treatment System. The installation of BWTS is closely related to the support of the ship owner or operator to immediately comply with the rules of the BWM Convention. Based on the results of interviews with the crew, it is alleged that ship owners and operators do not install ballast water treatment system because their ships do not serve the state or region that has implemented the Convention BWM as a whole. Then investment installation of processing equipment large enough (King and Tamburi, 2010), the age of the ship is also one of the factors why the ship owner and operators do not immediately install ballast water treatment system.

The degree of compliance of ship crew on BWTS equipped ships is categorized into 2 groups by using the median standard 7 where respondents who scored answers more than or equal to 7 are categorized approach to

compliance and respondents who scored less than 7 are categorized approach to non-compliance.

**Table 2.** Distribution of respondents based on compliance level on BWM convention on BWTS equipped ships

Category	Number of Respondents	Percentage (%)
Approach to Compliance	14	66.67
Approach to Non-Compliance	7	33.33
Amount	21	100.0

Source: Primary Data Research, 2017

Compliance level of crew on ships that have been equipped with ballast water treatment equipment based on the results of research as much as 66.67 % of respondents included in approach to compliance. Then descriptive analysis used percentage category tables that the final result obtained from the weighted value of interviews by using questionnaires instruments regarding the completeness of Ballast Water Management documents and the actions in accordance with the BWM Convention. Based on the analysis, the crew of ships that already equipped with BWTS belong to the category approach to compliance with an average grade of the overall answer being 87.50 %.

Ships that have installed ballast water treatment system, on average have complied with the provisions contained in the question items regarding the completeness of documents BWM. However, not all respondents do treatment of ballast water each time the ship sail. This is because the shipping is done with a very short route and still in one region or country. There are also ships like MV. GLD that does not conduct ballast water treatment for all tanks, processing is only done for ballast water on Double Bottom tank (DBT) No. 1 port side and star board side. This is due to the limited chemicals for ballast water processing available on board. Based on economic point of view, the investment for BWTS purchase and installation is in the range of US \$ 600,000 to US \$ 1.2 million and annual maintenance and operating costs range from US \$ 15,000 to US \$ 125,000. If the ship owner or operator does not conduct ballast water treatment (even if the ship is already installed BWTS) then the ship owner or operator can reduce the operational cost and maintenance cost of US \$ 70,000 per year (King and Tamburri, 2010).

The compliance level of ship crews on ships that not equipped with BWTS is categorized into 2 groups by using the median

standard 6 where respondents who scored answers more than or equal to 6 are categorized as approach to compliance and if the score of respondents is less than 6 then categorized as approach to non-compliance. The distribution of respondents can be seen in Table 3.

**Table 3.** Distribution of respondents based on compliance level on BWM convention on ships that not equipped with BWTS

Category	Number of Respondents	Percentage (%)
Approach to Compliance	20	60.61
Approach to Non-Compliance	13	39.39
Amount	33	100.0

Source: Primary Data Research, 2017

The results showed that from 33 respondents whose ship is still not equipped with Ballast Water Treatment System (BWTS), there are 60.61 % of respondents approached compliance category. If analyzed using the percentage category table, it shows that the crew on the ship that has not completed BWTS is included in the category approach to compliance with the average overall score 76.77 %. Of these 33 respondents, not all of them that have not the required documents in BWM Convention yet. There are several ships that already have Ballast Water Management Plan and Ballast Water Record Book according to the format specified in the BWM Convention. Referring to the results of interviews with the Port Authority, for the ships that have not installed the ballast water treatment system yet, at least they should have Ballast Water Management Plan and Ballast Water Record Book.

Ships that are not equipped with BWTS are required to perform exchanging of ballast water with the terms and standards that have been set. There are 3 methods of exchange of ballast water used, which are sequential method, dillution method, and flow through method (IMO, 2005). From the 33 ships that have not been equipped with BWTS, 66.7 % of respondents use flow through method, 15.15 % of respondents use sequential method, and 18.18 % of respondents did not answer. Results of research from Handoko and Tjahjono (2017) mentions only 14.8% of respondents who do BWE in accordance with D1-standard.

**Table 4.** Distribution of respondents in using water exchange methods of ballast water on ships that not BWTS equipped

BWE Methods	Number of Respondents	Percentage (%)
Sequential Method	5	15.15
Dillution Method	0	0
Flow Through Method	22	66.67
No answer	6	18.18
Amount	33	100.0

Source: Primary Data Research, 2017

The result of questionnaire shown in Table 4 on the method of exchange of ballast water on ships that not yet equipped with BWTS, majority of respondents answered using flow through method as much as 66.67 % of respondents. In line with research by Handoko and Tjahjono (2017), flow through method is also the most used method by respondents that is 23.8%. This method is done by filling the ballast water at sea or ocean and let the water to overflow, as many have done at least 3 times the volume of the ballast tanks (IMO, 2005). From the interviews, the use of BWE method, especially with Sequential Method, is very dangerous to sail safety because it disturbs the ship's stability and the risk of deflection on the ship due to errors in the calculation Kim (2013). According to Rahman (2017) before doing Sequential Method, several things to consider are weather, internal load, as well as matters relating to the operation of ships, pumping systems, and piping on ships.

Pereira et al., (2016), in their research stated that ballast water exchange can actually be monitored remotely so that ship owners or operators can make sure that BWE is implemented or not. Even systems from this technology can send reports automatically to the port authority. Currently, the main indicator to know whether the ship has already implemented BWE is by conducting a salinity check. Besides, Pereira et al., (2016) recommends that water turbidity may also be an indicator to identify ballast water exchange.

According to Kim (2013) in the future BWE is no longer permitted due to the uncertainty related to ships stability and the effectiveness of the method, so D2-Standard will be the only option for shipping companies to fulfill by installing BWMS. However, thing to be concerned if D2-Standard becomes the only option is a by-product of chemicals that can have a negative effect on aquatic organisms (Zhang et al., 2013), as well as byproducts of disinfectants (halogenated) such as dibromochloromethane, four haloacetic acids, and sodium bromate. The use of the active

substance as a disinfectant to kill the NIS in the ballast water will have a bad effect on the original organism in which the ballast water is removed, even though the active substance has been neutralized by a reducing agent such as sodium thiosulfate (Pelorus and Karahalios, 2017). Considering the use of chemicals that are feared could endanger the environment then the current use of ballast water treatment by combining the filtration system with the provision of heat is highly recommended (Balaji and Yaakob, 2011).

Based on interviews, respondent did not answer about the methodology used in the ballast water exchange due to their ignorance regarding ballast water management method that's already set in the BWM Convention. The lack of socialization and ship routes that only serve the domestic route and the absence of checks from the port authorities have left them unfazed with information on the rules for ballast water in various countries.

In principle, the ship is required to perform the ballast water treatment, either when the process of loading and unloading cargo ship is done by directly berthed at the port or anchored in the area that has been determined for the loading and unloading process. There are 3 methods for ballast water treatment ie by using the Ballast Water Treatment System (BWTS), by doing the ballast water exchange (BWE), and the last one is by utilizing the reception facility ballast water and sediment at the port (David et al., 2015).

The results of the research show that from all ships that have been installed BWTS or not yet installed BWTS, no one has ever reception facilities of ballast water and sediment at the port. According to David et al., (2015) reception facilities of ballast water and sediments in the port is the main measure in the management of regulated natural d BWM Convention (Guideline G5). Indeed, this reception facility can not cover all the activities of ballast water discharge. Because there are several conditions require the ship filling and discharging of ballast water outside the port or when the ship performs the loading and unloading activities of the cargo in the anchored area. It is caused by the condition that ship can not enter the port due to the limitation of draft or anything else.

Ballast water management is actually already regulated in a Government Regulation Republic of Indonesia No 21 of 2010 concerning Maritime Environment Protection (Peraturan Pemerintah, 2010) and further stipulated in Regulation of the Minister of Transportation of the Republic of Indonesia No

PM 29 of 2014 (Peraturan Menteri, 2014). Then followed by Regulation of the President of the Republic of Indonesia No. 132 Year 2015 On Ratification of The International Convention For The Control And Management Of Ships Ballast Water And Sediments, 2004 (Peraturan Presiden, 2015). But the results of questionnaires from this study showed that in the Offshore Port of Taboneo, there is no checks on ballast water management of the port authority. The research results of Yusuf et al., (2017) indicate that the rules have been implemented, but still get many obstacles such as socialization that is not working well, human resources and technology are not adequate, and the absence of making SOP. Based on data from KSOP Class I Banjarmasin (KSOP, 2017), an average of 100 ships per month that comes in the Offshore port of Taboneo for cargo loading activities. The more amount of ships that come and dispose of untreated ballast water, the greater the potential inclusion of IAS and NIS (David, 2015). In addition, the potential pollution of the marine environment by heavy metal Lead (Pb) due to ballast water disposal is greater, such as the results of research by Agustriani et al., (2016) which shows in the waters of Tanjung Api-Api happened addition of heavy metal Pb anthropogenic. One of the sources of contamination is the ballast water vessel waste and this can be seen from the positive correlation between metal Pb waters and ballast water.

Questionnaire results with the question of what is the most basic reason to be compliance to the rules of the BWM Convention (this question is open type) has varied answers but the substance presented can be divided into 3 kinds ie:

1. Compliance because this is a rule that must be executed. This attitude is taken either due to orders from the Captain, the operator or the owner of the ship, as well as knowing of any punishment given if caught not executing it when the port authority checks.
2. Compliance because of knowing the meaning and purpose of the implementation of BWM Convention. In this case the respondent knows that the ballast water that is not processed and directly discharged into the waters will have a negative effect on the environment.
3. Non-compliance because as long as the ship's officers have never or have never yet had a problem with the port authority on ballast water. Usually respondents who answered this always sail with a shipping route whose destination is a country or

region that does not fully apply the rules regarding the discharge of ballast water.

According to King and Tamburri (2010), the level of compliance associated with environmental regulations is influenced by normative factors such as morals, social pressures, as well as economic factors associated with unbalanced compliance cost and compliance costs incurred if not complied with. Economic theory and the reality of the field show that if environmental regulations are applied to large industries then the level of compliance is very dependent on economic factors, especially how to set the business to run by comparing the advantages and disadvantages if it does not comply with the rules.

#### 4. Conclusion

Based on research conducted the compliance level of ships crew on board which was equipped with a Ballast Water Treatment System (BWTS), there are as many as 66.67 % of respondents belong to the category approach to compliance and 33.33 % of respondents approaching non-compliance. And also the compliance of crew on board ship that has not been equipped with BWTS, there are as many as 60.61 % of respondents belong to the category approach to compliance and 39.39 % of respondents approached non-compliance.

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