A proactive international regulation system based on technological innovations against emerging environmental threats

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Abstract
The adoption and enforcement of most conventions and regulations have been triggered by a series of disasters that had devastating effects on the marine environment. To improve the safety levels at sea and at the same time to protect the marine environment, it is imperative that the major shipping nations must ratify and make domestic law the international rules. Consequently, MARPOL, other conventions and codes refer to significant actions for minimising most pollution threats to the marine environment. So, member-states through their national ship-owners must comply with every new or amended regulation. This paper will focus on types of pollution that are not covered by any international legislation or are at a preliminary stage for future implementation. These types are: (i) Volatile Organic Compounds (VOC), (ii) Carbon Dioxide (CO_2), (iii) SOx Scrubbers Wash Water.
Keywords: VOC, CO_2, SOx, MARPOL.

1. Introduction

In the last decades, the protection of the seas from pollution has become a complex issue which required significant attention. A point of concern has been time-consuming to adopt and ratify international regulations for the prevention of marine pollution from ship operations and accidents until the beginning of the 1990s (Knudsen and Hassler, 2011). MARPOL 73/78 has proved to be the first convention that deals with most types of marine pollution from ships. Typical examples in the past were the losses of the tankers Amoco Cadiz (1978), Haven (1991), Erika (1999), Prestige (2002) resulting in severe pollution and provoking the amendments of MAPROL and SOLAS conventions (Alexopoulos, 2001).
The relevant questions that arise refer to: (a1) whether the current regulations are actually covering all the types of pollution, (a2) if some types of pollution have already been discussed, but no further actions have been made, (b) if, by establishing new technology on board vessels new types of pollution have emerged.

2. The Need for Implementing New Forms Of Pollution Prevention?

It is well-known that the main aim of adopting and ratifying conventions and codes is the protection of the marine environment based on strict rules and regulations, without ignoring the availability of sophisticated and affordable technology. So far, regulations have been created on account of incidents/accidents, technological innovations, human safety, industry needs and resulted in gradual changes in the construction of modern vessels and the implementation of new technological standards. In the last two decades, regulations became stricter by IMO, and most of the environmental issues have been dealt with accordingly (Alexopoulos, 2008).

2.1 Volatile Organic Compounds (VOC)

So far, since vessels carry high sulfur oil? cargoes, after the discharging operations the cargo tanks are filled with inert gas consisting mainly of CO_2, nitrogen and an amount of toxic H_2S (hydrogen sulfide). In most of the ports, prior to ship's berthing for loading the vessel is required to purge its tanks with inert gas to displace the H_2S below a certain level. It is not clear if H_2S is a content of inert gas or it is released by high sulphur oil cargo in the tanks This process releases significant amounts of toxic gases into the atmosphere and additionally combustion derivatives with the most important the CO_2 which contributes to the Greenhouse effect. In some ports (Rotterdam, Ceyhan, and most US ports) local regulations have made mandatory the use of vapour line for the vessels to displace to shore all the gases contained in the cargo tanks while loading cargo. Then the shore facilities can process these gases to remove the H_2S and discharge the CO_2 into the atmosphere. In other words, the issue here is that the technology exists, but it has not been made mandatory globally (Endresen et al. , 2008).
Based on MARPOL, Annex VI chapter 3 regulation 15 includes the requirements regarding the prevention of air pollution from ships and precisely the volatile organic compounds. In this regulation, it is mentioned that every port where it is mandatory to use the vapour

line under the jurisdiction of a party to the Protocol of 1997, shall be regulated according to with the provisions of this regulation.

2.2 Carbon Dioxide (CO_2)

Regarding CO_2 the last few years, an effort has been made to reduce its emissions globally through international agreements, but there has not been any specific legislation. In the marine sector, this was done both for environmental and economic reasons (operational cost), i.e. through the technological advancement in the internal combustion engines and the design of the vessel's hull and propeller. However, these technologies seem to be obsolete and alternative means have to be implemented for a further reduction of CO_2 release into the atmosphere. Some fuel must be consumed for the CO_2 release but it is highly unlikely that trade would be interrupted, so new technologies have to be cost-effective and designed in such manner to be appropriately established on board the vessel to be invented and implemented. (González, 2008).

Bearing in mind that from 1st January 2019 the vessels are obliged to have an approved Ship Energy Efficiency Management Plan (SEEMP) and this to be evaluated from 1st January 2020, it is highly possible that reliable benchmarking will be created in the shipping industry for the CO_2 emissions and technologies with measurable results can be implemented for the further CO_2 reduction. One of the technologies closer to be widely used is Carbon Capture and Storage (CCS). This is a method where the CO_2 is extracted from the exhaust gasses produced from the combustion of fossil fuels, compressed and liquefied, and finally stored in pressurised containers. Afterwards, this CO_2 is stored underground in depleted oil and gas fields (Kelektsoglou, 2018).

2.3 SOx Scrubbers Wash Water

The desulphurization process of marine fuels is also a matter of cost. There are alternative sulfur reduction methods with the prevailing method to be the SOx scrubbers. These are straightforward machines which wash the exhaust gases using sea water and also by using its alkalinity, neutralise the acidity of the sulfur oxides. In the case of scrubbers, another environmental pollution issue arises, which so far has not been dealt with, at least globally, and any legislation has not covered it. This is the wash water from the scrubbers, which contains substances and soot deposits that are harmful to marine life and are discharged overboard during the process. So far in MARPOL, there has not been any provision regarding this issue, other than a general reference. Since the technology of scrubbers is evolving at high speed because of the high demand from shipowners (it is worth noting that the significant scrubber manufacturers have reached their full production capacity until 2021), it is highly possible that in the next years to come there will be strict regulations regarding the wash water discharge from SOx scrubbers. The likely scenario is the complete discharge prohibition with the implementation of the so-called "closed loop" scrubber systems. Consequently, this is an issue which has not been covered yet by any international legislation, and it needs attention because it may cause significant environmental problems (Henriksson, 2007).

3. Conclusion

It is unquestionable that nowadays the international regulated system is much more efficient, comparing to the past. Regarding the VOC, MARPOL in Annex VI chapter 3 regulation 15, comprises the ports with the mandatory use of vapour line. It only remains for the use of a vapour line to become binding to all ports internationally. Regarding CO_2 emissions, there is no mandatory international rule, but the CCS method can minimise the majority of emissions. Regarding SOx scrubbers wash waters, there is no legislation, besides general reference. Nevertheless, there is a "closed loop" scrubber system as an option to negate possible environmental damage.

It can be observed that every possible threat to the marine environment is not adequately regulated and one of the most important reasons is the rapid technological growth (Balland et al., 2013). The presence of technology provides tools almost equally protecting the environment and as easily as it can be damaged. A strategic and well-organised protection plan based on a proactive regulatory system may prove to be the proper way for the shipping industry to remain the most "environmentally efficient" area in international trade for many years to come

References

Alexopoulos, A.B. (2001). Environmental impact of the maritime transportation of crude oil. An analysis of tanker routine operations and serious casualties with particular reference to the Mediterranean Basin, *Revue Hellenique de Droit International*, **54**: 341-354.

Alexopoulos, A.B. (2008). Management and assessment of oil spills through systematic methods, *Journal of Middle East Forum*, **8**: 111-123

Balland O, Erikstad S., Fagerhult K, Wallace S. (2013), Planning vessel air emission regulations compliance under uncertainty, *Journal of Marine Science and Technology*, **18** (3), 49–357

Endresen O, Eide M, Dalsoren S, Isaksen I (2008), The environmental impacts of increased international maritime shipping. Past trends and future perspectives, Proceedings of OECD

González P. (2008), Policy implications of potential conflicts between short-term and long-term efficiency in CO2 emissions reduction, *Ecological Economics*, **65** (2), 292-303.

Henriksson, T. (2007) 'SOx scrubbing of marine exhaust gases,' *Wärtsilä Technical Journal*, Vol. 2007 (2), 55–58.

Kelektsoglou, K. Carbon Capture, and Storage (2018) A Review of Mineral Storage of CO2 in Greece, *Sustainability*, **10** (12), 4400.

Knudsen, O. F., & Hassler, B. (2011). IMO legislation and its implementation: Accident risk, vessel deficiencies and national administrative practices. *Marine Policy*, **35** (2), 201-207.