Literature Review

The world's first oil tankers appeared in the nineteenth century and carried kerosene for lighting, but the development of the motor car fueled demand for oil. At the time of Second World War, the standard oil tanker was the T2 - 16400 tons deadweight, but tankers grew swiftly in size from the 1950's onwards. The first 100,000-tonne oil tanker was delivered in 1959 to cover the route from the Middle East to Western Europe round the cape of Good Hope. Shippers saw economies of scale in larger tankers and by the middle of 1960's, tankers of 200,000 tons weight, the Very Large Crude Carrier or VLCC had been ordered. [2]

The prospective for oil to pollute the marine environment was recognized by the International Convention for the Prevention of Pollution of the Sea by Oil in 1954 (OILPOL 1954). The Conference adopting by the United Kingdom government, and the Convention provided for positive functions to be undertaken by IMO when it came into being. The Convention established by International Maritime Organization has entered into force in 1958 just a few months before the OILPOL convention entered to force. So, International Maritime Organization effectively managed OILPOL from the start, firstly through its Maritime Safety Committee. [2]

MT Torrey Canyon built in 1967 ran aground when entering the English Channel and spilled her entire cargo of 120,000 tons of oil into the sea. T incident raised questions about procedures in place to prevent oil pollution from ships and also uncovered deficiencies in the present system for providing compensation following accidents at sea. It was fundamentally this incident that set-in motion the series of events that finally led to the adoption of MARPOL. [4]

Due to the enormous growth in the maritime transport of oil and the size of tankers, the increased amount of oil being carried at sea was a growing concerned for the world. Many countries feel that the 1954 OILPOL Convention was not adequate, despite the various amendments which had been adopted. In 1969 the International Maritime Organization decided to convene an international conference to adopt a completely new convention, which incorporate the regulations contained in 1954 OILPOL. At the same time, the Sub-Committee on Oil Pollution was renamed as the Sub Committee on Marine Pollution, to widen its scope, and this became the Marine Environment Protection Committee (MEPC), which was in time given the same standing as the Maritime Safety Committee, to deal with all matters relating to maritime pollution. The conference was set in October to November 1973, and introductory meetings began in 1970. [5]

The 1973 conference incorporated much of 1954 OILPOL and its amendments into Annex I covering oil, while other annexes covered chemicals, harmful substances conceded in packaged form, sewage and garbage. Annex I lengthened and improved on 1954 OILPOL in several ways. It specified requirements for constant monitoring of oily water discharges and incorporated the requirement for Governments to provide shore reception and treatment facilities at oil dealing terminals and ports. Also established many Special Areas in which stricter discharge standards were applicable, including the Mediterranean, Red Sea and Gulf and Baltic Sea areas. As it turned out, there was slow movement at ratifying the Convention and the non-ratification of MARPOL became a main concern. The same time, a series of accidents involved with tankers in 1976-1977, mostly at or near United States

waters and including the grounding of the MT Argo Merchant, led to demands for more rigorous action to control accidental and operational oil pollution. The MT Argo Merchant ran aground off Massachusetts on December 1976. It was a small tanker which carried 27,000 tons of oil, but effected huge public concern as the oil slick endangered New England resorts and Georges Bank fishing ground sea areas. [2]

The MARPOL Convention was adopted on 1973 at International Maritime Organization. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. The 1973 MARPOL Convention had not however entered into force, the 1978 MARPOL Protocol absorbed the parent Convention and the combined instrument entered into force in 1983. [5]

IPIECA- (International Petroleum Industry Environmental Conservation Association) is the global oil and gas industries association for environmental and social issues. IPIECA was formed in 1974 which subsequently initiated the United Nations Environment Programme (UNEP). IPIECA is the global association connecting both the upstream and downstream oil and gas industry on environmental and social issues. IPIECA's membership covers more than half of the world's oil production. IPIECA is the industry's main channel of communication with the United Nations. As per their annual report 2020, while the amount of oil produced and transported has amplified as the world's economy has expanded, the general number of large spills has significantly decreased. This reduction is mainly due to efforts by companies operating throughout the oil supply chain to develop more efficient preventive measures. [6]

There are lot of published literature that explains or preaches oil spills and trend but there is relative lack of empirical studies examining oil spills by Tankers and environmental legislative developments. This study focuses on analysis of maritime environmental legislative regulations Marpol Annex 1, and developments of tankers to minimize oil spills.

Oil spills can appreciably affect the environment and surrounding of local communities. Even with advanced safety measures in place, the risk of an oil spill still remains. Since new oil resources in remote and sensitive environments are developed, there are new risks and challenges to be attended.

Research Methodology

The study focuses on secondary data of oil spill statistics 1970 to 2020 and convenience sampling method used in the study. Oil spill data used in this study are from the Environmental Research Consulting Spill Databases which collected data from a large number of sources and databases, including International Maritime Organization, International Tanker Owners Pollution Federation-ITOPF, United Nations Conference on Trade and Development- UNCTD statistics and other national and regional environmental agencies. On a continuously updated basis, the data are crosschecked and corrected with current information and new information on past events. Above Data gives more realistic picture on Tanker oil spills and they are reliable and approved by IMO.

A Least Significant Different test (LSD test) was utilized to analysis the relationship between Marpol Annex 1 legislative developments and Marine oil spills. MS Excel and SPSS software

were utilized for the purpose of analysis of the collected data.

Limitation of the study:

I. Less than 7 tones oil spills not taken into consideration as most of them are not reported and
unable to get correct figures.
II. Oil products as cargo transferring taken into considerations and tankers and non-tanker vessels'
bunker oil not taken in to account.
III. Study analyses is limited to Maritime Environmental Legislative developments of Marpol
convention Annex 1.

Discussion

The International Convention for the Prevention of Pollution from Ships (MARPOL) is that the main international convention aimed toward the prevention of pollution from ships caused by operational or accidental causes. Marpol consists of 6 annexes. In this study, main focus is on Annex 1 and how its implementation helped to minimize oil spills in Marine Environment.

Annexes	Date of Entry into force
Annex I – Regulations for the Prevention of Pollution by Oil	2 October 1983
Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk	2 October 1983
Annex III – Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form	1 July 1992
Annex IV – Prevention of Pollution by Sewage from Ships	27 September 2003
Annex V – Prevention of Pollution by Garbage	31 December 1988
Annex VI – Prevention of Air Pollution from Ships	19 May 2005

Table 1 – Marpol Annexes , Constructed by Author
Source : https://www.researchgate.net/Marpol

Marpol Annex I (Oil) came into force on 02nd October 1983 and contains conditions for discharge of mixtures containing oil and additionally needs applicable to the development and instrumentation of tankers larger than 150GRT and other ships larger than 400GRT. This Annex relies on the principle that oil and water is not easy to separate. It contains requirements relating to the operation, construction and instrumentation of ships. The operational needs stipulate the conditions that ships could discharge water/oil mixtures into the ocean. The different construction needs are such to minimize the probabilities of oil freight tank penetration within the event of accident, i.e. double hull construction and protecting locations with segregated ballast tanks. Needs for minimizing oil pollution from oil tankers within the event of bottom damages penetrating the freight oil tanks. [2]

The development and instrumentation are needed to suit the discharge conditions. Other construction needs are such to reduce the probabilities of oil leaks in case of accident i.e., double hull construction and protecting location of segregated ballast tanks. Requirements for minimizing oil pollution from oil tankers within the event of bottom damage are enclosed as below. [7]

A. Control of Operational Discharge of Oil **(**Discharges outside special areas)

Any discharge to the sea of oil or oily blends from the cargo area of an oil tanker, shall be proscribed except where all the following conditions are satisfied:

a. The tanker is not in a dedicated special area;
b. The tanker is over 50 nautical miles from the closest territorial land.
c. The tanker is making way, enroute;
d. The rapid rate of discharge of oil content does not exceed 30 liters per nautical mile;
e. the total quantity of oil discharged into the sea does not exceed for tankers delivered on or