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Marine Pollution: The Uncharted Course of Indian Shipping Industry

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ABSTRACT

Ports are the hubs which form a connecting link between waterways and mainland for transportation of goods. A country's major development depends on the activities conducted within the ports of the nation. In the late 20th century, people developed an interest towards the impact of human activities on the environment. This has led to the beginning of environmental history. Ports can cause environmental and physical safety concerns of if its construction and operations are not addressed. The damages that are caused due to neglect can be irreparable in the near future. Assessing and determining the impact of the port activities on the environment, periodically by mitigation strategies can help reduce or prevent damages to the environment. Transport systems are absolutely necessary and critical for day to day activities but are known to carry environmental costs. With increased need for transportation, pollution has also increased tremendously with emissions from ships. Air pollution in ports is a concern of great importance not only because of chemical effluents but also because of emissions from the ships and harbor specific activities. Therefore Identification of possible sources of pollution, prevention and control by regular monitoring and forecasting is of utmost importance. Environmental management plan should be incorporated by all ports to monitor air and water quality continuously.

1. Introduction

More than 80% of trade are handled by ports around the world with origins or destinations in developing countries. There are more than 2000 ports in the globe. Port operations worldwide are largely dominated by international operators and large shipping lines. (The World Bank Group, 2003). India has 12 major and 200 intermediate ports. For services like hoteling, unloading and loading activities, ships use electricity which is derived from Diesel engines of ships. This has led to increased emission of sulphur and nitrogen oxides along with particulate matter and black carbon. Apart from NOx and SOx emissions, Maritime transport is responsible for about 2.5% of global greenhouse gas emissions of approximately 1 billion tonnes of carbon dioxide (UNCTAD). Due to the absence of efforts to reduce pollution, seaports have caused significant environmental and health concerns in the coastal regions. Due to the increasing concern of people around the human and environmental health, legislative actions have been taken on global and national levels. The improved hull designs and propulsion systems has helped to reduce CO2 emissions up to 35% (IMO,2009). Various authoritative port associations have widely acknowledged the need to control air pollution and emissions from the ports(IAPH, 2007; ESPO, 2003) IMO has issued two major toolkits Ship Emissions Toolkit and Port Emission Toolkit developed under Global Maritime Energy Efficiency Partnerships(GloMEEP) Project. Using these toolkit's countries can develop plans that will develop and strengthen regulatory frameworks related to the control and prevention of air pollution.

2. Review of Literature:

Ports are filled with ships that run without emission controls, thousands of diesel locomotives and other polluting equipments which can impact the local communities, environment and marine eco system in the surrounding. This could lead to contamination of the waterbodies, pulmonary diseases, unaesthetic environment and most importantly the rise of cancer risks and introduction of new foreign diseases in human and marine organisms. (Gina Solomon 2004)

The primary air pollutants due to port activities that can affect environment and human health include particulate matter (PM), diesel exhaust, Sulphur oxides, nitrogen oxides, Volatile organic compounds (VOCs). Other pollutants are carbon monoxide (CO), formaldehyde, heavy metals, dioxins and pesticides that are used for fumigation process in ports. (Diane Bailey, Gina Solomon, 2004).

Ships are making a considerable and significant contribution to air pollution and greenhouse gases by emission of SOx, NOx, and particulate matter in and around their ports. To address the issue, reliable information on the sources, chemical composition of gases, and location of emission should be quantified. This will help to regulate the emissions by policy formulation and implementation on a global level. (Corbett and Fischbeck, 1997, 2000; Endresen et al., 2003; Eyring et al., 2005; Wang et al., 2008; Jalkanen et al., 2009).

Ships that run large diesel engines burn residual fuels that tend to contain large proportion of sulphur and heavy metals. The adverse effect of ship emission not only depends on the concentrations but also on the chemical compositions. (Lack et al., 2009, 2011)

Studies have identified that the combustion process of crude oil as fuel gives rise to tracers such as vanadium (v) and Nickel (Ni). The port of New York is reported to have recorded the emission of Ni in the summertimes of 2010. Ni emission is

a major cause of cardiovascular health hazards in human. (Lippmann et al., 2006; Peltier et al., 2009; Peltier and Lippmann, 2010).

The emission inventories of ports are not usually accurate as other sectors because port activities are not well defined in nature. This is due to unreliable sources of information and limited data due to lack of proper organisational system. To obtain accurate emission inventories, data about ship movements, in-port ship activities, ship engine rating, operating efficiency and fuel consumption should be maintained.(De Meyer et al. (2008), Saxe and Larsen (2004), Cooper (2003)).

The particulate matters that are emitted from the ships are responsible for lung cancer and pulmonary diseases that have costed 60000 lives annually near the coastlines of Europe, East and South Asia. The mortality rate is expected to grow by 40% by 2012. (James Corbett,2007)

Symptoms of Headache, nausea, dizziness, respiratory distress, and memory disorders were found in workers who were responsible for unloading of containers, unpacking of goods, opening of imported products due to intoxication by fumigants such as Magnesium Phosphide, Methyl bromide, Hydrogen Cyanide etc. The level of exposure, the duration and concentration can assess the severity of the symptoms and diseases. It is however difficult to discover the chronic health defects due to contact with fumigants and complex process is required to identify the level of exposure. (Alexandra M. Preisser, Lygia T. Budnik, Xaver Baur,2012).

3. Content:

According to Budyko (1972), The Indian Ocean is an area of negative water balance. Negative water balance is a state in which the amount of water or electrolyte of substance excreted is more than what is ingested. The Arabian sea located at the north eastern part of the Indian ocean is also an area of negative water balance. Although the whole of Indian ocean is considered as an area of negative water balance, the Bay of Bengal has positive water balance.

The Indian ocean is a favourable and suitable area to study the ocean- atmosphere interaction. The water mass of Northern Indian ocean between 100 and 1200 metes has very low dissolved oxygen concentration. This leads to denitrification in the Indian ocean due to the nitrate- nitrogen reduction. With accurately measured value, it was concluded that the oxygen deprived or poor layers have a turn over time as long as 4 years. This layer is an unstable time variable feature which reacts to any climatic and environmental agitation thus causing it to become anoxic (Naqvi, 1987)

Most of the countries surrounding the Indian Ocean are developing nations. The rapid industrialization and urbanization of these countries are contributing to the degradation of the marine environment. This is due to the release of chemical effluents and other wastes from industries, the nature of the topography of the bottom layers of sea, release of domestic discharges. Although these activites have persisted for a long time, its effect on the environment began to be felt only recently.

GESAMP (Group of Experts on the Scientific Aspects of Marine Pollution of UN) defined Marine pollution as “introduction by man directly or indirectly of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction of amenities”. Purity of a marine environment denotes the waters un spoilt and original pristine state that is fit for human use. Pollution refers to any deviation from purity of marine water. Any substance that makes the water dirty or unfit for use is considered a pollutant.

Contamination of environment is inevitable and cannot be controlled. Pollution can be native or natural. Native pollution is a result of synthetic pollutants such as plastics and hydrocarbons that are manmade while natural pollution is not caused or created by man and is solely due to soluble inorganic or organic substances (Johnston, 1976).

As long as the sea is used for human activities, Pollution to a certain extent is unavoidable but care should be taken to ensure that standards are followed to protect it from unrecoverable effects and damage.

Oil pollution is an important concern or contributing aspect of marine pollution. Oil is the only visible pollutant of the sea that leaves tarry lumps giving the waterbody an unaesthetic appearance. Spilled oil spreads quickly on the sea surface with a thickness of 100mm. With the rapid increase in the usage of petroleum, oil related products or oil based technology, transportation of oil through waterways has become an inevitable necessity. Oil pollution due to tanker disasters, operational, accidental or intentional releases and offshore oil exploration and exploitation are the major sources of oil pollution in the marine environment. In the Indian Ocean there has been a total of 15 tanker disasters and 3 blowouts from 1970 to 1983 (Couper 1983). The effects of such oil spills can result in reduction of light transmission in the sea, dissolved oxygen reduction, acute toxicity of water, and asphyxiation of fauna. Oil contains several carcinogenic and toxic compounds that can cause long term effects.

Another prospect of marine pollution is due to agricultural wastes. Agriculture requires action against pests insects and weeds for protection of plants. Tonnes of fertilizers are used in order to eradicate accumulation of pests on agricultural grounds. Some pesticides have a half-life of almost a decade to decay. These pesticides and fertilizers reach the marine environment through the atmosphere, direct discharges and river runoff. The effects of such discharges could lead to reproduction problems in the marine life. Chemicals are accumulated in their body tissues making them unfit for human consumption.

Domestic or sewage wastes usually contain organic matter which can be beneficial to the coastal environment but large amounts of compounds can create imbalances in the sea. Major effect of domestic waste is the multiplication of undesirable species such as pathogenic bacteria ,

eutrophication which is a phenomenon caused by over fertilization and disrupt the ecological balance.

The regulations for the prevention of Air pollution by the international maritime organization seeks to minimize the emissions from ships such as Sox, Nox, ODS, Voc shipboard incineration.

Mandatory technical and operational energy efficiency measures were adopted by IMO in 2013, which significantly reduced the amount of CO2 emissions due to international shipping. A guideline for the measures to be implemented and followed precisely was given by IMO thereby helping regulations on EEDI and SEEMP to be implemented smoothly by Administrations and Industries.

On 1st March 2018, Amendments to MARPOL Annex VI on Data Collection system for fuel oil consumption of ships were made. According to the amendment, ships weighing 5,000 gross tonnages and above were required to collect data for each type of fuel used and specified data is including proxies for transport work. The aggregated data is then reported to the Flag State at the end of each calendar year. If the data is found to be void of inaccuracy then the flag state issues a Statement of Compliance to the ship. The Flag state has to further transfer the data to IMO Ship fuel oil consumption database. IMO will then produce an annual report to MEPC.

IMO is focusing on the Improvement of energy efficiency of ships through Promotion of Technical Co operation and Transfer of technology by conducting workshops in all regions of the world to ensure effective implementation of the new regulations worldwide

In 2012, international shipping was measured to have contributed about 2.2% to the emissions of carbon dioxide (CO_2) globally . Global approach to improve effective emission control and energy efficiency is required although international shipping is the most energy efficient mode of mass transport and only a modest contributor to overall CO_2 emissions because sea transport will continue growing apace with world trade.

According to Kyoto Protocol, CO_2 emissions from international shipping cannot be attributed to any particular national economy due to its global nature and complex operation. Therefore, IMO has been energetically pursuing the limitation and reduction of greenhouse gas (GHG) emissions from international shipping, in recognition of the magnitude of the climate change challenge and the intense focus on this topic.

MARPOL is divided into Annexes according to various categories of pollutants, each of which deals with the regulation of a particular group of ship emissions.MARPOL includes regulations aimed at preventing and minimising, both accidental and operational, pollution from ships and currently includes six technical Annexes:

Annex I – Regulations for the Prevention of Pollution by Oil
Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
Annex III – Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
Annex IV – Prevention of Pollution by Sewage from Ships
Annex V – Prevention of Pollution by Garbage from Ships
Annex VI – Prevention of Air Pollution from Ships

ANNEX I

4. Regulations for the Prevention of Pollution by Oil

Marpol Annex I is the first implementation made by Marpol 73/78, one of the most important international marine environmental conventions. It was originally designed to minimize the pollution of the seas from the ship. Preserving the marine environment by elimination of pollution from oil and other harmful substances is the main aim or objective of the convention. Marpol Annex was enforced on October 2, 1983 and it provides details on the prevention of pollution.

Marpol Annex I introduced the idea of “special areas” which are considered as risk to oil pollution. Discharging oil in these special areas have been completely outlawed.

Chapter	Regulations	Topics
1	1-5	General: Definitions and Applications
2	6-11	Surveys and certification: Flag administration and Port State Control (PSC)
3	12-17	Machinery Space: Construction, discharge control and equipment (all ship types)
4	18-36	Cargo Areas: Construction, discharge control and equipment (oil tankers)
5	37	Shipboard oil pollution emergency plan (SOPEP)
6	38	Reception facilities
7	39	FPSOs and FSUs

The first half of Marpol Annex I deals with engine room waste. New technologies and equipments such as OCM (Oil content meters), OWS Oily water seperators and port reception facilities are developed to prevent waste.

The second part of the Marpol Annex I deals with cleaning the cargo areas and tanks. Oil Discharge Monitoring Equipment (ODME) is a technology that has greatly helped improve efficiency and environmental protection in these areas.

ANNEX II

5. Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk

Annex II came into force on 06.04.1987.The main goal is to dilute the residues of cargo in seawater to prescribed standard limits and facilitate the distribution of discharges. The discharges should be below the waterline so that the residue mixture gets retained in the ship boundary layer to enable easy cleaning and removal. This annexure contains discharge conditions for four categories of noxious substances and requirements applicable to the construction and equipment of ships carrying such substances. Unlike oil, most chemicals or noxious liquids will mix with water and are not easily separated from it.

Contents

Annex III

6. Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form

The elaborate title of MARPOL Annex III is "Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form". It regulates the safe sea transportation of harmful substances in packaged Form.Different from annex II (bulk chemicals) there are no pollution categories in annex III.

Such categorization is made in the International Maritime Dangerous Goods (IMDG) code, which must therefore also be considered when consulting MARPOL annex III. Marine pollutants according to the IMDG code are dangerous goods with properties adverse to the marine environment, e. g.:

- Hazardous to aquatic life (marine fauna and flora),
- impairing the taste of seafood, or
- accumulating pollutants in aquatic organisms

Contents

Regulation 1	Application
Regulation 2	Packing
Regulation 3	Marking and labeling
Regulation 4	Documentation
Regulation 5	Stowage
Regulation 6	Quantity limitations
Regulation 7	Exceptions
Regulation 8	Port State control on operational requirements

ANNEX IV

7. Prevention of Pollution by Sewage from Ships

Annex IV contains a set of regulations regarding the discharge of sewage into the sea from ships, including regulations regarding the ships' equipment and systems for the control of sewage discharge, the provision of port reception facilities for sewage, and requirements for survey and certification.

It is generally considered that on the high seas, the oceans are capable of assimilating and dealing with raw sewage through natural bacterial action. Therefore, the regulations in Annex IV of MARPOL prohibit the discharge of sewage into the sea within a specified distance from the nearest land, unless otherwise provided.

The Annex entered into force on 27 September 2003. A revised Annex IV was adopted on 1 April 2004 and entered into force on 1 August 2005.

The revised Annex applies to ships, engaged in international voyages, of 400 gross tonnage and above or which are certified to carry more than 15 persons. The Annex requires ships to be equipped with either an approved sewage treatment plant or an approved sewage comminuting and disinfecting system or a sewage holding tank.

ANNEX V

8. Prevention of Pollution by Garbage from Ships

MARPOL Annex V seeks to eliminate and reduce the amount of garbage being discharged into the sea from ships. Unless expressly provided otherwise, Annex V applies to all ships, which means all ships of any type whatsoever operating in the marine environment, from merchant ships to fixed or floating platforms to non-commercial ships like pleasure crafts and yachts.

The Annexure came into force on 31 December 1988. Today, more than 150 Countries have signed up to MARPOL Annex V.

MARPOL Annex V generally prohibits the discharge of all garbage into the sea, except as provided otherwise in regulations 4, 5, and 6 of the Annex, which are related to food waste, cargo residues, cleaning agents and additives and animal carcasses. Exceptions with respect to the safety of a ship and those on board and accidental loss are contained in regulation 7 of Annex V

Under MARPOL Annex V, garbage includes all kinds of food, domestic and operational waste, all plastics, cargo residues, incinerator ashes, cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship and liable to be disposed of continuously or periodically. Garbage does not include fresh fish and parts thereof generated as a result of fishing activities undertaken during the voyage, or as a result of aquaculture activities.

Contents

Regulation 1	Definitions
Regulation 2	Application
Regulation 3	Disposal of garbage outside special areas
Regulation 4	Special requirements for disposal of garbage
Regulation 5	Disposal of garbage within special areas
Regulation 6	Exceptions
Regulation 7	Reception facilities
Regulation 8	Port State control on operational requirements
Regulation 9	Placards, garbage management plans and garbage record-keeping

ANNEX VI

9. Prevention of Air Pollution from Ships

The main changes to MARPOL Annex VI are a progressive reduction globally in emissions of SO_x, NO_x and particulate matter and the introduction of emission control areas (ECAs) to reduce emissions of those air pollutants further in designated sea areas.

Under the revised MARPOL Annex VI, the global sulphur cap will be reduced from current 3.50% to 0.50%, effective from 1 January 2020, subject to a feasibility review to be completed no later than 2018.

MEPC 70 (October 2016) considered an assessment of fuel oil availability to inform the decision to be taken by the Parties to MARPOL Annex VI, and decided that the fuel oil standard (0.50% sulphur limit) shall become effective on 1 January 2020.

Contents

Chapter 1 – General

Regulation 1	Application
Regulation 2	Definitions
Regulation 3	General exceptions
Regulation 4	Equivalents

Chapter 2 - Survey, certification and means of control

Regulation 5	Surveys
Regulation 6	Issue or endorsement of Certificate
Regulation 7	Issue or endorsement of a Certificate by another Government
Regulation 8	Form of Certificate
Regulation 9	Duration and validity of Certificate
Regulation 10	Port State control on operational requirements
Regulation 11	Detection of violations and enforcement

Chapter 3 - Requirements for control of emissions from ships

Regulation 12	Ozone-depleting substances.
Regulation 13	Nitrogen oxides (NO_x)
Regulation 14	Sulphur oxides (SO_x)
Regulation 15	Volatile organic compounds
Regulation 16	Shipboard incineration
Regulation 17	Reception facilities
Regulation 18	Fuel oil quality
Regulation 19	Requirements for platforms and drilling rigs

10. Conclusion:

The service industry contributes the most to the Indian economy. Transportation is an important part of the service sector that provides employment to both skilled and unskilled employees. Transportation forms an important link in the supply chain. The lack of regulations and standards that should be followed while transporting goods through waterways has led to the degradation of the marine ecosystem. Oil spills and effluents from ships has genetically modified or destroyed species in the marine environment. This could ultimately affect human health in various ways. Therefore it is an absolute necessary to strike a balance between social factors and safeguarding the marine environment. To balance both important aspects the government and several regulatory committees and associations has provided mandatory guidelines that will reduce the environmental impact of shipping

References

1. Bailey, D., & Solomon, G. (2004). Pollution prevention at ports: clearing the air. *Environmental Impact Assessment Review*, *24*(7-8), 749-774.
2. Budyko, M. I. (1972). The future climate. *Eos, Transactions American Geophysical Union*, *53*(10), 868-874.
3. Corbett, J. J., &Fischbeck, P. (1997).Emissions from ships. *Science*, *278*(5339), 823-824.
4. Corbett, J. J., Winebrake, J. J., Green, E. H., Kasibhatla, P., Eyring, V., & Lauer, A. (2007). Mortality from ship emissions: a global assessment. *Environmental science & technology*, *41*(24), 8512-8518.
5. De Meyer, P., Maes, F., &Volckaert, A. (2008).Emissions from international shipping in the Belgian part of the North Sea and the Belgian seaports. *Atmospheric Environment*, *42*(1), 196-206.
6. Eyring, V., Köhler, H. W., Van Aardenne, J., & Lauer, A. (2005). Emissions from international shipping: 1. the last 50 years. *Journal of Geophysical Research: Atmospheres*, *110*(D17).
7. Jalkanen, J. P., Brink, A., Kalli, J., Pettersson, H., Kukkonen, J., &Stipa, T. (2009).A modelling system for the exhaust emissions of marine traffic and its application in the Baltic Sea area. *Atmospheric Chemistry and Physics*, *9*(23), 9209-9223.
8. Johnston, R. (1976). Mechanisms and problems of marine pollution in relation to commercial fisheries. *Marine pollution*, 3-156.
9. Lack, D. A., Corbett, J. J., Onasch, T., Lerner, B., Massoli, P., Quinn, P. K., ...& Herndon, S. (2009). Particulate emissions from commercial shipping: Chemical, physical, and optical properties. *Journal of Geophysical Research: Atmospheres*, *114*(D7).
10. Naqvi, S. W. A. (1987). Some aspects of the oxygen-deficient conditions and denitrification in the Arabian Sea. *Journal of Marine Research*, *45*(4), 1049-1072.
11. Peltier, R. E., & Lippmann, M. (2010). Residual oil combustion: 2. Distributions of airborne nickel and vanadium within New York City. *Journal of Exposure Science and Environmental Epidemiology*, *20*(4), 342.
12. Preisser, A. M., Budnik, L. T., &Baur, X. (2012). Health effects due to fumigated freight containers and goods: how to detect, how to act. *International maritime health*, *63*(3), 133-139.
13. Saxe, H., & Larsen, T. (2004).Air pollution from ships in three Danish ports. *Atmospheric environment*, *38*(24), 4057-4067.

