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WORLD MARITIME UNIVERSITY
Malmö, Sweden

IMPACTS OF THE IMPLEMENTATION OF
THE 0.5% OF SULPHUR CONTENT LIMIT
IN THE FUEL OIL IN PERU

By

GUILLERMO ALBERTO BENITES VALVERDE
PERU

A dissertation submitted to the World Maritime University in partial
fulfilment of the requirements for the reward of the degree of

MASTER OF SCIENCE

in

MARITIME AFFAIRS
(MARITIME SAFETY & ENVIRONMENTAL ADMINISTRATION)

2020

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): Guillermo Benites

(Date): October 31, 2020

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ABSTRACT

Title of Dissertation: Impacts of the implementation of the 0.5% of sulphur content limit in the fuel oil in Peru.

Degree: Master of Science

The IMO 2020 sulphur regulation has entered into force from 1 January 2020. As Peru is a State Party of the MARPOL Annex VI, has the obligation to implement this regulation.

This study embraces the impacts and the legislative actions that are needed to be done identifying in this sense, which are the national actors of the Peruvian maritime community whose internal norms, formats and procedures will require a modification or a new regulation.

In this sense, the legislative analysis incorporates the themes related to the port State Control inspections, the regulation of penalties or sanctions for non-compliance, the use of scrubbers, the survey and certification of ships, the use of the non-availability report, the supplier control, duties and regulations among others.

Moreover, this study takes into account the particular scenario of availability of the regulated fuel oil in Latin America, emphasizing of course the characteristics of the Peruvian case.

Also, the study considers the perception threw interviews of the maritime community about the implementation process, as well as evaluate the technical aspects and the necessary equipment that the maritime authority will need to incorporate in order to ensure the enforcement of the rule 14 of the MARPOL Annex VI.

The conclusion of the dissertation provides recommendations emphasizing the real need for an implementation plan to be carried out taking into consideration the proposed analysis.

KEYWORDS: Air pollution, Sulphur, Implementation, Enforcement, Port State Control, Availability, Suppliers, Regulated fuel oil.
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LIST OF ABBREVIATIONS

APN  National Port Authority
BTU  British Thermal Unit
CE Delft Committed to the environment’ Delft
CO   Carbon Monoxide
COMI Multisector Technical Commission on International Maritime Organization Affairs
CO2  Carbon Dioxide
DICAPI General Directorate of Captaincy and Coast Guard
ECA  Emission Control Area
ECS  Engine Control System
FONAR Fuel Oil Non-Availability Report
GHG  Green House Gas
HFO  Heavy Fuel Oil
HSFO Heavy Sulphur Fuel Oil
IAPP Certificate International Air Pollution Prevention Certificate
IMO  International Maritime Organization
LNG  Liquefied Natural Gas
LSFO Low Sulphur Fuel Oil
LSHFO Low Sulphur Heavy Fuel Oil
MARPOL International Convention for the Prevention of Pollution
MARPOL Annex VI Annex VI to the 1973 International Convention for the Prevention of Pollution from Ships
MDO  Marine Diesel Oil
MEPC Marine Environment Protection Committee
MGO  Marine Gas Oil
MSC  Maritime Safety Committee
OSINERGMIN Supervisory Agency for Investment in Energy
NOx  Nitrogen Oxides
PM   Particulate Matter
PSC  Port State Control
PSCO Port State Control Officer
SECA Sulphur Emission Control Area
SOx  Sulphur Oxides
TEU  Twenty-foot Equivalent Unit
WHO  World Health Organization
WMU  World Maritime University
CHAPTER 1. INTRODUCTION

1.1. Background

Air pollution is the most critical health risk. The Maritime Health Organization details that 9 out of 10 people breathe air that contains high levels of pollutants. Furthermore, a 2012 study detailed that 6.5 million deaths related to air pollution. Even more so in 2016, pollution caused 6.7% of all deaths worldwide (WHO, 2020). In particular, the emission of harmful gases into the atmosphere, such as sulphur oxides or SOx, is dangerous. Inhabitants of Africa, Asia and the Middle East live with the highest degree of pollution from this cause. Only one in ten people breathe clean air (WHO, 2016). Maritime trade is one of the main pollutants of the oceans. The world market in 2017 comprised of 137,215.5 million dollars of bunker fuel. That figure expects to double in 2025, even more so because of the increase in maritime trade (Allied market, 2019). The primary type of hydrocarbon used as fuel in waste is heavy fuel, derived from the distillation residue of crude oil. Crude oil contains Sulphur, which, after combustion in the engine, releases into the atmosphere along with the rest of the ship's emissions. Sulphur oxides (SOx), known to be dangerous to human health, bring about respiratory symptoms and lung diseases (Fujitsu, 2019). In the atmosphere, SOx can produce acid rain, which can in turn cause damage to crops, forests, and aquatic species, and contribute to the acidification of the oceans. It is one of the biggest threats of people health and the environment. Given international shipping, emissions are estimated at 2.1% of the global greenhouse gas (GHG) emissions, 12% SOx emissions and 3% of global carbon emissions from fuel combustion (Third IMO GHG study 2014; Corbett, Wang, & Winebrane, 2009; Notteboom, 2011). These emissions, according to the World Health Organization (WHO), resulted in over 400,000 premature deaths from lung cancer and cardiovascular disease. Likewise, 14 million childhood asthma cases recorded annually linked to air pollution. In terms of both lives and cost, the damaging health effect needs to be controlled. For instance, Central
Europe alone spent over 437,550 million Euro on health externalities (Ballini, Ölçer, Brandt, & Neumann, 2017). IMO has put forth effort to formulate international standards to make maritime transport a more responsible and friendly industry promoting energy efficiency, safe transport and protection of the environment. Proof of that exists in the Annexes under MARPOL: Annex I in oil pollution, Annex II on pollution by harmful substances carried out in package term, Annex IV on pollution by sewage, Annex V on the garbage disposal and finally Annex VI on air pollution. IMO took MARPOL Annex VI, to reduce air emissions from ships, placing an initial 4.5% sulphur content limit on marine fuel oil globally in 2005 (Cullinane & Bergqvist, 2014). The development of Annex VI was due to the growing worldwide concern to control air pollution (GEF-UNDP-IMO GLOMEEP Project and MARSEST, 2018) and added to MARPOL in 1997 upon the adoption of a Protocol to amend the Convention. It entered into force in May 2005 and has 97 Contracting States representing 96.75% of the world tonnage (IMO, 2020). In this Annex VI of MARPOL, the regulation of various pollutants include sulphur oxides (SOx), nitrogen oxides (NOx) particular matter (PM), volatile organic compounds (VOCs) and greenhouse gas (GHG) emissions. Considering the international nature of shipping, the transboundary nature of air pollution, the adverse impacts of SOx on human health and its negative impact to the environment, the IMO has taken a twofold controlled approach to SOx. First, it has established Emission Control Areas (ECA) including, the Baltic Sea area; North Sea area; North American and the United States Caribbean Sea area, which entered into force in January 2013 (IMO, 2020a), where special mandatory measures to prevent, reduce and control air pollution apply. A strategy to strengthen ECA starts on an appropriate fuel change to the operating zone. Second, it has established gradual limits on the maximum sulphur content of fuel oils used in ECAs and areas outside ECAs. For example, in 2009 the United States and Canada presented a proposal to the IMO to establish an emissions control area (ECA), in order to protect public health and the environment from SOx emissions from ships (ABS, 2020).
These ship emissions standards significantly reduced air pollution and dramatically improved air quality and people's health by reaching 0.1% sulphur in ship fuel. Because of this, SOx emissions in these countries reduced by more than 85%, and in these times, ships already can store two types of fuels and use them according to the area of operation. (EPA, 2010). Consequently, the year 2020 has started with a reduction in the sulphur limit. This expected to have a positive impact. Previously, however, states parties were going through a significant implementation change, in specific in the Latin American region where most refineries cannot produce bunker 380, ship fuel oil, with this sulphur content. It is essential to remark that regulation 4.1 of MARPOL Annex VI allows the use of an equivalent arrangement or any other approved technology to control SOx like the scrubbers. Finally, it is essential to explain the period from its inception to the future projection for the protection of the environment with low sulphur levels.

![TIME LINE MARPOL ANNEX 6 -REGULATION 14](image)

Figure1: Self-elaboration “Time Line MARPOL Annex 6 regulation 14”. Source: IMO.
1.2. Problem Statement

Peru being a maritime country par excellence and being part of Annex VI of MARPOL, therefore, ratified it in 2014. Consequently, it must comply with regulation 14 that established the limit of 0.50% sulphur in fuel oil and entered into force in January of this year. Moreover, Peru prioritizes the prevention of pollution, especially since it has several reserved protection areas throughout the Peruvian coast as well as close to ports, as in the case of the Paracas reserve, which is less than one kilometre from the port of Pisco. Peru needs to highlight its commitment to pollution prevention even more so by preventing, controlling and reducing gas emissions from ships. To date, there are no national regulations establishing control, verification, certification and other parameters regarding the new sulphur content by companies, flag vessels and especially by the Maritime Authority, the supervisory body and responsible for national and international regulations. In the South American region, several countries do not have regulations on this matter and have little knowledge. This regional problem affects the entire maritime economy. Besides, Peru has three main ports having the port of Callao as a centre of international maritime trade in the region and receives almost more than 60% of ships in its port. Strategically positioned, Peru is a top-level exporting country. It is crucial to assess the current level of implementation of and compliance with this sulphur regulation in Peru, which will help determine the next step moving forward. The best solutions will take into account the real national regulation, national availability of regulated fuel oil, port facilities, knowledge of regulations in the national maritime community, status of providers of new technologies, actions taken by administrative authorities and actions taken by shipowners. It is a priority for the flag state to select the best solution among those available and established by the IMO. In order to comply with the established sulphur limit standards considering three types of alternatives selected in this work. The first is LNG, the second is the use of scrubbers and finally biodiesel. The objective of this investigation is to indicate the appropriate procedure to achieve the implementation of the amendment to rule 14 of ANNEX VI of MARPOL to Peruvian legislation.
Considering the existing national regulatory framework, the characteristics of the national fleet, as well as the administrative, organizational and technical aspects of the maritime administration itself and the current reality related to the supply of improved diesel fuel both in the country and in the region.

1.3. Research Question and Objectives
To achieve the established objectives of the study and reach the final destination with clarity and conciseness, this dissertation will pose the following questions:
- Which changes will be needed in national law?
- Which will be the highest challenges for the Peruvian maritime community?
- How can the maritime and port authority enforce this legislation successfully?

1.4. Research Methodology
The methodological approach will be qualitative. The study will be a focus on identifying the impacts and actions needed to implement the Sulphur regulation limit in fuel oil in Peru. For this reason, analysis of qualitative data obtained from publications, official and commercial reports, interviews, books, regulations for other states (Argentina, Brazil, Chile, USA, Japan, South Korea and others) will be considered as sources. Also, legal-specific research shall be done as an analysis of actual national and international law, national institutional structures that are involved in the implementation and enforcement, also legal gap analysis will be necessary. Finally, an analysis will be carried out determine the challenges and possibilities of this implementation, with the questions that will be asked of various people who work in the maritime sector.

1.5. Scope of the Study
The investigation is focused on an analysis of the regional and national panorama in respect the implementation of the 0.5% sulphur limit in fuel oil (standards established by the IMO in Annex VI of MARPOL in regulation 14 that I started in January 2020), to propose an optimal way for the Peruvian maritime authority to
implement it. The main subject of this dissertation is to find the best option to comply with this regulation.

The IMO guides will be considered to help determine how to modify the national legislation. This rule will need the implementation to all the vessels under the Peruvian flag and not only the ones that have more than 400AB. Of course, we will also consider the refinery industry, the national situation, and the implementation of the use of scrubbers, in order to comply with the international standard of the SOx emissions. Finally, an evaluation of the technical advantages and disadvantages will be analysed with respect to the use of LNG and biodiesel. It is important to highlight the role of the administration to monitor the situation and the limits of administrative capacities.

1.6. Research Structure

The study contains nine chapters, references and appendices as follows:
Chapter 1.- An evaluation of the chosen field of study details and an address of the importance of research, incorporating the stages of research.
Chapter 2.- A review of the relevant literature that provides the scope of this study and the implementation of the regulations by the states to ensure compliance.
Chapter 3.- An overview of the impact on the environment and people’s health.
Chapter 4.- Implementing IMO Instruments in Peruvian National Law.
Chapter 5.- The necessary measures and methods to enforcement that will need to be determined to ensure constant compliance with regulation 14 of annex 6 of MARPOL.
Chapter 6.- Evaluation of surveys of seafarers.
Chapter 7.- Conclusions and recommendations.
CHAPTER 2. LITERATURE REVIEW

The emissions of Sulphur from vessels has been an issue since vessels started to operate on fuel oils in the early 20th century. In the present day, the shipping industry is responsible for an estimated 5-10% of the total Sulphur emissions from non-natural sources. That is the new rule applied by the IMO and begins the new stage of reducing air pollution. For this reason, there will be a drastic reduction of Sulphur in all vessels. The Guardian (2020). According to rule 14 amended the new global Sulphur limit in ship emissions is 0.5% since the beginning of 2020, this had meant a significant reduction considering that the limit before was 3.5%. The Tokyo Memorandum of Understanding in which Peru is a member warns of the imminent ban on transporting fuel, according to the standards indicated by the IMO. (Lloyd’s List 2020). In addition, they will increase controls by the Port State Control Officer. In order to comply with this, shipowners will need to make a significant investment, as they should bear in mind that the expectation is to comply with MARPOL, regardless of any additional cost and inconvenience. However, State Parties will need to develop an adequate normative framework that can guarantee compliance. In this sense, ships can have a scrubber system installed, a fuel-switching method, which currently the most common, or also they can operate on a different fuel type (LNG or Methanol) that is starting to become more accessible. The installation of scrubber systems as a compliance method could be the best financial option for a large shipping company, but that may not be the case for a smaller shipping company considering the initial capital costs. Scrubber systems allow ships to continue operating on HFO (heavy fuel oil, 3.5% Sulphur), which is a relatively cheap bunker fuel (Chalmers, 2018). Since 2020, despite permitted still as cargo, HSFO is no longer permitted in fuel tanks unless scrubbers are installed. This enables port state control (PSC) to detain ships carrying non-compliant fuel without having to determine if it had been used or not. Before the amended rule 14 entered into force, during the IMO meetings at the MEPC and PPR, many States expressed an opinion regarding the difficulties of implementing
this new limit due to many factors, one of the biggest factors expressed was the economic impact that this may have. There is a significant cost difference between the different bunker fuels and not all regions in the world can offer regulated fuel oil. Small refineries may be in crisis due to the cost to produce the regulated fuel oil.

On the other hand, State Party national authorities are in charge of the monitoring, compliance and enforcement of the new limit according to MARPOL Annex VI; also, as flag States and port States have rights and responsibilities. Port states must monitor vessels transiting their territorial waters, in case of some irregularities; they should report non-compliance to the relevant flag state. In addition, it is essential for these States to ensure the availability of low sulphur fuel oil and reception facilities for scrubber waste. In this respect, IMO has adopted 2019 Guidelines for port State control under MARPOL Annex VI. This is Guidance on ship implementation planning. Additionally, guidance on the best practice for fuel oil suppliers has also been issued with the objective to assist fuel oil purchasers and users in assuring the quality of fuel oil delivered to and used on board ships. Moreover, in 2018, MEPC adopted a MARPOL amendment to prohibit the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship unless the ship has a scrubber (IMO, 2020b).

The ships Implementation Plan and corresponding records are going to help the crew demonstrate to Port State Control (PSC) officers that they have acted in good faith and done everything to comply. At this point, it is essential to mention that the 2019 Guidelines require that when despite its best efforts, a vessel does not have compliant fuel, the Master or shipowner must present a record and evidence of actions taken in order to show that no such fuel oil was available. This notification by the ship is commonly referred to as a Fuel Oil Non-Availability Report (FONAR); of course, State parties are obliged to take all reasonable steps to promote the availability of compliant fuel oil, to investigate reports of non-availability and to report non-availability to theIMO (Norton Rose, 2019).
As we may notice, the implementation of this MARPOL rule it is not a simple procedure, that is the reason why many State parties have not yet adopted legislation that can guarantee the compliance of this new sulphur limit. However, flag and port States parties urgently require an adequate normative framework to implement this international instrument. MARPOL Annex VI does not specify what penalties are to be imposed for non-compliance, but it is required that under national legislation State parties establish severe ones to discourage contravention (civil and possibly criminal penalties). It is also essential to mention that as the implementation of this rule will require technical knowledge, there is a need to have crew members adequately trained. This training is necessary so they can manage the equipment or systems without causing technical errors.

It is also essential to have training for Port State Control so that they can effectively perform inspections with testing protocols to ensure compliance. For all these reasons, to achieve adequate implementation of ANNEX VI, all the relevant parties will need to actively contribute (ports, flag states, bunker suppliers, shipowners, crewmembers, inspectors, shipbuilders).

In 2017, specialists on the subject indicated that Peru would not be prepared to meet the demand for marine diesel with 0.5% sulphur as of January 2020. On the other hand, the imminent changes in the fuel specification by the IMO will influence the price of oil, as the requirements that seek to eliminate the high sulphur content will cause the price of clean fuel to increase. Like Peru, which imports marine diesel, Ecuador receives between 45% of its diesel demand needs through imports. Besides, it is essential to mention that the new implementation is a challenge for the Peruvian refineries of Petroperú in Talara, Conchán, Iquitos and La Pampilla in Callao. This future situation could reduce the availability of marine fuel in Callao, Peru's primary fuel supply port (Hellenic shipping news, 2017).

On the other hand, Argentina has low logistics in supply and bunkering. Large shipping companies load in ports in Spain, Central America and Africa. This country is in a place far from the maritime routes. (Biodiesel Argentina, 2018). Due
to this, Argentine shipping companies are considering possible solutions to adapt to the regulations for fuel oil with 0.5% sulphur, LNG and Scrubber. The first could seem the most economical and straightforward measure to apply since it does not imply a modification of the ship's infrastructures, but the availability of fuel oil with sulphur content lower than 0.5% is not as high as that of other fuels in the American region and even more so in Argentina. Besides, that supply and demand could make it more expensive. Argentine shipping companies do not rule out other measures that involve a higher initial investment for the adaptation of ships but that in the long term may be more profitable (Tiba, 2019). For example, the Brazilian Maritime Authority issued Circular 7/2019 that applied since the 1 January of 2020, providing guidelines for the compliance of rule 14 of annexe VI of MARPOL to the local shipping and maritime communities to increase awareness and ensure compliance. Also in October of 2019, the Brazilian state-owned oil giant Petrobras announced it has lowered sulphur cap for the marine fuels it sells to 0.5% m / m and discontinued the refining of fuel oils with high sulphur contents (Proinde, 2019).

Finally, Brazil and Chile sent documents trying to carry the recommendations of all the South American countries regarding the new regulation. Some of the documents presented were MSC 98/22/8 of 4 April 2017 and MSC 98/22/10/Rev.1 of 4 May 2017.
CHAPTER 3. SULPHUR EFFECTS ON HEALTH AND THE ENVIRONMENT

Air emissions affect citizens who live near the ports. Indeed, ships, when burning fuel in engines, release many pollutants because they use low quality fuels. One of the ports with the highest degree of pollution in Peru is undoubtedly the port of Callao. A large number of people live and work legally or illegally near the port. Also, the total population of the Port of Callao is 457,629 inhabitants and has an area of 45.65 km², being the main port of the country which in 2019 received 3,483 ships, most of the container ships, bulk carriers, tankers with a total of 2,313,907 TEUs. Consequently, it makes them a high-risk group for sulphur gas contamination. (APN, 2020).

![Image of Callao port](image)

Figure 2: City near the port of Callao. Source: (Logistica 360, 2019)

“Emissions” are pollutants released into the environment in a gaseous state. There is a considerable death toll related to air pollution. A particular region of Asian and the western Pacific have related 3 million deaths to pollution. (WHO, 2014). In this respect, WHO considers SOx to be a major pollutant affecting human health. In addition, crude oil contains Sulphur after combustion in the engines and releases into the atmosphere. Based on one Sulphur and two oxygen atoms, SOx is a colourless, irritating, non-flammable gas with a pungent odour. Furthermore, there
are laboratory-proven tests by epidemiologists in the United States that have determined that there is a very high relationship caused by the effects of SOx on people's health, leading to respiratory problems of all kinds. In addition to having severe problems in the nervous system (EPA, 2009). When inhaled, the airways become irritated, and sometimes lung tissue develop damage. This compound can cause or aggravate diseases related to the respiratory and cardiovascular systems. For this reason, children, the elderly and, in general, people with ailments such as asthma and bronchitis are the most sensitive to this contamination (IMO, 2020b). Sulphur oxides (SOx) cause respiratory symptoms and lung diseases such as cancer. In the atmosphere, SOx transforms and generates acid rain. In turn, it can cause damage to crops, forests and marine species. It also contributes to the acidification of the oceans. Moreover, the wind can facilitate this corrosive element to record thousands of kilometres before launching into the sea. It also negatively affects the ozone layer (EPA, 2020). Therefore, the reduction of the sulphur content in fuel has been an important battle in industries and transportation sector.

![Acid Rain Pathway](image)

Figure 3: This image illustrates the pathway for acid rain in our environment (EPA, 2020).
Figure 4: Ship Emitting Sulphur. Source: (Marine insight, 2019).
CHAPTER 4. IMPLEMENTATION OF RULE 14 OF MARPOL ANNEX VI IN PERU.

4.1. MARPOL Annex VI and Sulphur Regulation

The MARPOL Convention is the most important international instrument for the prevention and addressing of marine pollution from vessels. Developed through the IMO, this instrument and each annex of it develops the provisions for marine pollution. Specifically, Annex VI regulates air pollution from ships, in this sense; it covers emissions from vessels produced at the various stages of the shipping activity. In this sense, the substance concerned is Sulphur oxides, nitrogen oxides, volatile organic compounds and greenhouse gases (mainly carbon dioxide). Annex VI also includes requirements applicable to the manufacturing, certification, operation of vessels and engines, fuel quality and limits on nitrogen oxides (NOx) emissions and required the use of fuel with lower sulphur content. Pollution substances as Sulphur oxides (SOx), nitrogen oxides (NOx) released to the environment by ships need regulation. Consequently, they can cause adverse effects on humans (bronchospasm, cardiovascular diseases). Also, the environment contributing to climate change and global warming (acid rain, wave actions, wind speed, ice coverage), as with even physical infrastructure which supports shipping activity may be affected of the accelerated coastal erosion, inundations, and difficulties to have access to docks.

Approved by the Parliament with the emission of the Supreme Decree N° 029-2013-RE, Peru considers MARPOL Annex VI an essential instrument because it contributes to the Peruvian State compromise related to the improvement of its environmental laws in order to be part of the climate change international prevention policies. In this specific case, we are talking about the control of the ship source pollutants. Moreover, considering the damages that sulphur oxides can cause explained before, we can say that a correct implementation of rule 14 of Annex VI of MARPOL will cause a fundamental impact in the Peruvian maritime community.
As this rule applies to all ships as the central Convention says, including those that make international voyages but also those fishing vessels, the ones that do cabotage and even the ones that give services at port, which are very important for the Peruvian economy and external and internal commerce (EPA, 2020a). In this sense, the implementation of rule 14 of MARPOL will allow those participants of the maritime community to clearly know the existence of proper compliance protocols based on inspections by the maritime authority and encourage their training, so they can be able to check by themselves the levels of their air pollution emissions. In this sense, we can see that a correct implementation will encourage the maritime community to be more conscious and develop their technical/technological skills and knowledge about this issue.

Another aspect that we can remark about adequately implementing the rule 14 in Peru is the critical impact that this will have in the refining industry and the final supplier that will be explained more in detail in this chapter. However, it is essential to mention in this point that those actors will also need to follow new regulations considering the possible consequences that they will need to deal with in case they offer or finally sale a non-regulated fuel oil to ships. For those who bring maritime services to Peru, this implementation will also add a new opportunity, which will be the construction or installation of scrubbers. This should comply with minimum standards that the maritime authority will provide as informal regulation and should include an inspection program to emit and administrate conformity of the product or the installation in a ship under the Peruvian flag. Finally, we have to mention the internal consequences that the central maritime authority will need to the front face to complete the whole implementing process of this rule 14. At this point, we can mention some activities that need to occur as special training for the Port State Control Officers focused on technical and legal aspects. Indeed, an internal carry out of the need to hire another specialist to perform the inspections on board needs evaluation. For example, there may be a need for the presence of an environmental engineer or chemical engineer to support the Port State Control Officer’s main activity for an efficient inspection.
4.2. Legal Regime

4.2.1. Implementing IMO Instruments in National Law

In article 55, the Peruvian Constitution established that treaties signed into force by the Peruvian State are part of national legislation. Per article 56, Congress must approve treaties prior to ratification by the President of the republic provided they are related to the following issues: human rights, domain or State integrity, sovereignty, national defence, financial State obligations, or matters that create modify or suppress taxes. Congress must also approve any agreements that require modifications or require additional legislative measures for implementation. Under this regime, the IMO Conventions need Congress approval before ratification. They will need the development of legislative measures appropriately applied by the maritime authority and community. However, before the request goes to Congress, there is a discussion on whether or not the IMO Convention will be convenient or not. This must be done in the Multisector Technical Commission on International Maritime Organization Affairs (COMI) that was created to monitor international conventions formulated within the IMO framework. In general, all maritime studies link to them in order to recommend the national position and actions taken from our Peruvian delegation (El Peruano, 2007). In this sense, commission representatives of the following sectors discuss the IMO Conventions: Transports Ministry, Foreign Affairs Ministry, Peruvian Navy, Environmental Ministry, Production Ministry, Energy Ministry, International Commerce and Health Ministry. These representatives are the ones that decide the agenda every year based on the government priorities with respect to the new maritime legislation that is necessary. After that, every IMO Convention discussed has its own working group that elaborates and informs recommendations. Once the Commission agrees that a new IMO Convention should be ratified, then the Ministry of Foreign Affairs sends the proposal to Parliament for approval and authorization to proceed with ratification procedures. In the following graph, we can observe the procedure:
Figure 5: Self-elaboration” Organizational Structure COMI”. Source: El Peruano, 2007.

Once the Peruvian State is formally part of an IMO Convention, the next step is to formulate legislation. Under national regulation, two authorities can develop norms based on IMO Conventions. These two authorities are the Port Authority and the Maritime Authority. In reference to these two authorities, the Maritime Authority is represented by the General Directions of Captaincies and Coastguards (DICAPI). The Maritime Authority is the entity in control of implementation, execution and audition of the majority of the IMO regulations. This faculty can be observed at the Legislative Decree N° 1147. DICAPI has the normative faculties in respect to national flag vessels, the training and competences of seafarers, the protection of the aquatic environment and its activities by national and international instruments. On the other hand, the port authority jurisdiction is limited to the regulation of technical, operative and administrative aspects in respect the ports under the Peruvian jurisdiction and its infrastructure. The jurisdiction is also limited to the entry, permanence and departure of ship and cargo and the security aspects of main port services. In this aspect, the relation with IMO instruments is based on the correct implementation of port reception facilities and the regulation in port security (APN, 2004).
4.2.2. National legislation and Normative Aspects

The Peruvian legislation formally approved the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1979 and 1980 by the following law decree N° 1973 and 22703. Furthermore, the 25th of June of 2013, the Peruvian Parliament emitted the Supreme Decree N° 029-2013-RE in order to approve Annex VI of the MARPOL Convention. As previously mentioned, DICAPI is in charge of the implementation of the majority of the IMO Conventions. In this case, since the focus is on the Convention related to environmental regulations, it will be essential to mention DICAPI’s specific role. For this reason, we will like to mention that the Legislative Decree 1147 established the following in article 272:

The maritime authority is entitled to take the following actions:
- Establish policies for prevention, response, mitigation recovery and remediation of the effects of pollution on the aquatic environment.
- Control and monitor compliance by persons engaged in aquatic activities in accordance with national regulations issued by the National Maritime Authority.
- Suppress any contravention of national regulations, international instruments to which Peru is a state party and other rules that may apply to the Peruvian State on the protection of the aquatic environment.

It is essential to remark that the Supreme Decree N° 015-2014-DE regulates the general faculties established in the Legislative Decree N° 1147. Mentioned in Title III, the Maritime Authority coordinates with the Ministry of the Environment and other State entities and relevant international organizations for the protection of the aquatic environment. It also establishes that DICAPI has the faculty to establish the legal standards that are necessary to prevent pollution in accordance with international legislation and can prohibit navigation or permanence in the aquatic environment in case any ship or naval device does not have the necessary pollution preventive equipment or has committed an illegal action against the marine environment. In this sense, DICAPI emitted the Directorial Resolution N° 0823-2018 MGP/DGCG in 2018, with the intention to render the MARPOL ANNEX VI
regulations into the national law. However, with the modification of Rule 14, this Directorial Resolution needs an update.

4.2.3. Peruvian Maritime Administration
The Peruvian Navy, which is part of the Ministry of Defence, has a line organ and an operational force that is the Maritime Authority represented by the General Directorate of Captaincies and Coast Guard (DICAPI) according to the following table:

![Organizational Structure Ministry of Defence](image)

Figure 6: Self-elaboration “Organizational Structure Ministry of Defence”.

The DICAPI has jurisdiction in the Maritime, River and Lake area, and is responsible for regulating and ensuring the safety of human life, the protection of the environment and its natural resources, as well as repressing any illegal act; exercising control and surveillance of all activities carried out in the aquatic environment, in compliance with the law and international conventions, thus contributing to national development.
The graphic shows the organizational structure of the Maritime Authority. The Legislative Decree Nº1147 in its II title establishes that the Maritime Authority is exercised through the General Direction of Captaincies and Coastguards which likewise will exercise its jurisdiction through its General Director, the Chief officer of the Captaincies District, the Chief Officer at a regional level and the Port Captaincies. Even though the Peruvian Maritime Authority is part of the Peruvian Navy, the mentioned Legislative Decree establishes that this Authority has Independence and competence over the marine areas, water-front facilities, rivers and navigable lakes. Such authority focuses on ship regulation, safety of human life at sea, marine environmental protection, and suppression of illegal activities to ensure the safety and protection of activity development. Evidently, in accordance with international and instruments, of which Peru is a State party. When we talk about the implementation of an IMO Convention related to an environmental aspect, the Department in charge of it will elaborate an internal normative instrument in order to outline requirements for the maritime community; in this case, the Direction in charge will be the DICAPI’s Environmental Direction that
will need to coordinate with the Normative Direction. Under our constitution, every ratified treaty is understood as law. We know that IMO Conventions always demand further legislation in order to provide clarification on how applicable authorities will enforce the new obligations and establish legal consequences or penalties for non-compliance. The legal, international and IMO affairs department will revise the normative instrument proposal, and finally, the proposal will be approved by the General Director. Once this happens, a General Directorate Resolution is emitted, published, and enforced. During the enforcement period, the environmental department will be obligated to audit the maritime community to ensure compliance. In regards to any enforcement details that need sharing with the IMO, the environmental Department will coordinate with the international and IMO affairs office.

4.2.4. Peruvian Statements in Respect the Regulated Fuel Oil

The Peruvian delegation and other Latin American delegations had serious concerns regarding the implementation of the new Sulphur limit because most of the refineries of the Latin-American zone were not able to produce the new, demanded fuel oil. That is the reason why a document presented at the IMO expressed the region’s major concerns. The basis of the opinion was mostly provided by the Regional Association of Companies in the Oil, Gas and Biofuels in Latin America and the Caribbean (ARPEL). They asked other States at the IMO to give special consideration to Latin America. After the on-going crisis that started in 2014, new refinery and conversion expansion projects have been postponed due to economic resource problems, making it very difficult for most countries in the region to supply fuel with a 0.5% Sulphur content by the date set. This is the reason why the change in Sulphur content in marine fuels to 0.5% will have a massive impact on refinery operations. Based on the Assessment of Fuel Oil Availability Report, IMO decided to change the Sulphur content in marine fuel oil (CE Delf). The assumption at the time was that all conversion projects announced up to or running until 2015 would reach their completion and entry into operation. Low
crude oil prices conditions in recent years led to the cancellation or postponement of many projects in the world, especially in South America (Ecuador, Colombia, Peru, Argentina). The operating costs are very high and maturation, approval, construction times range from 7 to 8 years. Considering the state of most refineries in the region, Peruvian statements at the MEPC and the PPR remarked that there was uncertainty in the price of Sulphur-containing residual of 3.5% and Sulphur fuel below 0.5%. Lower prices could encourage small ship owners to continue using high Sulphur residuals.

On the other hand, it has always been an option to use scrubbers for the reduction of Sulphur emissions. The installation of more scrubbers means a lower amount of fuel oil of 0.5% will be needed. Less pressure will be exerted on the refining industry. However, the costs of installation remain very high. Many States of the Latin American block concluded that the change of the Sulphur content in marine fuel would have a substantial impact on the entire global energy system. In regards to maritime transport, the EC CE Delf Report needs an update. It will be essential to update the refinery actions related to this aspect (modification of their refining schemes) as well as update information regarding scrubber installations. Additionally, the Peruvian delegation proposed the creation of a working group during the PPR4 to analyse the justification and assessment of the existence of a new result concerning the implementation of the Sulphur content limit of 0.50% m/m.

4.3. Legal Gaps

The Peruvian national regulations have not yet established how the amendment of rule 14 is going to be implemented. For that reason, it is essential to ascertain the content of those regulations in order to align with eventual enforcement. In this mind-set, the central topics must first be considered. Moreover, relevant individuals will need a guide in order to comply with rule 14. To do so, it will be essential to consider the IMO Guidelines in relation to the implementation of the 0.5% Sulphur
limit, the Port State Control under MARPOL Annex VI, on board sampling and best practice for fuel oil purchasers/users.

**The use of scrubbers**

It is important to clarify that one Maritime Authority focus should be to regulate by a Directorate Resolution. This will obligate the shipowners to comply with the implementation of the 0.5% Sulphur limit or adopt an exhaust gas cleaning system under the related IMO provisions. MARPOL Annex VI specifies that the ship has to acquire a fuel oil with those characteristics, but can also use an alternative method. National legislation for the implementation of rule 14 should specify the acceptance of the use of scrubbers as an alternative method for compliance. However, according to paragraph 4 of Annex VI, "The Administration of a Party that allows the use of an equivalent (...) shall endeavour not to impair or damage its environment, human health, property, or resources, or those of other States". DCAPI should establish the minimum standards that a scrubber should have in order to be installed in a ship under its flag and when and how the approval inspection should be performed. DCAPI will need to establish the national company requirements required to install or manufacture the scrubber. These companies may also register as companies able to bring maritime services into Peru. According to the Guidelines for Exhaust Gas Cleaning Systems (EGCS), if there is compliance, then the flag Administration will recognize the system as an equivalent one. The confirmation of equivalence is going to be done for each vessel onto which the equipment is to be installed (case-by-case basis).

Additionally, the guidance for on-going compliance in the case of failure and recommended actions detailed on MEPC.1/CIRC.883 determines that any malfunction of these systems that last more than one hour or constant malfunctions should be reported to the flag and port states. The report should also explain the steps that the ship is taking in order to comply so that they can guide the ship with new actions to take. This is why the national regulation also should consider developing a specific notification procedure in case a ship under its flag experiences a failure on its EGCS. Furthermore, an accepted on board Monitoring Manual

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(OMM) is also retained on board the vessel for each installed EGCS; this should incorporate the following specification:

- Data on the sensors used in the EGCS emissions and wash water monitoring system, including service, maintenance and calibration.
- Positions where to take the exhaust and wash water measurements, together with any necessary supporting services or systems.
- Data on the analysers to use in the emissions and wash water systems, including operation, service and maintenance requirements.
- Procedures for analyser zero and span checks.
- Other information and data needed to operate and maintain the monitoring systems properly.
- Details on how the monitoring systems are to be surveyed (Value Maritime, 2020).

The plan of DICAPI to regulate and approve the use of EGCS as an alternative mechanism is that despite the high cost of installation, scrubbers seem to be a perfect solution for many owners since the availability of regulated fuel oil is not guaranteed.

**Survey and certification**

Inspections are fundamental to ensure compliance regarding the use of the regulated fuel oil or the level of the SOx. DICAPI should also regulate the procedures for using a scrubber. In this sense, it should be clear that the inspector should always look at the Bunker Delivery Note (BDN). The initial inspection will focus on documents, remote sensing, and portable devices. During this inspection, if clear grounds of suspected non-compliance exists, then the inspector should require samples of fuel oil (representative fuel oil sample should be collected during the bunkering process).

When the administration decides to analyse an oil sample, it should be done in accordance with ISO 8754:2003, by a laboratory that is accredited under ISO/EC 17025 and the test results should be under ISO 8754 reporting protocol (Imodocs, 2019). Accredited laboratories should also be listed on the DICAPI website.
Supplier control

DICAPI should regulate how the inspections on the supplier are going to be performed to ensure samples and test fuel oil are properly taken from the bunker barges or shore bunker terminals. In cases of non-compliance, there is a duty to inform the IMO to relay to the other State Parties. Accidental contamination of a product may happen in any part of the supply chain. Imprudent handling of fuel oil on board may cause non-compliance and that is why a vessel should have suitable procedures and instruments for proper use and safe handling of fuel oil (Safety Management System). Additionally, fuel oil purchasers “should engage with suppliers to establish any special requirements for such products and perform a detailed technical analysis, including issues of compatibility and whether it will be necessary to make modifications and adjustments to machinery and fuel oil handling systems before ordering the product” (Imodecs, 2018). In order to promote the compliance of purchasers, it will be useful for the DICAPI and the National Port Authority to publicly share a list of national suppliers on their websites that comply with the MARPOL requirements as its establish in regulation 18.9.1 of ANNEX VI. They should specify if they have a quality management system. The expectation is for purchasers to perform their due diligence and not rely wholly upon such a list.

National law must specify that part of the supplier’s everyday activity is to sample. The final sample will be sealed, labelled, and countersigned by the parties and should be retained at a minimum for 30 days. If a dispute arises then it should be retained until the dispute is resolved. Under these circumstances, DICAPI performs inspections to platforms that supply fuel oil to ships to verify their safety and security aspects. In the development of certain inspections, the issued certificate should be detailed to clearly state authorization to sell the regulated fuel oil. DICAPI can also get their own sample during delivery from the rail of the receiving ships, from on board bunker barge, or shore terminal supplying the bunker. Even when using terminals or platforms, supplier control has to be supervised by the OSINERGMIN, which is the national institution that has the faculty to inspect the
compliance of legal and technical regulations. Supplier control relates to the hydrocarbon sector regarding the conservation and protection of the environment in the development of the activity. In this sense, we have also to specify that OSINERGMIN should establish their own norms. According to MARPOL, those fuel oil suppliers should not only provide the bunker delivery note, but also should provide the information specified in appendix V of MARPOL Annex VI. It will also be required to deliver a sample of the fuel oil with the corresponding signature of the supplier’s representative and the master or officer in charge of the ship.

Duty to inform

Once sampling indicates non-compliance, then the Port State should inform to the ship administration and the entity under whose jurisdiction issued a bunker delivery note. This information must also be shared in the GISIS platform. A Party should inform IMO by GISIS when a ship has presented evidence of non-availability of the regulated fuel oil in a port. It is relevant to remark that regulation 18.1 of MARPOL Annex VI provides that it is the obligation of each Party to promote the availability of compliant fuel oil and inform the IMO of the availability in its ports and terminals. There is also a need to inform the Party or non-Party under whose jurisdiction a Bunker delivery note was non-compliant and to inform the IMO of the supplier that issued that BDN. This specific aspect the Guidance for the best practice for Member State/coastal State (MEPC.1/Circ.884) describes that the information be sent to the administration or the IMO and that it should include the following: a) name of supplier as stated on bunker delivery note; b) description of the nature of the violation; c) laboratory analysis of the MARPOL delivery sample; c) the penalty applied and its description.

The non-availability aspect

Regulation 18.2 of MARPOL Annex VI determines that in case a ship is not able to get the required fuel, it should notify its flag state and the port authority at the next port. The fuel oil non-availability report is a declaration that a breach has or is about to occur. The shipowner has to be in a position where they can provide the evidence to demonstrate an attempt to purchase compliant fuel oil throughout its
voyage plan. FONAR cannot be considered as an exemption from using compliant fuel, for this reason, the party that receives the FONAR should make detailed guidance to follow. The Port State may contact the shipowner or operator in order to ask for more information. The flag state and the port state need to be very meticulous with the description of actions taken to attempt to accomplish compliance. For a shipping company and master, it is important to communicate upon discovery that compliant fuel will not be available (DNV.GL, 2019).

**Penalties**

With proof of non-compliance, the administration will be able to prevent the ship from sailing until it takes the corresponded measures required. Such measures may involve de-bunkering or obtaining a permit for a single voyage to the nearest bunkering facility (with the approval of the destination port). When we talk about the supplier and their obligation to provide the regulated fuel oil, we have to consider establishing penalties in cases of non-compliance. Another aspect that will be important to consider is to regulate individual sanctions for any patterns of repeated non-compliance by a fleet in twelve months, considering even the use of FONARS. For example, the U.S. Coast Guard in its new procedure for shipping industry to notify the us government of non-availability of compliant fuel oil, determines that the U.S. Coast Guard will investigate all details of non-compliance with MARPOL Annex VI to determine what actions may be guaranteed. Such activity may range from concluding the investigation with no follow-on plan, detaining the vessel, and pursuing civil penalties” (US Coast Guard, 2019). In general, with the national implemented regulation, owners should be aware that non-compliance might require action at the owners’ expense to bring the vessel within compliance (Skuld, 2019). Even though no specifications or compulsory routine testing exists, when proven that the fuel delivered does not comply with the quality, the administration should take actions against the supplier. In this particular aspect, the supplier may be sanctioned by the OSINERGMIN. National regulation does not have authority over the quality of the product. However, the port could cancel other services that the supplier’s main activity depends upon.
4.4. Availability and suppliers in Peru

To make LNG available in Peru, energy companies must invest. In the South American region, especially in the Pacific area, there are only a few ports that receive gas for importation. One is located in Chile, and another one is located in Colombia (refine plant and terminal in Cartagena), and Ecuador (refine plant and terminal in Guayaquil). Currently, Peru has the first liquefied natural gas (LNG) terminal in South America located south of the port of Callao, approximately 300 km in the city of Pisco. The following graphic depicts the port terminal:

![Peru LNG Terminal](image)

Figure 8: Peru LNG Terminal. Source: (Peru LNG, 2020).

Peru LNG began operations on June 10, 2010. During 2019, the LNG produced by PERU LNG and marketed by SITME was mainly distributed to South Korea (34%), Japan (20%), China (18%), Spain (9%) and other European and Asian countries (19%). Peru LNG port terminal can receive ships with a cargo capacity between 90,000 and 173,000 cubic meters as it has an impressive port infrastructure. The maritime terminal is made up of a 1.3 km extension dock; also, it has a 300-meter-wide dredged navigation channel, with an 800-meter-long breakwater that allows the safe shipment of LNG in LNG tankers. In 2019, fifty-eight tankers visited the PERU LNG maritime terminal. However, there is a fundamental problem with the fleet of Peruvian vessels. It is minimal in Peru, taking into account that PERU LNG
is the only terminal available to load LNG in the entire maritime domain of Peru. It is not a pleasant or commercially attractive market to load LNG in the different ports of the country, mainly due to the lack of infrastructure in the ports. For this reason, the most significant commercial movement is for export. (Peru LNG, 2020). Considerable variation exists in the price of LNG, especially in the shipments that left Peru LNG during the first quarter of 2020, which averaged US $ 3,555 per million BTU compared to the US $ 6,090 in 2019 (Bnamericas, 2020).

In order to determine what type of scrubber may be the best option, it will have to be the shipowner or a certified consulting company that evaluates what type of scrubber is the best for your ship. For this, the routes and alkalinity of the water must be taken into account. Moreover, the equipment on board, such as the main engine, auxiliary groups, and boilers shall be considered. In Peru, there are many shipyards on the coast and in the Amazon. However, those who can perform Scrubber installation work on vessels are the following:

The first is SIMA Peru S.A., a National Peruvian company with more than 60 years of leadership in the Naval Industry. It offers customers a wide variety of possibilities for the construction, maintenance and all types of operations of vessels from high and low-board commercial vessels. Its operations centres are located in the Ports of Callao, Chimbote and Iquitos; the first two located on the Peruvian coast and the last one in the Amazon river. They have modern infrastructure and highly qualified personnel in the design, development and construction of ships up to 50,000 DWT, with the capacity to be evaluated by international classification companies, maintenance and repair in dikes up to 25,000 DWT, as well as modernization and structural modification. (SIMA, 2020). The second is Constructions A. Maggiolo S.A., located in the port of Callao. It has a team of administrative, industrial professionals, and naval engineers. Additionally, it performs construction, repair and modification services to boats (Maggiolo, 2020). Finally, the company Andesa S.A. Located in the northern region of Peru. It has an experience of more than 40 years in the naval sector, with current capacity for
vessels of 500 TPM, they carry out Naval Repairs in General (Varadero Andesa., 2020).

Another critical point is the use of heavy fuel oil is common by the Peruvian flagships as it is a fraction obtained from the distillation of petroleum, either as a distillate or as a residue, so the cost is more feasible than other distillate fuels in the South American region. In the maritime field, the classification of fuels used in the maritime industry is extensive; however, this work will only consider the following types of maritime fuel that can be supplied in the South American region and even more so in Peru. In that sense, we can say that the best known MGO (Marine diesel). This fuel meets the technical specifications and the necessary sulphur limit, and used in merchant ships such as in fishing vessels. In the second place, we have the IFO 380 and IFO 180, in Peru. The cost of implementing two types of fuel in one ship is not very expensive. The third is LSMGO (Low Sulphur Marine Diesel) this fuel has a percentage of less than 0.1% sulphur. Finally, the VLSFO 0.5% complies with the ISO 8217: 2017 standards according to the characteristics with the most Sulphur content of 0.5% that would be more feasible to acquire in countries outside the South American region. The costs of these fuels vary according to supply and demand, and even more with several other external factors. However, currently, it is up to the shipowner to choose a type of fuel. Everything will depend on the type of vessel or the possibility of purchase. In the following tables, you can see the fuel prices in Peru.

<table>
<thead>
<tr>
<th>OIL PLANT</th>
<th>DIESEL MARINO ULS</th>
<th>IFO-380 LS</th>
<th>IFO-180 LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALLAO</td>
<td>660.85</td>
<td>537.26</td>
<td></td>
</tr>
<tr>
<td>TALARA</td>
<td>660.84</td>
<td>528.12</td>
<td>528.12</td>
</tr>
<tr>
<td>IQUITOS</td>
<td>699.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DATE-06/06/20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Self-elaboration “Oil Prices Peru”. Source: (Petroperu, 2020)
### CALLAO - PERU BUNKER FUEL PRICES

<table>
<thead>
<tr>
<th>CALLAO</th>
<th>PRICE</th>
<th>UNIT</th>
<th>UPDATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFO 180</td>
<td>403.00</td>
<td>$US/MT</td>
<td>31/12/2019</td>
</tr>
<tr>
<td>IFO 380</td>
<td>340.00</td>
<td>$US/MT</td>
<td>10/04/2020</td>
</tr>
<tr>
<td>LSMGO 0.1%</td>
<td>527.00</td>
<td>$US/MT</td>
<td>29/07/2020</td>
</tr>
<tr>
<td>MGO</td>
<td>688.00</td>
<td>$US/MT</td>
<td>27/01/2020</td>
</tr>
<tr>
<td>VLSFO 0.5%</td>
<td>377.00</td>
<td>$US/MT</td>
<td>30/07/2020</td>
</tr>
</tbody>
</table>

Table 2: Self-elaboration “Oil Prices Callao”. Source: (Oil Monster, 2020).
CHAPTER 5. ENFORCEMENT OF RULE 14 OF MARPOL ANNEX VI IN PERU

5.1. Port State Control Implementation
To develop appropriate protocols of Port State Control will be a fundamental aspect in order to ensure the enforcement and the compliance of rule 14 of MARPOL. In this order of ideas, those Officers need a national guide with a procedure to follow for compliance. The first activity that a Port State Control Officer (PSCO) should do on board is to examine the International Air Pollution Prevention Certificate and its supplement, in a way that it should declare if a ship is the regulated fuel oil or is using an equivalent arrangement. In case the bunker delivery notes or the representative sample is not in compliance If a ship is using an equivalent system, then as it is mention in the Resolution MEPC.321(74), the PSCO will look at:
- Evidence that the ship has received an appropriate approval for any installed equivalent means (approved, under trial or commissioned);
- Evidence that the ship is using an equivalent means, as identified on the supplement of the IAPP certificate, for fuel oil combustion units on board or that compliant fuel oil is used in equipment not so covered; and.
- BDNs on board which indicate that the fuel oil is intended to be used in combination with an equivalent means of SOx compliance or the ship is subject to a relevant exemption to conduct trials for SOx emission reduction and control technology research. (Resolution MEPC321(74),2019).
After these steps are concluded, and just in case the PSCO has observations and grounds for believing that the ship is not in full compliance and there is no congruence with the certificates, then a more detailed inspection should be performed. Saying this, it will be essential to clarify that "clear grounds" under the IMO Resolution MEPC.321(74) can incorporate:
- Evidence that certificates required by the Annex are missing or invalid;
- Evidence that documents required by the Annex are missing or invalid;
- The absence or malfunctioning of equipment or arrangements specified in the certificates or documents;
- The presence of equipment or arrangements not specified in the certificates or documents;
- Evidence from the PSCO's general impressions or observations that serious deficiencies exist in the equipment or arrangements specified in the certificates or documents;
- Information or evidence that the master or crew are not familiar with essential shipboard operations relating to the prevention of air pollution, or that such operations have not been carried out;
- Evidence of inconsistency between the information in the bunker delivery note and paragraph 2.3 of the supplement to the IAPP certificate;
- Evidence that an equivalent means has not been used as required; or.
- Evidence, for example by fuel calculators, that the quantity of bunkered compliant fuel oil is inconsistent with the ship's voyage plan; and
- Receipt of a report or complaint containing information that the ship appears to be non-compliant including but not limited to information from remote sensing surveillance of SOX emissions or portable fuel oil with sulphur analysis devices indicating that a ship appears to use non-compliant fuel while in operation/underway (Resolution MEPC.321(74),2019).

The detailed inspection includes the sample analysis in order to verify the Sulphur content in the fuel oil delivered and based on the laboratory results, the Maritime Authority decide the consequences. However, for that to be legal, a Directorial Resolution must be emitted by this institution. In particular, including the facts that will determine if a ship should be detained. In this aspect, the Resolution MEPC.321(74) establishes some guidelines to determine a deficiency as severe. This includes situations like the absence of the IAPP Certificate or Technical files if applicable if the ship is not using the regulated fuel oil and does not install equivalent equipment or the use of an equivalent system but with no formal approval. Also, is essential to remark that if the master claims the impossibility to
bunker with compliant fuel oil, then the PSCO should make sure that they have followed the FONAR procedure regulated in rule 18 of MARPOL that also should be detailed in national law (DICAPI's Directorial Resolution).

Until this point, it will be essential to mention that DICAPI has PSCO, but they have not yet received special training about how they should proceed in order to guarantee the compliance of this rule. Another issue that will need resolution is the new equipment needed in order to perform these duties such as manual devices and sampling equipment. For the detailed inspections, it will be useful to consider technical, chemical or mechanical professions to participate in PSC inspections. In addition to that DICAPI will need to open a registry for the laboratories that will be able to examine the fuel oil samples when it is necessary as they should be accredited to ISO/IEC 17025:2017 or an equivalent standard performance of the given Sulphur content test ISO: 8754:2003.

5.2. List of Peruvian flag ships
Currently, the port of Callao moves more than 80% of the cargo throughout the country. It is the most important port. It is vital to provide adequate cabotage to achieve effective management of maritime transport. In general, in South America, we do not have an optimal cabotage system. It is even less in Peru. Cabotage transport regulations seek that as the national fleet expands, Peruvian companies can acquire international ships to provide this service. For this reason, it is very important to have a large merchant fleet to improve Peru's global image.

Another critical point to have a fleet of ships be able to carry out international navigation to carry out trade beyond our maritime borders. That is why Peru has a small fleet of Peruvian flagships for all types of commerce that must comply with the mandatory regulation of 0.5% sulphur following the new standard established by the IMO. It is essential to mention that the Peruvian fleet has old and new ships. They will have to apply the best system to comply with the new regulation. The following table shows the list of vessels with the Peruvian flag that trades mainly in the Peruvian maritime domain.
<table>
<thead>
<tr>
<th>TYPE OF VESSEL</th>
<th>NUMBER OF VESSELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 GENERAL CARGO</td>
<td>1</td>
</tr>
<tr>
<td>2 OIL TANKER</td>
<td>21</td>
</tr>
<tr>
<td>3 GAS CARRIER</td>
<td>5</td>
</tr>
<tr>
<td>4 CONTAINER</td>
<td>1</td>
</tr>
<tr>
<td>5 CHEMICAL TANKER</td>
<td>1</td>
</tr>
<tr>
<td>6 BULK CARRIER</td>
<td>1</td>
</tr>
<tr>
<td>7 TOWING</td>
<td>50</td>
</tr>
<tr>
<td>TOTAL</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 3: Self-elaboration” Peruvian Vessels”. Source: DICAPI.
CHAPTER 6. INTERVIEWS ANALYSIS

In this chapter, we will analyse the responses and opinions made as part of this work from members of the maritime community based on several questions regarding this topic. Members included individuals from the Maritime Authority, Port Authority, Ship owners, Shipyard Owners, Maritime Advisors, and Ship Captains. It can be analysed that the majority of people in the maritime field recommend the use of low sulphur fuel, such as the installation of a scrubber because the Peruvian flag vessels are few and old. It is the most appropriate and simple way to comply with the standard. It obviously depends on the type of ship. Besides this, they recommend that the best control tool would be adequate gas measurement equipment and on-board fuel quality control. In addition, they oblige the Maritime Authority to appropriately qualify and train the PSCOs to verify the sulphur limits on ships correctly. It is always taking into account a time limit to be able to implement the on-board system, being able to implement this standard since it could affect the ship owners economically. In the following graph, we can see the opinion of the maritime community about the methods available in order to comply with rule 14 of MARPOL Annex VI.

![Pie Chart](image.png)

**Figure 9:** Percentage of type of method. Source: Maritime Community
CHAPTER 7. CONCLUSION AND RECOMMENDATION

In conclusion, DICAPI needs to elaborate upon new specific regulation in order to implement and enforce rule 14 of MARPOL. In this sense, this new regulation has to cover the following essential aspects:

- Port State Control inspections procedures to communicate expectations to the ship owners and maritime terminals. It will also be essential to establish internal guidance for the PSCO.
- Procedures for the approval of scrubbers and authorization to be a competent company for scrubber manufacturing or installation.
- Regulations related to the FONAR to give guidance to ships that will have to notify the non-availability of regulated fuel oil.
- Penalties against the shipowner and the suppliers that do not comply.
- Regulation from the Port Authority to guarantee bunkering port services.

The Maritime Authority will need to start as soon as possible to coordinate a specific training program for its PSCOs so they can have the specific knowledge that we have seen is required. It will also be helpful to analyse the idea of hiring exceptional professionals such as environmental engineers or chemical/mechanical engineers with prior experience in the sector in order to give the PSCO support, especially at the beginning of the implementation plan. DICAPI will also need to purchase the correspondent monitoring equipment that may guarantee an adequate level of PSC performance, as we have seen this aspect repeated by the interviewed individuals as well as the feeling of urgency to implement this rule 14. In this dissertation, we have analysed the different possible methods or systems needed to comply with the parameters of rule 14 of MARPOL. One of the methods is the purchase of the regulated Sulphur, the other one is the installations of a scrubber, and the other one could be the use of LNG; this last one is a limited option because in the Peruvian territory there is only one port that could be able to sell to the vessels this product and it is not a major one. If we talk about the purchase of fuel oil with
0.5% of Sulphur, then we can say that the Peruvian refineries are not prepared for massive production of it so they will import the product in order to sell it which will mean that the price of it can be high for the shipowner in the country. Finally, the use of scrubbers could be a good option if the maritime authority approves national designs for ships that will not make international voyages, as it will be much cheaper than the ones manufactured abroad. For this reason, we have seen that the aspects that generate the most significant uncertainty and concern for the Peruvian maritime sector are the growth of costs, price volatility, the decrease in capacity and the increase in transit times. Likewise, we must pay attention to the additional costs that could influence the price that the end-user must pay since the carriers will want to pass on the extra cost to the shippers according to the destination and type of ship. In this sense, taking the interviews and members of the Peruvian maritime community into account, the ship owners face a challenge of important decisions in terms of investment, ship planning, and supplier market, among others. Due to this, they hope that the Maritime Authority can carry out prompt management in order to have a clear regulatory framework to comply with rule 14 of MARPOL. Having said so, we can emphasize the real need for an implementation plan to be carried out as soon as possible that not only the Maritime Authority can continue to exercise its obligations successfully but that the Peruvian maritime community can be guided to change to continue contributing to the environment.
REFERENCES


