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A comparative study of implementation of existing measures for oil spill response in Northern Indian Ocean and investigate improvment mechanisms

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A COMPARATIVE STUDY OF IMPLEMENTATION OF EXISTING MEASURES FOR OIL SPILL RESPONSE IN NORTHERN INDIAN OCEAN AND INVESTIGATE IMPROVEMENT MECHANISMS

By

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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.

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ABSTRACT

Title of Dissertation: **A comparative study of implementation of existing measures for oil spill response in Northern Indian Ocean and investigate improvement mechanisms.**

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Oil is a major source of energy in the world. The geographical distribution of oil rich regions away from the major consumers has led to transportation of large quantities of oil across the ocean. The contribution of maritime transport in the total quantity estimated to be entering into the sea annually is much lower than the land based sources. However, the risk of a large quantity of oil being released in a small area in case of a marine casualty leading to disastrous consequences, has forced the attention of public and the environmental regulators towards shipping.

The dissertation briefly discusses the harmful effects of oil in the marine environment and combat techniques for contextual support to the topic. A short look is taken at the history of oil spill response to understand the development of existing mechanism. The mechanism for responding to oil spills is a combination of well developed response organisation structure, a comprehensive contingency planning, adequate equipment & manpower and the supporting legislative framework. The existing regulatory mechanism addressing these aspects is summarised to compare them against actual implementation by the countries in the region.

A comprehensive examination of the factors affecting the risk profile of Northern Indian Ocean towards an oil spill incident is undertaken. Some of the unique factors affecting this risk include the concentration of major oil producing nations leading to two thirds of the global seaborne oil trade passing across the area on two highly congested tanker routes, geopolitical factors which caused the largest oil spill ever in the world history during first gulf war and developmental needs taking priority over environmental concerns.

The capabilities of the region in oil spill response is examined by dividing the countries into three subgroup- South Asia, Middle East and North-eastern Africa and investigating the set up provisioned by the government, The role of private organisations and the regional cooperative arrangements is also explored. The information is collated and evaluated to determine the strengths and weaknesses of the current system in the three subgroups. The existing mechanisms for oil spill response in two other sea areas – North Sea and Baltic Sea, have also been summarised to compare and contrast the capabilities with the three groups.

The dissertation thus critically analyses the existing capabilities in the Northern Indian Ocean and presents a number of recommendations for improvements.

KEYWORDS: Oil Pollution, Contingency Planning, OPRC, Indian Ocean, Oil Spill Response, Tiered Response,

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LIST OF ABBREVIATIONS

ADNOC	Abu Dhabi National Oil Company
ALARP	As Low As Reasonably Practicable
BAPCO	Bahrain Petroleum Company
CLC	International Convention on Civil Liability for Oil Pollution Damage , 1992
DWT	Deadweight tonnage
EEZ	Exclusive Economic Zone
EGPC	Egyptian General Petroleum Corporation
FSI	Flag State Implementation
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage,1992
GESAMP	Group of Experts on Scientific Aspects of Marine Environmental Protection
HELCOM	Helsinki Commission- Baltic Marine environment protection commission
IMO	International Maritime Organisation
IPIECA	International Petroleum Industry Environmental Conservation Association
INTERTANKO	International Association of Independent Tanker Owners
INTERVENTION	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties,1969
ITOPF	International Tanker Owners Pollution Federation
KOC	Kuwait Oil Company
MARPOL	International Convention for the Prevention of Pollution from ships, 1973 as amended by protocol of 1978
MEMAC	Marine Emergency Mutual Aid Centre
NOSCP	National Oil Spill Contingency Plan
OCIMF	Oil Companies International Marine Forum
OECD	Organisation for Economic Co-operation and Development
OILPOL	International Convention for the Prevention of pollution of the Sea by Oil, 1954
OPA 90	Oil Pollution Act, 1990
OPRC	International Convention On Oil Preparedness Response And Cooperation, 1990
OSRL	Oil Spill Response Limited
PAJ	Petroleum Association of Japan
PDO	Petroleum Development Oman
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
PSC	Port State Control
PSSA	Particularly Sensitive Sea Areas
QP	Qatar Petroleum

RECSO	Regional Clean Sea Organisation
SAUDI ARAMCO	Saudi Arabian Oil Company
SOLAS	International Convention for The Safety of Life at Sea, 1974
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
VLCC	Very Large Crude Carrier

CHAPTER 1

INTRODUCTION

1.1 Background

The discovery of oil[1] in the 20th century as an efficient and convenient source of energy revolutionised the concept of quality fuels for industrialised countries as it suited the rapid technological advances especially in internal combustion engines. In later years, it became a frontline energy source overtaking coal. However, the imbalances in the production and consumption patterns resulted in the requirement for movement of large quantities of oil through various regions. The shipping provided the most efficient and economical means of transport for this oil and in 2007, the global seaborne oil trade was approximately 43 million barrels per day or about half of the world oil production (Energy Information Administration, 2009).

Though the initial efforts of exploiting oil did result in oil pollution experienced in ports and coastal waters, these were considered as minor risks causing fire hazards and damage in ports and insignificant health menace. However, the issue progressively gained significance through the early 20th century and efforts were initiated to control the oily discharges from the ships and prevent leakages of oil when loading, unloading or refuelling at ports (Pritchard, 1987).

The drastic impact of oil pollution on the marine environment and the economic dependence of coastal communities on marine industries such as fishing, tourism etc. became an increasing problem as greater knowledge about the harmful effects of oil was gained. It was also discovered that the recovery and combating mechanisms

[1] The term 'Oil' is used generically for crude oil and its derived products.

towards such pollution were extremely difficult posing technical as well as practical difficulties. The effects of the pollution were, in fact, far-reaching and transgressed the conventional boundaries defining losses. The issue has been aptly summarised by Ornitz & Champ (2002) quoting ITOPF and USCG as follows:

> Oil spills result in tangible, direct losses of life, injuries, damage to environment, cargo and vessel, loss of time, loss of consumer base and many indirect costs. Oil spills are no longer considered an avoidable accident of environmental condition or a function of catastrophic events.

The pollution by oil in the marine environment can be caused by many sources .Though the relative contribution of each of the recognised sources may differ in distinct marine areas, it is well established that the land based sources[2] are likely to be the most significant even in marine areas with heavy tanker traffic (GESAMP, 2001). However, their entry into the sea is much less conspicuous, being released continuously in moderate dissolved concentrations and therefore detectable by chemical analysis only. In contrast, the impact of a ship / tanker accident releasing a sudden large quantity of oil results in catastrophic effects exemplified by sympathetic images of oily sea birds on polluted beaches. It creates much larger negative publicity despite such sea based activities in general and accidental ship discharges in particular making a minor source of oil pollution in marine environment (GESAMP, 2007 & GESAMP, 1993).Thus, the media frenzy in highlighting such an incident increases the perception of the risk associated with shipping as a major pollutant of the oceans by the society.

However, the impact of shipping may also involve many other facets and the issue furthermore needs to be considered in the light of steady growth, over the years, in both the size and number of vessels particularly the tankers which carry extremely large quantities of oil or oil products. A single VLCC is capable of carrying more than 200,000 to 300,000 tons of oil at one time. Thus, any single spill caused by such a ship due to marine accidents, collisions, groundings etc. may be disastrous. Even if the risk associated with the occurrence of such an accident is significantly lower, it

[2] Land based sources account more than 50 % share of input of oil into the sea globally, GESAMP, 1993

evokes much greater concern due to inconceivable consequences to marine environment in the affected area.

Therefore, this dissertation will focus on the oil pollution threats in the marine environment through sea based activities only. These will include maritime transportation in general and tankers in particular. The operational and accidental discharges from the ships (both tankers and non-tankers), offshore exploration and production facilities and other miscellaneous sea based activities handling oil e.g. coastal refineries, oil storage facilities and marine oil terminals etc. constitute the major categories of pollution originated from sea based activities. Though, each of them require a different strategy for addressing the issue of prevention and response / control measures, the broad parameters for the overall oil spill response mechanism may be deemed to be same in all the cases.

As Ornitz & Champ (2002) have rightly postulated regarding this issue:

> The oil spill response is an extremely complex and challenging cross disciplinary experience. In the operational decision making process, it combines a wide range of issues and activities under emergency response conditions that include – the nature of the material spilled, which undergoes changes in physical and chemical properties and biodegradation over time, local environmental conditions , sensitivity of impacted natural resources and selection and effectiveness of response/clean up technologies.

Thus, capability of prevention and response to oil pollution at sea depended upon the technical expertise available and the constraints of financial resources. Further, the Torrey Canyon incident in 1967 also indirectly fuelled further disparity in these methods between the developed and the developing countries. The focus of international community which was earlier more or less on operational discharges of oil from ships understandably shifted to the massive levels of oil pollution resulting from a shipping casualty (Cormack, 1999). It led to the strengthening of legal framework, revamping of compensation regime and capacity building by major industrialised nations for prevention and response measures. This also included greater research to improve the technologies for more efficient combating methods.

However, the developing countries lagged behind in such efforts due to constraints of resources and technical expertise.

The experience gained during the years has justified a cooperative approach by all parties involved to ensure effective response. These include IMO, national governments, industry organisations and expert / research organisations. The OPRC Convention, 1990[3] also promotes the spirit of bilateral cooperation between countries and between governments and industry (IPIECA, 2005).

1.2 Objectives of Study

The study aims to achieve the following:

(a) Describe the harmful effects of an oil spill on marine environment & coastal economy and discuss existing oil spill response techniques.

(b) Describe the historical development of oil spill response mechanism and discuss existing arrangements.

(c) Examine various threats for an oil pollution incident in Northern Indian Ocean and develop the risk profile.

(d) Identify the criteria for evaluating effectiveness of an oil spill response mechanism.

(e) Discuss the capabilities of individual countries in the Northern Indian Ocean in responding to an oil spill incident and role of regional cooperative arrangements.

(f) Identify strengths and weaknesses of the existing arrangements in the region.

(g) Make recommendations for improvement in the existing arrangement for oil spill response in Northern Indian Ocean.

1.3 Research Methodology

The study primarily intends to utilize the qualitative approach by initially proceeding to collate the available information about the existing arrangements for oil spill

[3] International convention on Oil Pollution Preparedness, Response and Cooperation came into force on 13 May 1995.

response in the countries surrounding the region. The information anticipated included the details regarding the regulatory framework, international conventions, national provisions and operational structure, regional agreements, and industry initiatives. A literature search is also undertaken to provide an analytical support and critical review on the subject.

However, the author was surprised that the area of the Northern Indian Ocean has not been provided sufficient attention by scholars and researchers. The literature, information and other data about the marine oil pollution issues was also extremely limited. The few sources available generally described the technical aspects of oil pollution instead of focusing on the administrative or operational set up for coordinating response. This posed a difficulty as very few details about many countries were available. The author took up the challenge on the advice of the professors and the supervisor and decided to generate the information needed for the study by directly approaching the concerned organisations. These included maritime administrations, oil spill response agencies, national environmental agencies, regional organisations working in the field of oil pollution, academic institutions and ocean research institutes. The process was quite cumbersome and exhausting which involved large correspondences, delicate negotiations, patience and finally convincing them to share the information. Thus, the author was moderately successful. However, there are still certain areas where insufficient data is available. Further, some of the data was shared in private capacity or through informal or unofficial sources, thus it is utilised without a reference or citation for ethical reasons.

Finally, the available information is evaluated in respect of the identified criteria to formulate arguments towards critical analysis and concluding proposition.

The research work of the dissertation has been divided into five chapters. The topic is introduced in the first chapter with preliminary explanatory background. Chapter two will present the need for action towards marine oil spills and discuss the international legislations and technical details about the fate of marine oil and its harmful effects to environment and coastal economy. Chapter three will critically analyse and evaluate the risk of oil spills in the Northern Indian Ocean and discuss various factors that impinge on the risk matrix. Chapter four examines the capabilities for oil spill

response of various countries in the area. The detailed analysis will be undertaken by dividing them in three groupings- South Asia, Middle East and East Africa. The efficacy of regional initiatives and capability set up by the private entities in this area will also be investigated. The arrangements existing for response in two other ocean areas are also summarised to compare and contrast the capabilities available in the three subgroups to other regions of the world. The concluding Chapter five provides recommendations as perceived by the author based on the analysis to help facilitate the implementation strategies addressing the deficiencies and weaknesses in the system.

CHAPTER 2

MARINE OIL SPILL- IMPACT AND RESPONSE

2.1 Oil – Our Premier Energy Source

Crude oil and other products derived from it have become a major source of energy in all the regions of the world which accounted for about 35 percent of the world's primary energy demand in 2005 (IEA, 2007). Although its overall share is likely to decrease over the years, it is still expected to account for 32 percent of the world's energy demand by 2030 (SeeTable.1) due to the economic resurgence of China, India and other developing economies.

Table 1: World primary energy demand in the reference scenario[4].

Source	1980	2000	2005	2015	2030
Coal	1786	2292	2892	3988	4994
Oil	**3106**	**3647**	**4000**	**4720**	**5585**
Gas	1237	2089	2354	3044	3948
Nuclear	186	675	721	804	854
Hydro	147	226	251	327	416
Biomass & Waste	753	1041	1149	1334	1615
Other Renewable	12	53	61	145	308
Total	**7228**	**10023**	**11429**	**14361**	**17721**

Source: World Energy Outlook 2007, International Energy Agency.

[4] Tonne of oil equivalent (toe) is a unit of energy equal to the amount of energy released by burning one tonne of crude oil.

The important point to note here is that almost all the increase in the oil production will occur in the traditional oil rich countries and thus the reliance on imported oil by the main consuming regions including the OECD and Asian economies will increase substantially (IEA, 2008).The world oil tanker fleet at the beginning of 2009 comprised of 9159 tankers with 418 million DWT and the tanker order book in relation to the current supply, reflecting high demand for oil transportation, stood at 41 percent (ISL,2009a).

There is a high degree of uncertainty regarding the data concerning inputs of quantities of oil into the sea from different sources. The US National Academy of Sciences estimated it to be 1.3 million tonnes per year with 30 percent attributed to marine transportation including operational discharges from ships (National Research Council, 2003). However, the contribution was estimated to be 36 percent out of the 1.2 million tonnes by GESAMP (2007).More focussed data concerning the causes of oil spills resulting from shipping activities is provided by ITOPF [5](2009a) in Figure. 1.

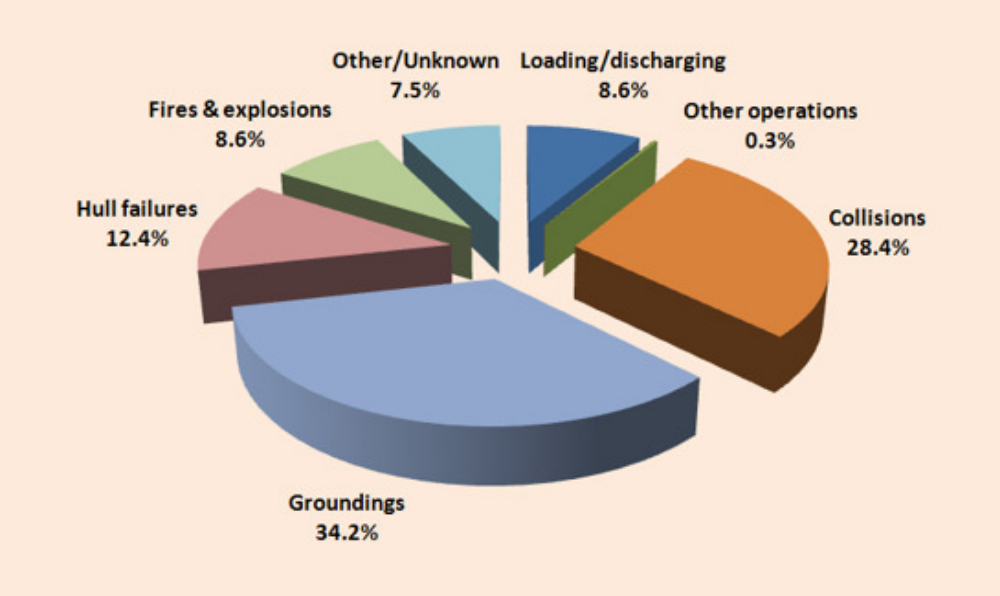

Figure 1:Cause of large spills (> 700 tonnes),1974-2008.

Source: ITOPF Handbook 2009

[5] The International Tanker Owners Pollution Federation (ITOPF) is a not-for-profit organisation, involved in all aspects of preparing for and responding to ship-source spills of oil, chemicals and other substances in the marine environment.

The spills from the shipping accidents, mainly those caused by the tankers, release a large quantity of oil and thus pose a much higher threat to the marine environment than other sources of pollution. As can be seen from Figure 1, accidents were the main cause of the large oil spills with groundings and collisions accounting for 63 percent of the total incidents.

2.2 Marine Pollution by Oil

UNCLOS Article 1(1) (4) defines pollution of the marine environment as

> the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.

Thus, it also incorporates the contamination of the seas by oil spilled during maritime transportation and other sea based activities. The important aspects of this definition are that it is both action oriented as well as effect oriented and provides a broad parameter in that the pollution not only exists when the effects really occur, but also, when they are likely to happen (Molenaar,1998). The last part of the explanation has contributed to the existing mechanisms of the oil spill prevention and response regime including the right of intervention by the coastal state (Kennish, 1997).

2.3 Oil- Properties and its Fate in the Marine Environment

Although any type of marine pollution involves definite measures towards prevention and combating mechanisms, oil, due to its typical constitution and behaviour, presents an enormous challenge. The specific behaviour processes that occur after an oil spill determine how the oil should be cleaned up and its effect on the environment (Fingas & Charles, 2001).The various types of petroleum oils range from light volatile

fractions to heavy tar-like residues and have unique characteristics. These characteristics influence their fate or behaviour and the harm or damage caused to the marine environment (National Research Council, US, Ocean Affairs Board, 1975).

The main physical properties which affect the behaviour and persistence of oil spilled at sea are specific gravity, distillation characteristics, viscosity and pour point, all of which depend upon its chemical composition (ITOPF, 2009). The details about these properties are placed at Appendix 'A'. When oil is spilled at sea, it spreads and moves on the surface of water while undergoing a number of chemical and physical changes, collectively termed as weathering (ITOPF Handbook, 2009 & Fingas& Charles, 2001).Figure 2 represents these different processes.

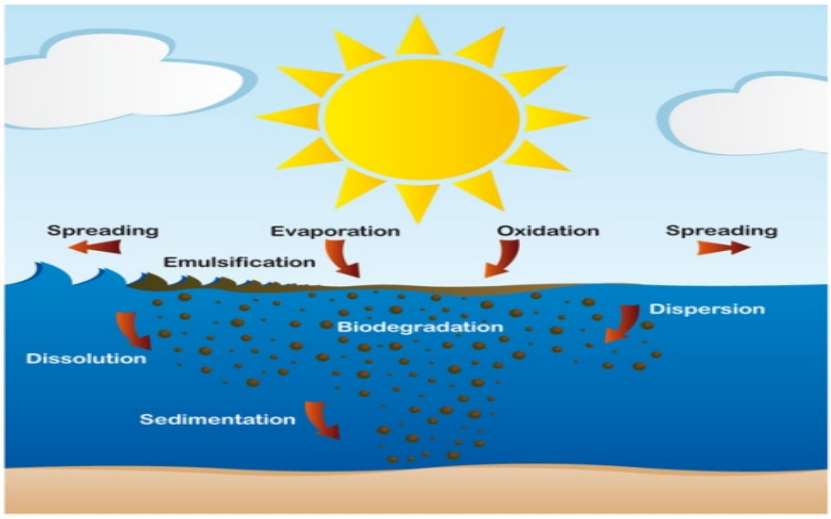

Figure 2 : Weathering process.

Source: ITOPF Handbook 2009

One more important aspect to remember is that the potential human and environmental effects of oil spilled depend on not only the quantity and type of oil spilled, but also the location and different ecological and oceanographic conditions. Thus, a lot of models have been developed to estimate ambient hydrocarbon concentrations translating into the overall effects expected (National research Council, 2003).However, the predictive models can provide a reasonable assessment of the track, location, shape and weathering of oil spill if more detailed data, especially for the topography and unique shoreline interaction etc. for any given geographical area

is available, which is generally accurate only if it is obtained in real time (GESAMP,1993).

2.4 Effects of Oil Spills

Oil spills can seriously affect the marine life of the affected area with an inevitable loss of marine resources and negatively influence the economy of the coastal community. The effects can be divided into two main categories:

2.4.1 Effect of Oil on Marine Ecosystems

The impact of oil on a marine ecosystem is not uniform and varies according to the general location or living area of the species- near or at the surface of the sea and at the seabed. Though ITOPF (2009) does not agree conclusively about any long term harmful effects of oil on marine ecosystems, a lot of research in this field suggests a different picture. The principal species known to be affected are mentioned below (Boesch & Herchner, 1974):

(a) **Birds and Mammals** The most recognisable visual image attributable to oil pollution by a layman is that of an oily bird dying on an oiled beach. There are a large number of birds reported to be killed after heavy oil spills due to fouling of their feathers and ingestion of oil. The biological systems including their breeding are also found to be severely hampered even in the surviving birds and mammals.

(b) **Fish and Fisheries Resources** The fish are severely affected due to the damage caused by the oil to the eggs and larvae apart from the killing of fish trapped in oil. The tainting of commercial fish, oysters and mussels has also been experienced.

(c) **Plankton** Toxic and sub lethal effects on the plankton have been reported to be caused by oil.

(d) **Wetlands** The salt marshes and mangroves swamps suffer a long-term impact thereby adversely affecting the associated marine habitat supporting numerous species.

(e) **Special Environments** Special environments like Polar Regions, coral reefs and estuaries may experience much higher degradation compared to normal shoreline.

2.4.2 Effects of Oil on a Coastal Economy

The effects on economy may be short term or long term and may include the following:

(a) Contamination of coastal amenities e.g. recreational activities, leading to serious effects on tourism and related industries.

(b) Fisheries and mariculture in the area is affected by damage to equipments, contamination of area and clean up operations.

(c) Coastal industries using sea water intake e. g. Power plants, desalination plants etc. may also be seriously affected.

2.5 History of Oil Spill Response

The issue of oil pollution from ships came into prominence initially during and immediately after the First World War due to highly flammable gasoline discharges causing damage and fire to ports. The first efforts towards dealing with these incidents were quite basic with regulations by various countries to prohibit the oily discharges from ships within a designated zone, 3-mile of territorial waters in Britain in 1918 and 25-mile zone in the United States as per local regulations in 1921 (Pritchard, 1987). The efforts of the British government with the participation of ship-owners, oil companies and harbour officials resulted in the introduction of Oil in Navigable Waters Act,1922 which was the first attempt of legislating the issue concerning oil pollution both in the national and international realms. Further, the cooperation between Britain and the United States led to an international conference to address the issue in Washington in 1926. Although the conference failed to adopt any convention, it laid the ground for the voluntary adoption of a 50-mile prohibition zone by British

ship-owners, which was later followed by other European countries as well as the United States [6](Pamborides, 1999).

Similar efforts on oil pollution control at international level were attempted in the League of Nations in 1935 which, however, also failed but brought forward many new concepts including that of penalties sufficient to act as deterrents against acts of pollution, provisions of reception facilities by port and some arrangements for treatment of oily wastes onboard ships (Mitchell, 1994).

An international agreement on oil pollution finally fructified in the form of the International Convention for the Prevention of Pollution of the Sea by Oil, 1954 popularly known as OILPOL[7].It was later amended in 1962 and 1969 to cope with the technical difficulties to ensure compliance of limits of permitted quantities of oil in oily discharges from ships, strengthen the enforcement provisions and the reporting requirements (Khee & Tan, 2006).

The Torrey Canyon[8] disaster in 1967 brought into focus the need to address the accidental discharges from the ships in addition to the operational discharges which were the main areas of concern prior to this incident (Sands, 2003). Further, the pollution affecting Britain from foreign tanker spilling oil outside the territorial seas of Britain also posed problems of jurisdiction for initiating preventive actions by the coastal state. This laid the foundation for not only the Intervention Convention,1969 , to be adopted providing the right of intervention to a coastal state in such a case, but also for many other important aspects to be addressed in respect of liability and compensation for pollution damage by ships, prevention of accidental pollution through reinforcing design & construction standards, operational procedures and training of seafarers (Franckx, & Basedow & Magnus, 2007).The significant consequence was , however, the development of the International Convention for the Prevention of Pollution from Ships, 1973(MARPOL). Although the convention faced difficulty in getting support for ratification, it took another series of tanker accidents

[6] 100 mile zone was promulgated in United States.
[7] Adopted on 12 May 1954, the convention was initiated by British Government in the absence of IMO.
[8] TORREY CANYON ran aground off England coast on 18 March 1967 in which entire cargo of approximately 119,000 tonnes of crude oil was lost

including that of Argo Merchant[9] in 1976 to prepare ground for a protocol for the convention to be developed and adopted in 1978 and for these to come together and enter into force (Ehlers & Lagoni, 2006).

2.6 Regulations Governing Oil Pollution

Although the initial efforts for regulating oil pollution at sea were largely driven by the national interests of a few major maritime states, IMO became the forum for implementation of the international conventions comprehensively addressing almost every aspect of the issue. The important instruments impacting the oil spill control regime are mentioned below:

2.6.1 International Convention for the Prevention of Pollution from Ships, 1973 as amended by protocol of 1978(MARPOL 73/78)

This is the most important of the IMO conventions on marine pollution and aims to achieve complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimisation of accidental discharges of such substances. It incorporates measures about the design standards, operational procedures, surveys, inspections and emergency planning and preparedness by ships and other stakeholders to prevent oil pollution from ships.

2.6.2 International Convention for The Safety of Life at Sea, 1974 (SOLAS)

This is primarily considered to be maritime safety convention but also indirectly impinges upon prevention of oil pollution and safety of environment. The design and construction standards for ships cater to tankers as well as non tankers and ensure the minimum risk of pollution due to accident or during normal operations. The significant part that can be considered as directly affecting oil pollution is chapter IX, the ISM Code, which specifically incorporates environment protection in the safety management system of ships as well as shipping companies and encourages active involvement in pollution prevention from ships.

[9] ARGO MERCHANT ran aground on Nantucket Shoals, off Massachusetts, USA, on 15 December 1976, and spilled her entire cargo (28,000 tonnes) of fuel oil.

2.6.3 International Convention On Oil Preparedness Response And Cooperation, 1990 This was the landmark convention as it provided a framework for extensive measures towards not only prevention of oil pollution, but also, building up response capabilities and mechanisms to combat an oil spill. In addition to reinforcing certain existing provisions in MARPOL and SOLAS, it provided for the states to establish a national system for prompt response to oil pollution incidents which should include a contingency plan, provision of minimum required oil spill combating equipment, regular exercises and training of personnel. It also stressed the importance of cooperation among the states at bilateral, regional and global level and also among the states and the oil industry, port authorities and other stakeholders. The importance of technical cooperation and mutual assistance agreements and research and development was also emphasised. Thus, it is a premier convention for developing a global oil pollution response regime.

2.6.4 International Convention on Civil Liability for Oil Pollution Damage (1992 CLC) and the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (1971 Fund Convention) as amended in 1992 and Supplementary 2003. These two conventions provide a compensation regime for oil pollution damage including clean up costs and are funded by the tanker owners and the oil receiving companies respectively.

2.6.5 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 The convention empowers the coastal state to

> take such measures on the high seas as may be necessary to prevent, mitigate or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution of the sea by oil, following upon a maritime casualty or acts related to such a casualty, which may reasonably be expected to result in major harmful consequences.

Thus, it created a mechanism where the interests of the coastal state are also given priority due to the threat of pollution though balanced by a need for consultations by the coastal state with all appropriate stakeholders.

2.6.6 International Convention on Salvage, 1989 This convention promoted the salvors to undertake an operation with fewer chances of success but likely to result in substantially reducing or preventing damage to the marine environment. It provided a suitable compensation to the salvor in such scenario if he has failed to earn a reward in a conventional way.

According to GESAMP (1993), the problem of marine oil pollution is addressed by the current legislative regime in the following ways:

- Reducing accidents.
- Reducing the consequences of accidents.
- Combating major oil pollution incidents.
- Preventing operational pollution.
- Protecting special geographical area.
- Providing compensation.
- Helping implementation.

2.7 Stakeholders in Oil Pollution Response

It is paramount that various stakeholders contributing towards a successful and efficient regime for preparedness and response to an oil spill undertake their responsibilities seriously and sincerely. The responsibilities of a few of the major stakeholders are discussed in the following paragraphs:

2.7.1 States/Governments The role of governments needs to be considered in three different categories:

- **Flag State** This has a primary role in ensuring safe maritime oil transportation and is responsible for establishing and maintaining measures for effective application and enforcement of the

relevant international conventions to achieve maritime safety and environment protection (Ornitz & Champ, 2002).

- **Port State** This has been considered as providing the last of the safety nets protecting human life and the environment from accidents and oil spills in the form of port state control. Thus, it also has to contribute towards weeding out substandard shipping (IPIECA, 2005).

- **Coastal State** The importance of the coastal state needs to be understood with reference to the development of national policies for shipping in general and oil pollution in particular , with regard to a long environmentally fragile coastline, proximity to major oil transportation routes and absence of ports regularly used by ships (Molenaar,1998).Despite obvious pressures and constraints against instituting such measures ,it has to be proactive in its duty to protect and preserve the environment as mandated by UNCLOS.

2.7.2 Ship-Owners and Operators Operational safety is the responsibility of the ship-owners and operators and thus they have to ensure strict compliance with all of the measures concerning maritime safety and environment protection including design, construction, maintenance, manning, operation, and safety management of the ships (Viega,2003).

2.7.3 Cargo Owners and Charterers Although they do not have a direct role in this context, they certainly have an interest in making sure that the cargo reaches its final destination safely by ensuring that the ship is operated properly. Consequently, they have to ensure a balance between quality, price and risk while selecting a ship thereby discouraging operation of substandard ships (Khee & Tan, 2006).

2.7.4 Protection & Indemnity (P&I) Clubs and Insurance Industry They have an inherent interest in reducing marine casualties and more importantly, any major oil pollution which is likely to result in huge compensation costs.

Thus, they are expected to promote good shipping practices including compliance of safety management system (Khee & Tan, 2006).

2.7.5 Classification Societies It has generally been observed that a majority of flag states have delegated many functions regarding survey and certification to the classification societies. Thus, in addition to their traditional role of classification of the ships, they have a responsibility to ensure the promotion of safety culture through stringent observance of the rules & standards concerning design, construction and operation of ships (Molenaar, 1998 and Ornitz& Champ, 2002).

2.7.6 Oil and Shipping Industry Organizations/Associations The role of oil and shipping industry organizations/associations in providing technical expertise & guidance and support in oil spill response cannot be discounted. They play a leading part in ensuring compliance of existing regulatory requirements as well as in developing innovative techniques, systems and procedures. The relevant organizations are International Association of Independent Tanker Owners (INTERTANKO), International Petroleum Industry Environmental Conservation Association (IPIECA), International Tanker Owners Pollution Federation (ITOPF) and Oil Companies International Marine Forum (OCIMF).

2.7.7 International Maritime Organization (IMO) IMO has played an active role in developing instruments to contribute towards framing a comprehensive policy for marine pollution issues in addition to encouraging technical assistance for capacity building and cooperative arrangements among member states. Thus, it has a prominent position in evolving a successful and responsive global oil pollution response regime (Molenaar, 1998).

2.8 Oil Spill Response Techniques

2.8.1 Tiered Preparedness and Response

The oil spill response is usually organized in a structured tiered preparedness and response approach to ensure establishment of oil spill preparedness and undertaking a response where the potential oil spill incidents are categorized in terms of their potential severity and the capabilities that need to be in place to respond (IPIECA, 2007). Thus, the concept has been considered as a function of size and location of a potential oil spill and has been defined in tiers as depicted in Figure 3.

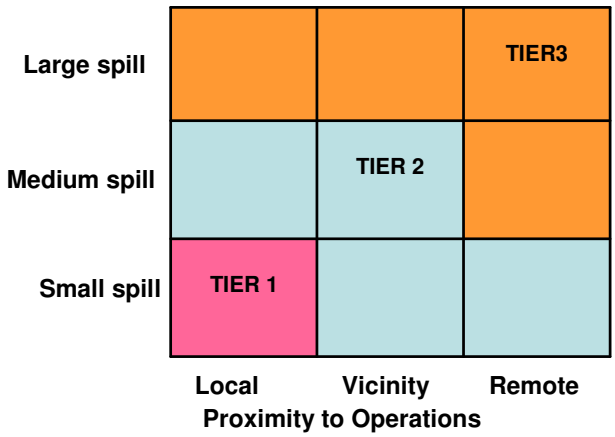

Figure 3 : Tiered preparedness and response.

Source: Guide to Tiered Preparedness and Response, International Petroleum Industry Environmental Conservation Association (IPIECA), 2007

Tier 1 Operational spills at an operator's facilities who is expected to respond with own resources.

Tier 2 Spills likely to extend outside the Tier 1 response area and may be larger in size requiring additional resources.

Tier 3 Oil spills causing major impact due to their scale and likelihood and demand substantial resources from national and international sources.

The process of defining these tiers of capability and their boundaries calls for a risk management study to ensure appropriate risk mitigation strategies (IPIECA, 2008).

2.8.2 Oil Spill Response Technologies

The capability to respond effectively to an oil spill is a combination of three factors – physical conditions at the time of an accident /spill, suitability, capability and availability of technology deployed and the skills, training and readiness of an organization / people responsible for combating the spill (US Congress Office of Technology Assessment, 1990). Thus, the technology available provides the limitations, if any, for any oil spill response operation to be successful. The oil spill response technology may be broadly divided into following categories:

- **Mechanical Response** According to Doeffer (1992), this involves mechanical recovery of spilled oil by a variety of techniques. It consists of containment booms which provide a mechanical barrier to floating oil by extending above and below the waterline. The clean up operations after containment of oil are carried out by removal of oil from the water surface by using mechanical devices called skimmers. These skimmers work on the principle of gravity (weir type), oleophile (sorbent type), suction, centrifugal and submersion and are suitable for different types of oil to be collected. There are also specially designed oil spill response vessels capable of operating in open ocean (US Congress Office of Technology Assessment, 1990).In addition, certain sorbent materials are also used to remove oil from the surface of water when oil is free floating and close to the shore or stranded on the shore.

- **Chemical Response** This involves the use of certain chemicals to act as surface tension modifiers and inhibit the spread of oil. However, the use of dispersants to mitigate oil spills has to be decided taking into account many factors including closeness to coast and depth of water.

- **In-situ Burning** Sometimes, burning the oil at sea (in-situ burning) is also resorted for oil spills in open sea and occasionally on stranded oil on shorelines.

- **Shoreline Clean-Up** When the oil contaminates the shoreline, it requires specialized equipments for clean up in addition to conventional manpower intensive manual cleaning and thus can be classified as a different response technique than a mechanical or chemical response undertaken at sea. It also involves the use of bio-agents to accelerate the natural biodegradation process of oil.

2.8.3 Oil Spill Response – Contingency Planning

While the technical aspects of dealing with a spill are clearly important, the effectiveness of the response of a major pollution event will ultimately depend upon the quality of the contingency plan and of the organization and control of the various aspects of the clean-up operation (ITOPF Handbook, 2009). However, it needs to be remembered that contingency planning in oil spill response involves measures of readiness which include recognizing the need for preparedness , allocating resources , gaining participation and then ensure continued effort, testing, evaluation and improvement as depicted in Figure 4 (IOSC,2008).

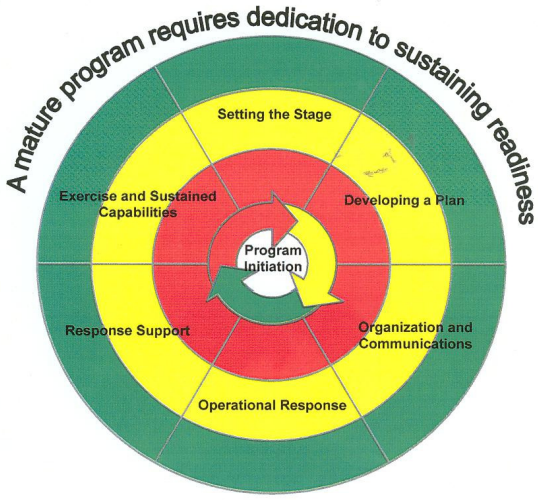

Figure 4 : Oil spill readiness.

Source: Assessment of Oil Spill Response Capabilities: A Proposed International Guide for Oil Spill Response Planning and Readiness Assessments, International Oil Spill Conference, 2008

Although there are requirements for such plans onboard a ship (tankers and certain non-tankers) in compliance with MARPOL 73/78 and the ISM guidelines, the most important aspect relates to the emergency preparedness of the various coastal states that are expected to build up and maintain emergency response capability for an oil spill as per OPRC, 1990.

The process of contingency planning involves three broad steps whereby first, the information is gathered, then interpreted and developed into appropriate strategies leading finally to the drafting of operational procedures. Figure 5 provides a schematic representation of this process.

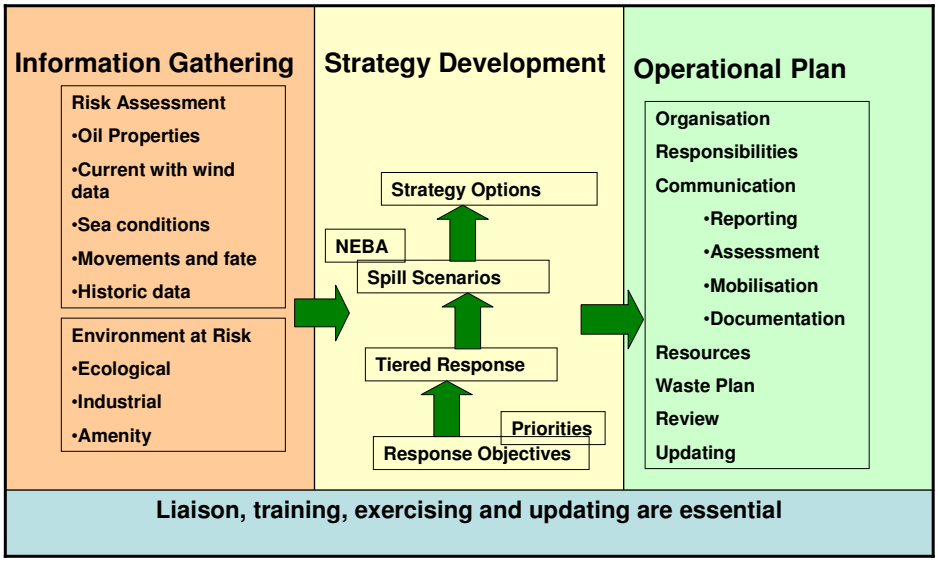

Figure 5 : Contingency planning process.

Source: A Guide to Contingency Planning for Oil Spills on Water, International Petroleum Industry Environmental Conservation Association (IPIECA), 2000

Some of the significant features of the plan include the following: (ITOPF; IPIECA etc.)

- Use of risk assessment techniques for defining risk criteria for resources, environment etc.
- Training and review of procedures is essential for continuous improvement.
- Selection and limitation of response techniques to be determined in various scenarios.
- Cooperative approach by all parties for effective response.

- Defining termination of clean up operation and final disposal options is critical.

2.9 Oil Pollution Compensation Regime

The peculiarities of an oil pollution response with very large financial costs involved in clean up, recouping economic loss and environmental restoration came into prominence in 1967 with the Torrey Canyon disaster which defied conventional liability and compensation rules for damage. Thus, it acted as a catalyst for the development of an elaborate international regime to provide compensation for pollution damage caused by spills from oil tankers in the form of the International Convention on Civil Liability for Oil Pollution Damage,1969 and International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage,1971 (Jacobsson,2003).

2.9.1 International Convention on Civil Liability for Oil Pollution Damage, 1969(CLC) --

This governs the liability of ship-owners for oil pollution damage and lays down the principle of strict liability and compulsory liability insurance. However, they are allowed to limit their liability in certain circumstances to an amount related to the tonnage of the ship (Faure & HU, 2006). The convention was amended in 1992.

2.9.2 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 -

This established a system for compensating the victims of oil pollution when they are inadequately compensated under the CLC. It established an International Oil Pollution Compensation (IOPC) Fund to be managed by an inter-governmental organization and financed by contributions from specified oil receivers depending upon the quantities of oil received by them after sea transport. The convention was amended in 1992 and further a supplementary fund was also created in 2003 for additional compensation. The operation of the scheme is represented in the Figure 6.

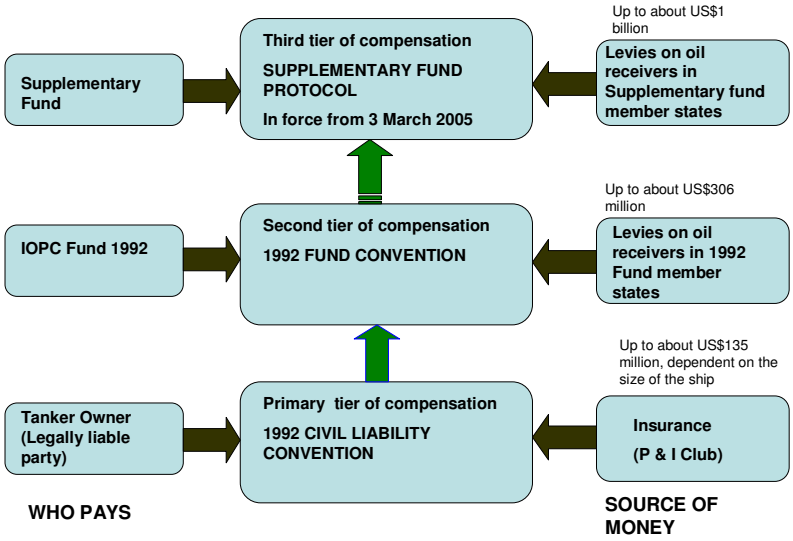

Figure 6 : Three levels of compensation.

Source: Action against oil pollution, International Petroleum Industry Environmental Conservation Association (IPIECA), 2005

2.9.3 <u>International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001</u> The compensation regime for oil pollution damage mainly focused only on tankers for oil carried as cargo. However, the drastic increase in the size of all types of ships has enhanced the potential for a major pollution incident being experienced even due to a bunker oil spill by a large non tanker ship. Thus, the International Convention on Civil Liability for Bunker Oil Pollution Damage was developed which recently entered into force in November 2008. It provides a mechanism for compensation to victims who suffer damage caused by spills of oil carried as fuel in ships bunkers. It is modeled on the CLC, 1969 maintaining the principles of strict liability and compulsory insurance (IMO, 2009).

2.9.4 <u>Oil Pollution Act, 1990</u> The United States is not a party to the international compensation regime discussed in the preceding paragraphs. The Oil Pollution Act, 1990 provides the general framework for the same; however, individual states sometimes have more stringent oil spill laws (ITOPF, 2009). The potential compensation available under OPA, 90 is similar to that of the international compensation regime (IPIECA, 2005).

2.10 Trends in Oil Spill Incidents

There is no comprehensive global database available which maintains statistics of oil spill incidents caused by shipping. However, the database maintained by ITOPF covering oil spills caused by oil tankers only is generally accepted as a reference by everyone for discussion on trends in oil spill incidents over the years and gauges the effectiveness of preventive and response measures. Table 2 shows that there has been a significant decrease in the number of large oil spills in the last thirty years and 2008 witnessed the least number of spills over 7 tonnes.

Table 2 : Number of spills over 7 tonnes.

Year	7-700 tonnes	> 700 tonnes	Year	7-700 tonnes	> 700 tonnes	Year	7-700 tonnes	> 700 tonnes
1970	6	29	**1983**	52	13	**1996**	20	3
1971	18	14	**1984**	25	8	**1997**	28	10
1972	48	27	**1985**	31	8	**1998**	25	5
1973	27	32	**1986**	27	7	**1999**	19	6
1974	89	28	**1987**	27	10	**2000**	19	4
1975	95	22	**1988**	11	10	**2001**	16	3
1976	67	26	**1989**	32	13	**2002**	12	3
1977	68	17	**1990**	51	14	**2003**	15	4
1978	58	23	**1991**	29	7	**2004**	16	5
1979	60	34	**1992**	31	10	**2005**	21	3
1980	52	13	**1993**	31	11	**2006**	11	4
1981	54	7	**1994**	26	9	**2007**	10	4
1982	45	4	**1995**	20	3	**2008**	7	1

Source: Oil tanker spill statistics 2008, ITOPF (2009b)

The seaborne trade of oil has been growing continuously with the consequent increase in movements of tankers. However, despite this increase in oil trading, a downward trend in oil spillage has been observed as is evident in Figure 7.

Figure 7 : Seaborne oil trade and number of tanker spills over 7 tonnes, 1970-2008.

Source: ITOPF (2009b).

CHAPTER 3

NORTHERN INDIAN OCEAN-RISK PROFILE FOR OIL POLLUTION AND ITS IMPACT

3.1 Introduction

The Indian Ocean has been defined as the area between latitudes 25 degrees north and 40 degrees south and longitudes 45 degrees east and 115 degrees east (Figure 8). However, the focus of this dissertation is limited to its northern part due to specific factors highlighted in succeeding paragraphs. The Northern Indian Ocean incorporating the Arabian Sea surrounded by the landmass of the Indian subcontinent, Middle East Asia and the eastern Africa has unique oceanographical characteristics and experiences high levels of seaborne traffic.

Figure 8 : Area covered by Indian Ocean.

Source: www.uknetguide.co.uk/.../map_indian_ocean.gif, 2009

Prior to the discussion on the risk profile for oil pollution in the area, the rationale of risk management has to be understood.

3.2 Rationale of Risk Management

Risk management involves a process where the risks associated with a particular activity or situations are studied in a particular context focussing on development of strategies for handling them. These broadly relate to measures applied for assessment of risk including identification of hazards & their evaluation and estimation of risk, the evaluation of risk and the risk control options and then approaching to effectively manage these risks (Elmer, 2003). An effective risk management strategy incorporates determining priority of the risks accordingly to their potential seriousness in terms of damage caused & likelihood of occurrence and not only developing control measures but also implement them by close monitoring thereby achieving the goal of proper risk management. Thus, it acts as a tool for maintaining an acceptable level of safety (Chantelauve, 2003).

It is important to note that the definition of risk incorporates not only the probability of occurrence of a hazardous situation, but also the consequences of that occurrence. Thus, all the factors that have an impact on these two domains have to be taken into account while developing a risk profile for the Northern Indian Ocean. Thus, the various factors will first be discussed in detail. Thereafter, their significance and inter-relationship with each other will be critically analysed to develop a risk profile. These factors are now discussed in detail.

3.3 Maritime Trade and shipping traffic

The skewed distribution of oil reserves in the world is striking as the major producers are not the major consuming nations, thus necessitating transport of large quantities[10] of oil across the globe. The world's main oil producing countries are located in the Middle East and thus a vast amount of oil originating from the oil terminals at their ports flows towards the consuming nations transiting the ocean. There are two important transportation routes for oil tankers in the Northern Indian Ocean. One of

[10] More than half of the global oil production is transported through oil tankers, Energy Information Administration, US, 2007.

these routes passes across the Arabian Sea along the Indian EEZ, round Sri Lanka, via the southern Bay of Bengal to the Far East. The other route goes through the strait of Mozambique, round South Africa to the western hemisphere (Gupta & Qasim, 2001). Figure 9 provides details concerning seaborne crude oil trade routes in the world.

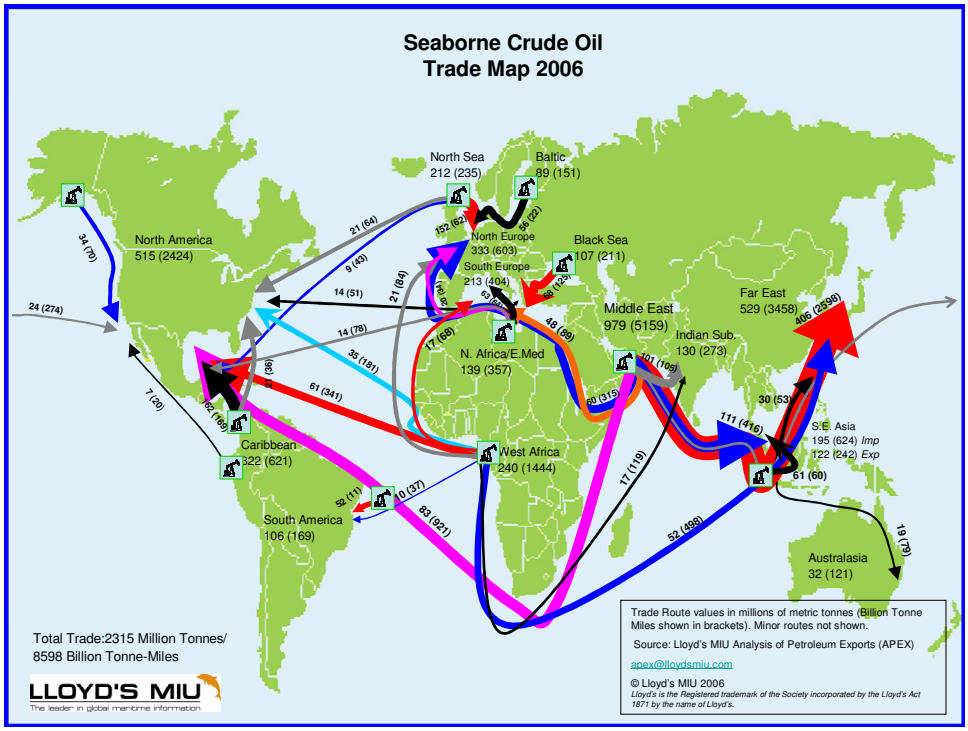

Figure 9: Movement of oil through sea.

Source: Lloyd's Marine Intelligence Unit, 2006

It is estimated that about a half to two-thirds of the global marine transport of oil is carried along these two tanker routes. Although, generally not many major accidents or oil spill incidents have been observed and not too frequently, there have nonetheless been a few accidents in the area. However, the operational discharges from ships including bilge, bunker and ballast washings also contribute significantly towards the quantity of oil entering the ocean.

According to the research carried out by Japan Oceanographic Data Centre on the presence of oil slicks in the Northern Indian Ocean, as quoted by Gupta & Qasim, 2001, about 83.5 percent of the total observations turned out to be positive. The data of all observations in the entire Indian Ocean is depicted in Figure -10 (Qasim, 1998).

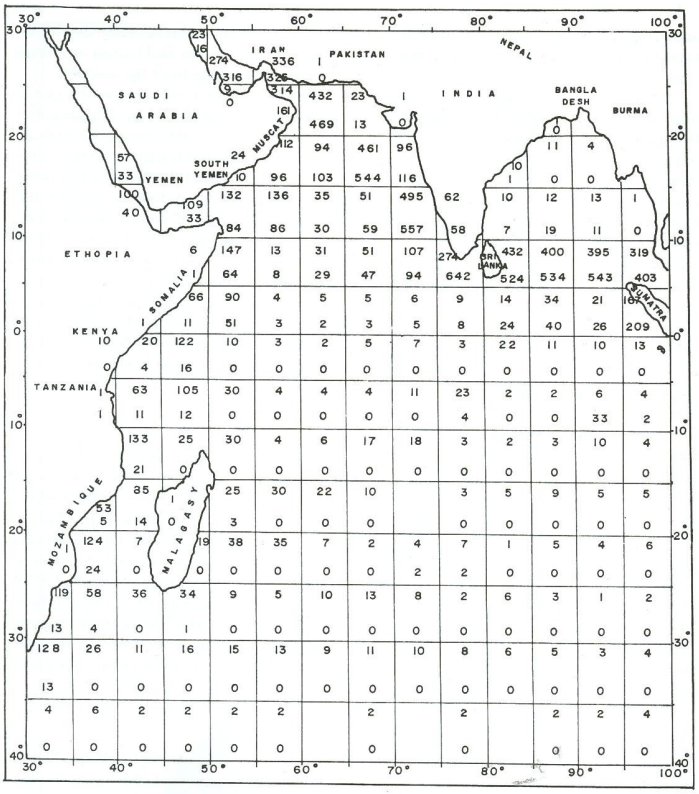

Figure 10 : Observations on oil slicks and other floating pollutants every 5 degree square in Indian Ocean.

Source: The Indian Ocean –A perspective, Sengupta & Desa, 2001

This also reinforces the fact that the oil slicks are quite frequent along the tanker routes of the Northern Indian Ocean, while south of the equator, there is hardly any trace of oil pollution. This analysis fairly corresponds to the density of oil tanker traffic as depicted in Figure 1 where the region experiences one of the highest concentrations of tanker traffic in the world.

In addition to the tankers, the region also witnesses other shipping traffic transiting the area. The conventional traffic has also experienced a drastic increase due to the economic resurgence of the surrounding countries especially India and other Asian economies in recent years .The growing need for movements of more merchandise across the shipping lanes to support the increasing appetite of industries and consumers has resulted in escalating the overall conventional shipping traffic in the area. This increased traffic combined with existing heavy tanker traffic contributes to the high density of shipping in area and further enhances the risk of marine accidents.

3.4 Global Hub for Ships Recycling

The region can also be termed as the hub of ship recycling industries in the world with major recycling yards located on the Indian subcontinent. The combination of increased demand of steel for industries, availability of low cost labour and minimal safety and environmental standards has catapulted the region into a major recycling destination. The leading recycling countries in the world are Bangladesh, India and Pakistan as depicted in Figure –11.

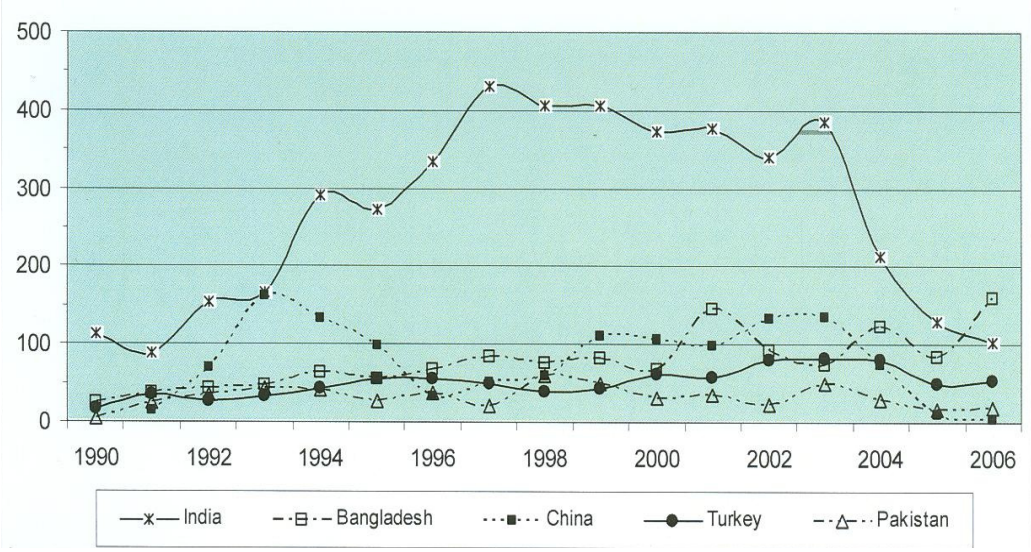

Figure 11 : Leading ship recycling countries.

Source: A statistical overview of ship recycling, Mikelis, 2007

During 2008, a total of 654 vessels with a tonnage of 11.5 million dwt were reported to be broken up which was 58 percent more than that in 2007 (ISL, 2009b).The phasing out of single hull tankers from the world fleet as per the schedule adopted by IMO will also drastically increase recycling of these vessels in coming years. The current economic crisis has also forced the ship-owners to consider scrapping ships as an option to ride the bottom phase of the shipping market cycle.

A majority share of these vessels land in the Indian subcontinent for recycling transiting the region. It is important to note that , most of such vessels proceed under own power on their last voyage to the final destination in a ship recycling yard and barely adhere to the safety and environment protection regulations including adequate manning required by the relevant international instruments. Thus, it increases the risk

of marine casualty in the region due to grounding, collision etc. resulting from the operation of these unseaworthy ships. Though, no major casualty or oil spill incident has been reported involving such vessels, a number of minor incidents have been observed including some near-misses. The countries have undertaken a few measures to ensure knowledge of the condition and voyage details of these vessels in advance to minimise such incidents. However, these are generally routine, administrative procedures and given less priority by the maritime safety and environment protection administration. Consequently, these vessels pose a certain risk for being involved in a marine accident especially during bad weather or the local monsoon season.

3.5 Ecologically Sensitive Area

The region encompasses unique marine ecosystems supporting rich biodiversity of flora and fauna in addition to providing habitats for important species to flourish. Though a majority of the world's mangrove area (over 47 percent) containing 85 percent of the world's mangrove species lie in the Indian Ocean, the northern part accounts for a significantly less proportion of these habitats. However, there are significant mangrove areas located around the coasts of India, Pakistan and Sri Lanka with scattered areas around the arid regions in the northernmost part close to Yemen, Oman and UAE (Kathiresan & Rajendran, 2004).It is important to note that most of these regions lie close to the shipping routes transgressing the area thereby posing an enhanced risk regarding oil pollution severely affecting these marine habitats.

Further, a number of sensitive and fragile ecosystems e.g. coastal and backwater lagoons, mudflats and estuaries are also located around the area (Schwartz, 2005). These ecosystems support a fine balance of a variety of species to coexist and sometimes also integrate breeding grounds. The area also encloses the low lying atolls on the Lakshadweep- Chagos ridge with abundant coral reefs. These areas have been found to contain one of the largest numbers of species in the region (McClanahan, Sheppard & Obura, 2000). It reinforces their importance not only as an environmental conservation issue but also as a major contributor towards coastal economy of these areas which are highly dependent on tourism. Thus, any oil spill in the area is likely to have a devastating effect over the region's fragile coastal economies.

Since the northern part of the ocean is landlocked from three sides by the continental masses of Asia and Africa, any major oil spill in the area is likely to persist for a longer duration of time compared to a relatively open ocean in the southern part where it may be easier to be drifted away by ocean currents and wind.

Though there are no designated Particularly Sensitive Sea Areas (PSSAs) in the Northern Indian Ocean, there are many designated marine protected areas especially along the coasts of India and Pakistan. These areas are critical both in terms of ecosystem processes and its properties. These are crucial to the health of marine ecosystems due to their highly productive capacity to contribute to the food chain and support breeding cycles, spawning grounds, migratory corridors etc. (McNeely, Harrision & Dingwall, 1994).

3.6 Geographical Factors Affecting the Risk of Oil Pollution

The area comprises a geographical region which is subject to various weather phenomena resulting in frequent harsh weather conditions. The effect of the tropical monsoon season coincides with the annual cycle of origin of tropical cyclones, thus accentuating the combined effect to create extreme weather in the area. Though the number of cyclones generated in this region is comparatively much less than other regions of the world, their impacts are relatively very high and devastating especially close to coast (SAARC, 2008). Incidentally, it has also been observed that during the past three decades, the number of severe tropical cyclones (Category 4 and above) has increased sharply from 8 percent to 25 percent in the Northern Indian Ocean (SAARC, 2007). This will definitely result in directly increasing the hazard exposure in open areas in ocean as well as in coastal regions where the effects are further compounded due to the vulnerability for development of storm surges. The climate change and the rise in sea temperatures will lead to more intense cyclones which may occur even in regions which have not historically suffered cyclones (United Nations, 2007). Thus, the high traffic density in combination with the landlocked ocean area and the probability of increased frequency of severe weather phenomena enhances the risk of a major disaster in the region. Incidentally, the 2006 season witnessed 18 incidents of grounding or sinking of ships in Indian waters, which demonstrates the gravity of the

problem. Details of the incidents are given in Figure 12. It is clear that incidents are spread out along the both the coasts with a larger number occurring on the west coast of India (ICG, 2007).

Figure 12 : Incidents of grounding or sinking of ships in Indian waters.

Source: Blue Waters, Indian Coast Guard, 2007

Although, these incidents have fortunately resulted in only minor oil spills in some cases, the Tasman Spirit oil tanker which grounded off Karachi harbour in Pakistan in 2003 during severe weather in the monsoon season resulted in a major oil spill in the area.

Thus, the vulnerability of shipping traffic to these specific weather and geographical conditions reinforces the requirement for a comprehensive strategy for reducing the risk by improving forecasting methods, dissemination techniques for weather information, arrangements for providing assistance to ships in emergency situations, e.g. places of refuge etc. and capacity building in oil spill response in surrounding countries. However, there is no common national or regional initiative on these lines developed in the region. Therefore, it raises the risk profile of the region against a marine casualty in general, and oil spill incident in particular.

3.7 Inefficient implementation of pollution prevention measures

It is widely accepted that adequate enforcement of oil pollution prevention measures contributes positively in minimising the risk of pollution and its consequences. These measures include not only the legislative instruments and policy directives, but also effective monitoring activities such as inspections and measuring compliance. However, it is important to note that the efficacy of these measures should focus on the intentional as well as accidental discharges from the ships.

3.7.1 Older and Single Hull Vessels

The countries surrounding the northern Indian Ocean consist of a wide range of maritime states with differing levels of marine activities. However, a majority of countries have a relatively less stringent inspection regime, both as flag state implementation (FSI) and as the port state control (PSC). Thus, it is a frequent and prevalent practice by ship-owners to deploy such ships in the area which are older and relatively sub-standard ships. These ships are generally withdrawn from the highly regulated and stringent areas like Europe, to take advantage of the inefficient inspection regime prevailing in the region. Though , there have been a few countries like India which has set an age restriction of 25 years for foreign ships entering its territorial waters, most of the countries have no such measures to regulate quality of ships in their waters. Even in the case of India, the effectiveness of the ban is questionable as it excludes many categories of ships including oil and product tankers, and also exempts Indian registered ships (WSJ, 2006)

Further, the region has also not witnessed any activity towards regulating the single hull tankers transiting the area. Though, there have been basic arrangements for adhering to the IMO mandated deadline for phasing out of these tankers, the countries have not displayed any proactive approach in this field compared to certain countries in Europe e.g. France, Italy, Spain, etc., which have banned single hull tankers from entering their ports if they are carrying specific types of cargo regarded as worst pollutants (INTERTANKO, 2009).

3.7.2 Provision of Reception Facilities

A major contribution towards reduction of marine oil pollution, including the avoidance of many illegal discharges, would be the provision of proper waste reception facilities – adequate in capacity & scope, affordable and readily accessible (Swift, 2005). The major ports and terminals in the region generally provide for a provision for such facilities. However, most of the ports and terminals either have a nominal or minimal facilities or lack sufficient capacities. Further, there are considerable shortcomings in enforcing the provisions regarding illegal discharges by the port states thereby providing no deterrence to the crew of the ships against such intentional acts or discharges. Thus, there have been concerns expressed recently about the number of illegal discharges from the large volume of shipping within the region (Ingole & Sivadas, 2007).

It is evident that there is a direct relationship between the adequate provisioning of accessible facilities for reception of oily wastes at ports and terminals and the incidents of intentional discharges at sea. However, it has to be remembered that a majority of shipping in the region including the tankers is a transiting traffic and do not enter into the ports located within the area. Thus, the contention of the argument for sufficient reception facilities has to be critically evaluated and weighed against this traffic not being affected by such efforts. Incidentally, the positive concerns towards this issue to prevent illegal discharges are likely to contribute towards raising awareness about the environment protection and generate an encouraging response on such matters. It would also promote the development of a mechanism supporting prevention of such acts by all ships including inbound, outbound or transiting traffic in the area.

3.7.3 Lack of Strong Enforcement Mechanism

The region does not have any national or coordinated mechanism or agency that effectively monitors the intentional discharges, investigates the defaulters and undertakes enforcement of sanctions or penal actions. For example, in the

case of the United States, the Coast Guard is highly effective and empowered to take such measures and is authorised to even impose certain monetary fines on the polluters (Cohen, 2004). Most of the countries in Europe, Japan and Australia also have regular surveillance arrangements by their respective agencies to monitor the area around their coasts for any oil spills including illegal discharges by ships. Any oil slick located at sea is traced back to the defaulting ship and processed for legal or monetary sanctions. Such coordinated acts incorporating regular patrol and follow up not only create a deterrence effect on subsequent defaulters but also contribute in inculcating a sense of fairness towards those ships that comply with the accepted environment friendly policies and regulations. Though there are national agencies and organisations responsible for oil spill response in respective countries in the region, most of these neither possess technical resources nor are legally empowered to initiate these proactive measures.

3.8 Developing Economies – Competition for Resources

Though the economic prosperity of a country or a region does not directly affect the risk profile for an oil pollution incident, it may be considered as an influencing factor while evaluating the consequences part of the risk equation utilized for undertaking risk assessment in the area. Thus, a similar incident of oil pollution may have vastly different consequences at two different places depending upon the effect it causes on the economy of the coastal community and the resources available for mitigating its effects.

The Northern Indian Ocean region is surrounded by countries which are largely developing nations with many of them struggling to balance the need of resources for basic developmental need and effectively meeting the environmental concerns. They have a large population which is depending on the sea and coastal areas for their survival. Millions of people (more than 2.5 million in India) are directly or indirectly engaged in the production of fish with a significant percentage of fishermen in the world located in this region (FAO, 2008).

Further, Maldives, a small island country, totally depends on coastal tourism for major part of the revenues to fund its national budget. In addition, other countries in the region also have a significant tourism industry engaged in coastal tourism with millions of people involved in these activities. Thus, any major oil spill incident will result in not only an environmental disaster in the region but also in devastating effect towards these economic activities. Infact, the economic effect may have a longer term implication than the environmental one as, even after the restoration of the environment, the lack of resources would severely restrict the revival of coastal communities towards sustainable economic enterprises. Though, the relatively prosperous regions are also likely to suffer enormous damage, the effects would be much lesser due to availability of resources and diversified economic activities. In contrast, most of the population in these developing countries under risk are involved in subsistence activities and have limited or no alternative source for their livelihood in case of any deterioration of sea and coastal areas. Thus, such an incident can wipe out the livelihood of millions of people.

The lack of resources also severely restricts quick and efficient response strategies in case of an incident thereby accentuating the negative impact and delaying restoration and recovery. The provisioning of necessary infrastructure for dealing with such contingency would suffer due to high cost involved and lack of technical expertise.It is obvious that the constraints of resources also have a significant effect in overall perception of the society about the risk involved in a particular scenario depending upon its relative importance. Thus, the issue of environment protection in general and marine oil pollution in particular is usually not considered as a priority area vis-a–vis the requirement of resources for critical problems such as education, healthcare, food security and child welfare. The key validation regarding poverty alleviation taking precedence over other activities is illustrated by Table 3 which lists the human development index ranks of the selected countries in the area along with the percentage of population below the national poverty line.

Table 3 : Percentage of population below poverty line & HDI index rank.

Sr no.	Country	Population below poverty line	HDI Rank
1.	Bangladesh	40.0	140
2.	India	28.6	128
3.	Maldives	NA	100
4.	Pakistan	32.6	136
5.	Sri Lanka	25.0	99
6.	Yemen	41.8	153

Source: Compiled by Author with data obtained from Human Development report 2007-2008, United Nations Development Programme, 2007.

This competition for resources negatively influences the provisioning of funds and efforts towards essential but relatively less popular activities such as pollution, environment protection, etc.

The overall effect of these circumstances impinges on the risk matrix and progressively increases the risk in respect of an oil pollution incident by improperly amplifying the consequences domain. Moreover, the intricate web of interdependent factors creates a situation where the economic prosperity of the state plays a considerable part in developing a mechanism for oil pollution prevention and response in a strange but unique way.

3.9 Geo-Political Factors Affecting Oil Pollution Risk

The region encompasses distinctive geopolitical factors that also generate an influence in the development of risk profile of an oil pollution incident. The area towards the eastern boundary comprising South Asian countries of the Indian subcontinent is politically stable and does not possess any significant issues of concern. However, the countries in the northern part comprising Middle East are relatively volatile with not only internal but also external political tensions prevailing. There have been a number of major events that impacted shipping traffic in the area over a period of time. One of the most important and uncharacteristic development was experienced during the

closure of the Suez Canal first in 1956 and then for a much longer period between 1967 and 1975 (Suez Canal Authority, 2009). Thus, all the shipping traffic in the area was routed around the African continent thereby affecting traffic density in the Northern Indian Ocean. Though, the political and diplomatic considerations have changed significantly in today's context, the fragile relationship between Israel and the Arab world even today, point towards the possibility of such closures again. As much of the tanker traffic passes through the canal, any disruption in the canal passage in turn affects the shipping in area. Apart from these closures of the canal due to political tensions involving the host country, Egypt, the prolonged war between Iran and Iraq in the 1980s also resulted in the traffic in the canal being affected considerably. Incidentally , the region still remains in a fluid state , if not similarly volatile as earlier, with political and diplomatic tensions and stand-offs quite common among neighbouring countries .

The intricacies of the geo-political factors transgressing environmental arena were specifically evident during the First Gulf War in 1991 when Iraqi soldiers dumped thousands of tonnes of oil from a loading dock in Kuwait into the Persian Gulf. This irrational act resulted in one of the largest oil spills ever in the recorded history (Ingole & Sivadas, 2007). The effects of this spill were experienced largely off the coasts of Saudi Arabia but the effects were felt throughout the region, beyond the Gulf area even up to the Indian coast and created long term ecological, environmental and economic consequences.

The region also experiences an unusual situation in respect of Somalia, where no political governing administration retains control over the state. Thus, the state is functioning without an effective government for the last many years, thereby leaving a large coastal area and surrounding waters without any control and monitoring. This gap in the implementation of maritime safety and environment protection measures in such a large area definitely affects the adjoining areas in the region in ensuring compliance of such measures.

The current situation in Somalia has resulted in another problem affecting the maritime field. There has been a sudden jump in the incidents of piracy and hijacking of vessels transiting the area and now it has the notoriety of being the hot spot of

maritime piracy. The incidents have become so common that many shipping companies have started considering routing of their vessels around the Cape of Good Hope and avoiding the area completely. Thus, these events have succeeded in creating an effect in influencing the traffic pattern in the region in the short term. Though, these incidents have not resulted in any casualty to the ship resulting in collision, grounding or sinking, the frequent use of heavy military style weapons like rocket launchers, heavy machine guns, grenades, etc. by these pirates might sometime result in damage to the ships hull resulting in leakage of bunker or cargo oil leading to catastrophic results.

The circumstances become more complicated due to notable existence of terrorist activities in some countries of the region. Though lying dormant in recent years, the bombing of USS Cole at Aden harbour in Yemen in 2000 (Figure 13)and of the French oil tanker Limburg in the Gulf of Aden in 2002 highlights the risk of such events.

Figure 13 : USS Cole at Aden harbour after the terrorist attack in 2000.

Source: www.globalsecurity.org, 2009

Any such terrorist attack on a super tanker might result in disastrous consequences in the area. The strategy of a terrorist organisation to engage in an activity with maximum effect for a small effort to have a global publicity compliments the selection of targeting maritime shipping, especially a VLCC, in area.

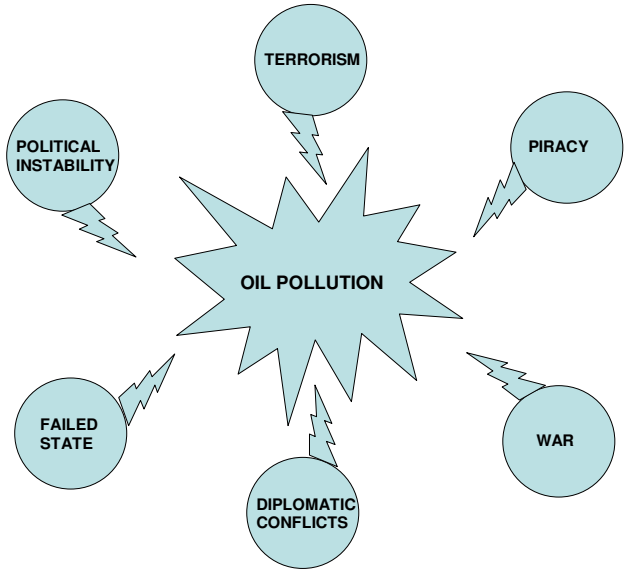

Figure 14 : Geo-political factors influencing risk of oil pollution in Northern Indian Ocean.

Source: Author, 2009

The combination of politically and diplomatically fragile relationships among neighbouring states, a failed state, piracy infested waters , conflict prone area and probable terrorist activities create unique geo-political conditions unlikely to be duplicated anywhere in the world as shown in Figure14. Though , the probability of any of these factors is quite low or even negligible in certain cases , the high costs involved in the consequences of even a single event definitely forces us to take it into consideration for developing risk matrix in the area. A single event has the potential to topple the balance of the risk equation evolved after careful research of all conventional factors as these asymmetric factors provide an uneven and lopsided weightage towards determination of the risk.

3.10 Developing Risk Profile by Analysing Contribution of Various Factors

The discussion in the preceding paragraphs highlighted some of the key parameters that influence the development of risk profile for an oil pollution incident in the Northern Indian Ocean. These factors traverse through a wide domain for identification of hazardous situations that impact on the probability of the occurrence

and the severity of the consequences of such an incident. Though some of these factors seem to suggest an independent profile or existence, most of them actually define a relationship of interdependency with a few others. Thus, the analysis of the overall situation needs to address the issue in the context of individual aspects correlating with the combination of these factors.

The most striking aspect among the information available about the region is the existence of one of the busiest shipping traffic area in the world. This is specifically evident from the two major tanker routes passing through the area. It is also undisputable that both of these routes together carry a significant proportion of oil coming out from the ports of the largest producers of oil in the world located in the Middle East. Hence, the presence of a large number of tankers transiting the area at any given time certainly contributes in enhancing the risk of any marine accident. The tanker traffic is again combining with the other normal shipping in the area to create even more dense shipping in the region, thus, further enhancing this risk. However, the risk for the marine accident needs to be distinguished from the risk of oil pollution. The two are definitely interrelated but are not the same. The risk equation regarding probability and consequences can be applied in such a scenario to determine the difference between the two. In this case, not only there is high probability of a marine accident occurring in the area due to high traffic density, but also the presence of a disproportionately large number of tankers among these ships drastically increases the probability of an oil pollution incident. Incidentally, such an incident is likely to be much more severe due to the likelihood a large quantity of oil spilled at sea from the oil cargo tanks compared to the situation when a non-tanker ship is involved in such an accident. Thus, due to this cumulative effect, the risk for oil pollution becomes relatively much higher than the risk for a marine accident in the area.

However, this discussion does not preclude the contention that traffic density alone cannot be considered as a predominant factor in causing an accident at sea. It can surely be argued that there are other contributing factors equally or at least significantly important which influence the risk of an accident. Thus, we have to consider these factors in our area now to determine how much they contribute towards increasing or decreasing this risk.

The most important of these factors is the weather conditions experienced at sea. The vagaries of the monsoon season and the tropical cyclones have been discussed earlier which generate severe weather conditions annually in Northern Indian Ocean. Despite the contention of an increase in the harsh weather conditions due to the increase in the frequency of the severe tropical storms in the recent years, it needs to be considered against the fact that the average weather conditions experienced in the region are relatively less severe than those prevailing in other oceanic areas. The root of this argument is based on two main aspects which define the weather conditions at sea – generation of cyclonic circulations leading to very rough weather and the average wave height experienced in the area. Let us look into these aspects more closely to draw a justified inference. Firstly, the region generates the lowest number of cyclones compared to any of the other oceanic regions (less than 4 percent). Further, even after the increase in the frequency of severe cyclones reported in recent years, there are still only 7 such cyclones (category 4 and above) experienced in the last 15 years. In comparison, the Southern Indian Ocean generated 50 such cyclones in the same period (SAARC, 2007). The number of severe cyclones generated in various oceanic areas in the last 15 years is shown in the Table 4.

Table 4: Change in number and percentage of Hurricane/Cyclone.

Basin	1975-1989		1900-2004	
	Number	**Percentage**	**Number**	**Percentage**
East Pacific Ocean	36	25	49	36
West Pacific Ocean	85	25	118	41
North Atlantic	16	20	25	25
South West Pacific	10	12	22	28
North Indian	1	8	7	25
South Indian	23	18	50	34

Source: South Asian Disaster Report, 2007

Secondly, the average wave height experienced at sea in the region is relatively quite low at 2 to 3 metres which indicates that the general sea conditions prevailing in the area are moderately calm and not severely rough except during cyclonic disturbances.

In comparison, the south Indian Ocean experiences the biggest waves on the planet averaging up to 7 to 8 metres with occasional waves twice this height. The northern Atlantic Ocean also witnesses waves of average height of 5 metres (Anthoni, 2000). The average heights of the waves in various regions of the world are depicted in Figure 15.

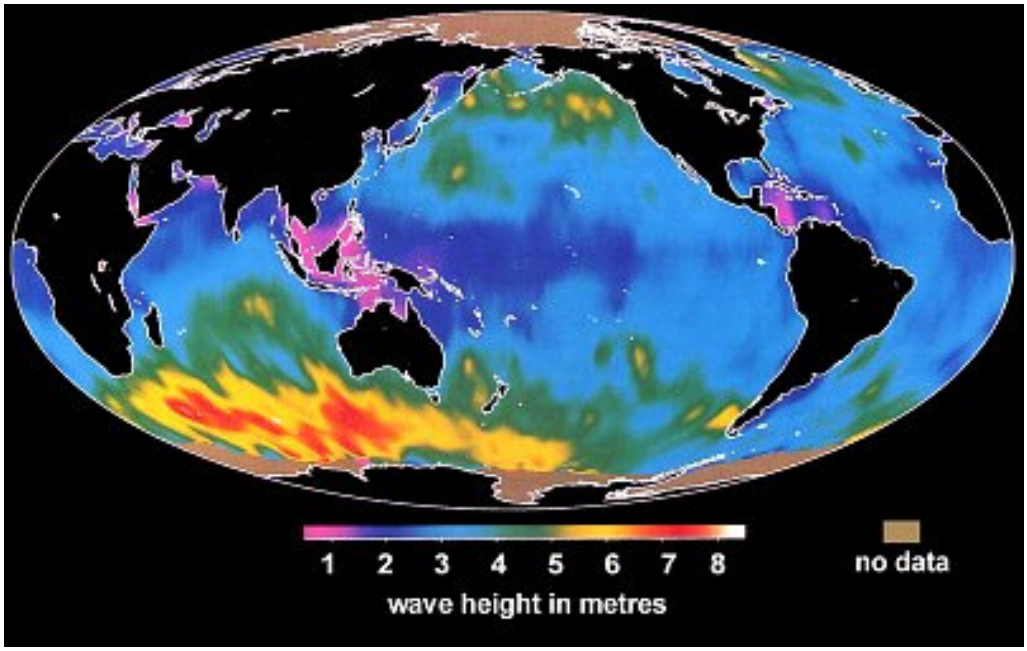

Figure 15 : Average heights of the waves in various regions of the world.

Source: Oceanography: waves theory and principles of waves, how they work and what causes them, Anthoni, 2000

Thus, it is observed from Figure 15 and Table 4 that the northern Indian Ocean is a relatively calm sea area where the weather and sea conditions are way below being abnormal and harsh for a major part of the year. These conditions may worsen for a short duration of time during an occasional (but not very frequent) storm generated in the area. Hence, the weather conditions do not significantly contribute to the risk of an oil pollution incident in the region.

The quality of the shipping in terms of sub standard ships operating in the area is also one of the important considerations in determining the risk of an accident. It can be regarded as an independent factor as well as having a certain influence on the traffic density. The presence of major ship recycling centres in the Indian subcontinent leads to a constant flow of ships on their last voyages passing through the area. Most of these ships certainly can be classified as fairly unseaworthy creating a hazardous

situation. With the increase in the number of these ships due to the requirement of phasing out of the single hull tankers, the problem is expected to become more compounded in the short term. However, the threat posed by these vessels has to be examined and evaluated with respect to their impact on the overall risk situation in the area. It is estimated that over 50000 ships pass through this region every year. On the other hand, only a few hundred vessels (less than 1 percent) transit the area bound for the recycling yards. Further, most of these ships carry a quantity of fuel oil barely sufficient to meet the demand for undertaking their last voyage and do not in itself pose a risk of a large oil spill in case of an accident due to their un-seaworthiness. Thus, they can cause significant damage only if they are involved in a major collision with other vessels operating in area causing damage leading to oil pollution from these vessels. However, with such a negligible presence, the probability of such an event is extremely low, though consequences of which may certainly be much higher. Thus, it is fair to consider the risk contribution by these vessels to be reasonably low.

The other aspects which impinge on the quality of shipping are the comparative lacuna in inspection regime by maritime states, limitation of policy initiatives to root out old and substandard ships and insufficient enforcement powers. These issues are related not only to the technical expertise and legitimacy of intent of various countries involved for substantive action, but also the economic constraints and developmental pressures not related to maritime interests. The reality of environment or maritime issue being sidelined for other priority areas needs to be accepted for these developing countries. Thus, the overall impact of such a situation is certainly a negative influence on the risk profile in this case. It is especially true in the case of intentional discharges by ships due to insufficient capacities in reception facilities or flaccid enforcement mechanisms. The combined effect can be considered to pose a relatively medium risk for an oil spill incident in the area.

The existence of ecologically sensitive area in the region has been discussed and the hazard to these areas cannot be always quantified in terms of economic and social costs. The comparison of the area with other oceanic areas of the world brings out that the biodiversity and marine ecosystems existing in the area conform to the world average. Though there are no PSSAs designated in the region, and the presence of

mangroves or other such sensitive habitats are also limited, the long term impact of any oil spill on them makes for a high risk criterion.

The presence of unique combination of geo-political factors in the region cannot be compared with any other region of the world. The inter-relationship of these factors creates a high risk, though with low probability but disastrous consequences, for a situation of oil pollution in the area. The mishap prone area due to conflicts, piracy or terrorism substantially poses a challenge for the development of any risk criteria due to highly uncertain circumstances as well as consequences. However, despite this difficulty, it is safe to consider it as a medium risk situation in our context.

Thus, the overall risk profile for an oil pollution incident can be developed by summarising the discussion in the Table 5.

Table 5 : Development of risk profile.

		Risk Classification				
Probability	**Severity of Consequences**	Minimal	Minor	Moderate	Major	Catastrophic
Frequent		Low	Low	Medium	**High**	**High**
Probable		Low	Low	Medium	**High**	**High**
Occasional		Very Low	Low	Medium	**High**	**High**
Remote		Very Low	Very Low	Low	Medium	**High**
Improbable		Very Low	Very Low	Low	Medium	**High**
Incredible		Very Low	Very Low	Very Low	Low	Medium

Source: Clinical Risk Assessment Criteria, Retrieved from World Wide Web, 17 August 2009, events.london.nhs.uk/events/uploads/appendix_c.doc

The data can be evaluated against the concept of ALARP (as low as reasonably practicable) matrix which determines the level of risk acceptable to the society. The concept provides for the need for undertaking measures for reducing the risk to as low as reasonably practicable by taking risk reduction or control measures.

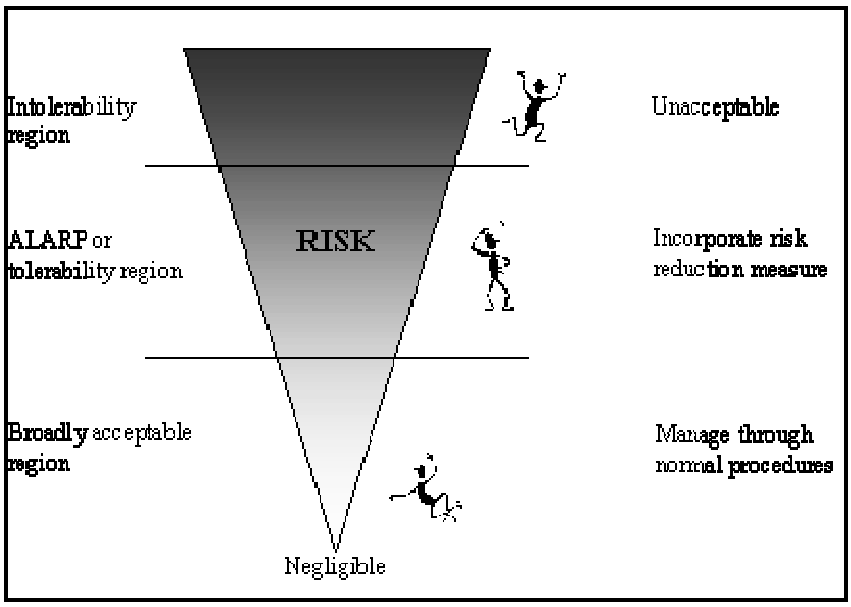

Figure 16 : ALARP Matrix.

Source: http://www.aribaproject.org, 2009

Thus, Table 6 and Figure 16 show that the risk of oil pollution incidents falls in the ALARP or tolerable region. This necessitates the requirement for the countries in the region to implement measures for reduction of this risk. These measures include the provisioning of oil spill response capabilities in addition to implementing adequate preventive measures to reduce the risk of oil pollution. Thus, an efficient oil spill response mechanism acts as a suitable risk control and reduction system enabling reduction of overall risk of oil pollution in area.

CHAPTER 4

EXISTING MECHANISMS – OIL SPILL RESPONSE IN NORTHERN INDIAN OCEAN

4.1 Introduction

The Northern Indian Ocean has been found to have a medium risk for an oil spill incident with a few distinct zones of relatively higher risk as discussed in Chapter 3. There are a number of measures that have been undertaken by the surrounding countries in the region to minimise this risk. These include certain preventive measures to influence the probability of occurrence of an oil spill and active measures for response in combating it to limit its consequences. The present chapter addresses the issue of the existing mechanisms for response. However, certain preventive measures that have a direct bearing on the response arrangements have also been included in the discussion. These include legislative framework, and liability & compensation regime.

As discussed earlier, there is a lack of data, information and literature concerning the Northern Indian Ocean especially regarding oil pollution. Hence, the author attempted to address the issue of insufficient data by directly approaching various sources of information. These included maritime administrations, oil spill response agencies, and national environmental agencies, regional organisations working in the field of oil pollution, academic institutions and ocean research institutes. Although the author was moderately successful in his endeavour, some of the information was shared in private capacity and not available in public domain. Thus, it will be used without a citation or reference for ethical reasons.

The area of study encompasses a number of countries which have distinct requirements of oil spill response depending upon the risk, availability of resources and capabilities. Thus, it is necessary to divide the area into certain subgroups to discuss the effectiveness of response arrangements. There are two approaches that can be considered. Firstly, the countries can be grouped into three categories – large oil producers, large oil consumers and others. The main oil producers located in the Middle East have a different requirement for response arrangements influenced by a greater risk than a major consumer like India. However, this approach does not provide sufficient flexibility for a critical discussion on all aspects influencing the capabilities of response. Further, it does not address the domain for regional or bilateral cooperation which are essentially organised on the basis of geographical locations. Thus, it is preferable to turn to our second approach in dividing them into groups selected on geographical basis - South Asia, Middle East and North East Africa. This will certainly be more appropriate for discussion on local parameters influencing the area. The list of major oil spills from tankers, experienced in the region is placed in Appendix 'B' for reference.

The author has identified that in order to successfully respond to any type of emergency, including an oil spill incident, there are four essential requirements:

(a) Well defined organisational structure with clear designation of responsibilities for launching response.
(b) Comprehensive plan addressing all contingencies.
(c) Availability of adequate equipment and other resources.
(d) Technical expertise in terms of adequately trained personnel.

Hence, the response capability of various countries has been examined under these broad parameters with certain other relevant issues included in some cases which affect the overall response capability. These include the legislative framework to support response infrastructure and financial issues especially the recovery of costs in case of liability by a third party.

The discussion initially focuses on the capabilities of national arrangements of the individual countries and later includes the support provided by the industry or private organisations and the regional cooperative arrangements. Finally, the arrangements

existing in two other oceanic areas- North Sea and Baltic Sea have also been summarised to compare and contrast the capabilities existing in these regions with those in the Northern Indian Ocean.

4.2 Oil Spill Response Measures in South Asia

4.2.1 India

India is the largest country in the region with a coastline of 7500 km. It is a leading oil importer and also has some offshore oil development and production facilities located around the coast. The country has been in the forefront in initiating necessary measures to prevent and control marine oil pollution. The responsibility for implementing these measures and coordination of response activities in case of an oil spill was entrusted to the maritime administration i.e. the Directorate General of Shipping. The agency was tasked basically to implement MARPOL provisions and had minimal response capability. Thus, the coordination of response arrangements was transferred to the Indian Coast Guard in 1986 for efficient response. It provided an impetus in improving these arrangements. Although there was no international obligation for developing a National Oil Spill Contingency Plan, such plan was drafted in 1988 which identified the requirement of cooperation among various agencies and delineating of their responsibilities with nomination of a lead agency for overall coordination. The plan was approved in 1993 by the government and Indian Coast Guard was nominated as the Central Coordinating Authority for marine oil spill response (ICG, 2006).Thus, India was fortunate to have a system already in place to meet the requirements of the OPRC developed later by IMO and ratified by India.

Presently, India has a well developed national plan for oil spill contingencies integrated with the local and regional plans developed for specific ports, industrial facilities and other areas, which are regularly updated. The response is organised in a tiered response arrangement. The local ports, oil facilities and industrial organisations have the responsibility of setting up the capability to respond to a Tier-I oil spill in their area of up to 700 tonnes under the

supervision of the coast guard. The coast guard has developed a capacity to respond to a Tier-II oil spill of up to 10000 tonnes with three suitably equipped independent pollution response teams located in Mumbai, Chennai and Port Blair respectively to cater for any such incidents around the west coast, east coast and Andaman & Nicobar Islands respectively. It has a dedicated fleet of ships, helicopters and aircraft to support such operations and incidentally is shortly inducting three large specialised pollution response vessels in its inventory. It has developed arrangements to solicit cooperation and assistance for tackling a Tier-III oil spill in Indian waters and is also planning to augment its own capabilities. A large stockpile of equipment is also maintained by private organisations in the country (ICG, 2006).

The country also has a high technical expertise in this field and has a well developed capacity for undertaking training of personnel. It is well supported by periodical exercises at local, regional, national and international level.

India is also a party to the CLC 92 and FUND 92 and has successfully claimed compensation in a few cases. It has encouraged the resource agencies in contributing resources to build up capabilities. There has been no major oil spill experienced by the country recently, the last being the 40000 tonnes spilled by Maersk Navigator in 1993 off A & N Islands (ITOPF, 2009c). It is also a party to other relevant IMO instruments such as Intervention Convention and Salvage Convention.

Thus, the country has a well defined organisational structure, trained manpower, sufficient combat capabilities for a medium spill, efficient contingency planning and a supporting legislative framework to launch an effective response to an oil spill incident.

4.2.2 Pakistan

The other major country in the region, Pakistan, presents an interesting picture as it brings out typical constraints in developing an efficient oil spill response

infrastructure in a developing country. The country has been quite proactive in ratifying the IMO instruments concerning marine oil pollution and even ratified the OPRC and Intervention Convention much before India. However, it has been quite slow to take steps to implement these measures in national domain. The issue of oil spill management was not addressed in the national policies and legislations developed for environment protection in the country. Although the issue of marine pollution was sometimes included, it lacked specific focus on oil spill response mechanisms (Mian & Bennett, 2009). Further, there was no central agency designated to coordinate the response to such an incident. A host of agencies empowered under different environmental acts on marine pollution were authorised to take action in this field. For example, the Pakistan Environment Protection Act, 1997 designates Pakistan Environment Protection Agency, Pakistan Merchant Shipping Ordinance, 2001 empowers DG Ports and Shipping while Maritime Security Agency Act, 1994 authorises DG Maritime Security Agency to take measures in respect of marine pollution which seems to include marine oil pollution (Mian & Bennett, 2009).

However, the lacuna in the oil spill response capabilities was exposed during the worst environmental disaster in Pakistan's history when an oil tanker, Tasman Spirit, grounded off Karachi harbour in Jul 2003 spilling more than 30000 tonnes of crude oil at sea. A large area was affected by the spill which resulted in severe and long term ecological as well as economic impacts. The national oil spill contingency plan was at the draft stage during this period and yet to be approved by the government. Thus, there was an initial confusion regarding organising response with complications arising due to various individual local, national organisations claiming jurisdictions in coordinating the response. It resulted in delay for launching response. The operations were also hampered due to lack of technical expertise and limited equipment and resources. The clean up operations involved huge costs. However, it was found that these costs could not be recovered as the country was not a party to any of the liability and compensation instruments of IMO concerning oil pollution.

This incident led to serious thinking on the issue and thus, the national environment policy developed in 2005 specifically included oil spill management for the first time in national policy and also stressed the need to develop a national oil spill contingency plan. It also called for initiating active legislative and operational measures to implement relevant international instruments and set up response capabilities. Thus, the issue was fast tracked and Pakistan ratified the CLC 92 in 2005 and the National Marine Disaster Contingency Plan was formulated and approved by the government in 2007. It consisted of three parts and also included the oil spill contingency plan with responsibility of coordination clearly designated to Maritime Security Agency (MSA) (SDMC, 2008).

Thus, the incident positively contributed in catapulting the issue of marine oil pollution into national prominence by highlighting the lacuna in the system for response and assisting in addressing these lacunae through policy initiatives. This has significantly improved the response capabilities. Presently, there are limited resources and equipment available with the MSA and the port authorities. The training efforts for personnel of various organisations involved in response have also commenced to build up expertise. Although no details about capabilities of response are available, it is understood that the ports have been directed to maintain Tier-I capability with the support of oil handling companies operating therein while MSA caters for the Tier-II response. A few exercises have also been conducted at national level to validate the contingency plan and fine-tune the response organisation structure. Despite recent proactive approach, the country is yet to ratify the FUND convention.

4.2.3 Sri Lanka

The country lies close to an important shipping lane at the point of convergence of maritime traffic routes. Due to this strategic location, the issue of marine pollution was accorded due importance in national policy and Sri Lanka was quite active in ratifying relevant IMO instruments including

MARPOL, CLC, FUND and Intervention Convention. Further, not only it was prompt in implementing these regulations in a separate Marine Pollution Prevention Act in 1981, but also created a specialised agency, Marine Pollution Prevention Authority (MPPA) to undertake steps in ensuring operational implementation of these measures (MPP Act, Sri Lanka). However, specific measures towards creation of any infrastructure to respond to an oil spill incident were not undertaken. Incidentally Sri Lanka is yet to ratify the OPRC. However, the first national oil spill contingency plan was prepared by MPPA in 1995 ,revised in 1998 & 1999 and finally approved by the government in 2000 (MPPA,2009).

However, a need was felt to revise the plan again due to changes in national regulations on disaster management which included a major oil spill as a national disaster and also to adapt the current plan to the requirements of a regional plan under development for South Asian Seas Programme under the UN Environment Programme (UNEP). The revision was undertaken in a project of Institutional Strengthening of Oil Contingency Management (INSTCOM) funded by the Norwegian government which was completed in 2003 (SDMC, 2008). A new Marine pollution prevention act was promulgated in Jan 2009 to strengthen the MPPA which was renamed as Marine Environment Protection Authority (MEPA) (MPPA, 2009).

The response mechanism presently in place is developed on the tiered concept with three levels of response. However, the demarcation of these classifications have been done as – up to 50 tonnes for Tier –I , 50 to 100 tonnes for Tier-II and more than 100 tonnes for Tier-III. The local agencies e.g. ports, oil terminals are mandated to have an approved contingency plan along with appropriate response equipment and resources to launch Tier-I response. They have to take command of such operations and keep the MEPA informed about the developments and request assistance in case it develops into Tier-II or III.

Tier-II spills are handled by MEPA with support from local facilities for Tier-I. However, large spills requiring Tier-III response will be dealt with mainly by

requesting international assistance in augmenting national resources. The organisational structure is clearly defined with MEPA being the lead agency for coordinating response up to Tier –II independently. As the Tier-III spills are most likely to be treated as a national disaster, the response coordination will be taken over by the Disaster Management Committee (DMC). However, the MEPA is most likely to work as operational coordinator under the DMC due to its expertise in this field. Thus the command and control of response operations is well defined and documented in the plan to avoid any confusion.

The national plan addresses contingencies of a small oil spill and therefore there is limited response equipment available in the country. Most of the equipment is located with the Sri Lankan Ports Authority and the Ceylon Petroleum Corporation, which is more suited to be used in sheltered waters in and around the port area. Thus, an oil spill incident far away from the coast still needs to be tackled utilising minimal resources. Further, the MEPA does not have any vessels and aircraft available to launch response operations and has to depend upon a host of resource agencies for these resources which are not specifically suited for these operations. The response is cooperated by the MEPA through the three regional centres established at Hamanthota, Galle and Kaluthara other than the national centre at Colombo.

There are no major oil spills experienced in Sri Lankan waters. However, regular training of personnel is undertaken in-house by MEPA and also by utilising expertise available at regional level. The contingency plan is also validated by periodic exercises.

It is among the few countries in the region which has implemented the CLC and FUND conventions in their national legislations. Thus, there exists a mechanism to recover the liability costs towards oil spill clean up and restoration expenses.

4.2.4 Maldives

Maldives is an archipelago consisting of a chain of small low lying islands. Due to its special vulnerability, it has a need of placing a high priority on environmental sustainability and environmental protection to be incorporated as an essential element in the national development planning process. However, the specific factors uniquely influencing this island nation focussed the attention on issues such as climate change, global warming and sea level rise in the context of environment protection and to a certain extent pollution generated due to human developmental activities. The absence of any major port also resulted in the issue of marine oil pollution being forced out of the national policy. Thus, the National Environment Action Plans (NEAP), the first of which was formulated in 1989 and the second in 1999 also did not address this issue despite the overall objective of the plans being – to protect and preserve the environment of Maldives (Maldives Embassy, US, 2009). However, with the Environment Protection and Preservation Act, 1993, it also addressed the area of intentional discharges by ships for the first time with provisions of fine against defaulters.

Maldives was, however, an active member in IMO and was among the first few countries in the region which has ratified the important instruments related to oil pollution except the OPRC and Intervention convention, which it has not ratified yet.

The country currently does not have a national oil spill contingency plan and has included the development of such plan in the third NEAP (2009 to 2013) to be completed by mid-2010 (NEAP 3 Maldives,2009). It also does not have any capability for oil spill response and relies on the capabilities available at the regional level in the area in neighbouring countries. The only port in the country visited by ocean going vessels also does not have any such capability. Although it has not witnessed any major oil spill, it seems to be the most vulnerable country in the region against such incident.

4.3 Regional Cooperation in South Asia for Oil Spill Response

The cooperation among the various countries in South Asia was provided a formal platform by the UNEP Regional Seas Programme which encouraged the development of regional agreements for combating marine pollution in cases of emergency even prior to the OPRC coming into force in 1995. Thus, the Action Plan for the South Asia Regional Seas Programme was adopted in 1995 which addressed the issues concerning environmental management with specific emphasis on development and implementation of national oil spill contingency planning (SASP, 2009). Although the regional oil and chemical marine pollution contingency plan was drafted and approved by the high level meeting held in Colombo in 2000, it is yet to be implemented as it has not been activated by finalisation of necessary MoUs of cooperation. Thus, there is no formal cooperation arrangement in the region on oil spill response.

However, there have been some instances of assistance provided at the regional level by countries in the region. In 2006, India responded to the request of Sri Lanka for assistance to combat an oil spill off Galle harbour due to the sinking of MV Amanat Shah and provided a pollution response task force comprising two large vessels with integrated helicopters and aircraft along with pollution response equipment and personnel (ICG, 2009). During the Tasman Spirit oil spill in Pakistan, India offered assistance in terms of equipment and personnel for oil spill response. However, the offer was not utilised by Pakistan. India also regularly undertakes training of personnel in combating oil spills for Maldives and Sri Lanka and conducts periodic exercises with them. Thus, the informal set up exists for cooperation among the countries towards launching joint operations to combat any major oil spill in area. However, it is purely voluntary and case specific in the absence of any institutional mechanism.

4.4 Industry / Private Capabilities for oil spill response

In India, most of the major ports have developed Tier-I response capabilities with provision of necessary equipment. In addition, around 20 operators of offshore oil

facilities have also set up Tier –I response infrastructure (ITOPF, 2009c). Some of the major oil production companies e. g. Oil and Natural Gas Corporation have also made arrangements to utilize equipment of oil spill response from the industry cooperatives and other contractors located in East Asia and other location globally. Thus, a significant quantity of equipment is available with the private organisations in India. However, in other countries except Sri Lanka, where a nominal capability exists with Sri Lankan Ports Authority and Ceylon Petroleum Corporation, very limited quantity of equipment is available with the private entities.

4.5 Strengths and Weakness of Response System in South Asia

The region presents an interesting mix of implementing mechanisms for addressing environmental concerns related to marine field including the arrangements for responding to oil spill incidents. The major factor influencing the development of these mechanisms seems to be the relative importance of oil pollution as a policy issue in national domain and the availability of adequate resources for building up the required equipment and resources. The fact that the region did not experience any major oil spill for many years also significantly contributed to this lack of awareness. The major incident in respect of Tasman Spirit oil spill in Pakistan definitely has a positively effect in bringing the issue into prominence and forcing critical examination of these arrangements by the countries. The analysis of the discussion in preceding paragraphs suggests the following strengths and weaknesses:

Sr.No	Strengths	Weaknesses
1.	**Contingency Planning** The major country in the region, India has a sufficiently well developed contingency planning supported by regularly updated national plan and related local level plans.	**Contingency Planning** National contingency plan in respect of Pakistan has recently been drawn up while that of Srilanka is pending revision. In both cases, there is lack of well developed local plans connected with the national plan. Maldives does not have such a plan in place.

Sr.No	Strengths	Weaknesses
2.	**Tiered Response Capability** India has developed a capability to respond to Tier –II spills up to 10000 tonnes while Sri Lanka has capability up to 100 tonnes.	**Tiered Response Capability** India is the only country that has the capability to respond to oil spills of more than 100 tonnes.
3.	**Equipment and Resources** India has an adequate stockpile of specialised combat equipment including vessels and aircraft to launch effective response.	**Equipment and Resources** Very limited equipment and resources are available in Pakistan and Sri Lanka with no specialised vessels or aircraft. No resources are available with Maldives.
4.	**Competent National Authority** All countries except Maldives now have a clearly defined command structure in place with a designated national authority for oil spill response.	**Competent National Authority** The nascent arrangements in Pakistan is yet to stabilise while in Sri Lanka, the role of DMC in Tier-III oil spill with declaration of a national disaster is confusing.
5.	**Training and Exercises** India has a high level of expertise for training and undertakes regular exercises at local, national and international level.	**Training and Exercises** Maldives has no capability. Pakistan is in the process of setting up the required mechanism while Sri Lanka has limited training expertise and national exercises.
6.	**Regional Cooperation** Good precedence exists for informal cooperation among the states for joint operations.	**Regional Cooperation** No formal agreement exists for cooperation among the states for oil spill response.
7	**OPRC** India and Pakistan have ratified.	**OPRC** Sri Lanka and Maldives have not ratified. Although Pakistan has ratified, it is in the process of implementing it

Sr.No	Strengths	Weaknesses
8.	**Other Issues** India and Sri Lanka have ratified relevant IMO instruments and incorporated in legislative framework.	**Other Issues** Pakistan and Maldives are yet to ratify FUND convention. Pakistan is developing the legislative framework for implementation of ratified conventions. Maldives does not have any such framework currently.

4.6 Oil Spill Response Measures in the Middle East

The Middle East region is the most important area in the Indian Ocean region in respect of risk of oil pollution as a major portion of seaborne oil trade is originated from this area. The response arrangements towards an oil spill incident in various countries in the area are summarised as follows:

4.6.1 Iran

Iran is one of the major oil producers in the region and is also among the few countries which have been in the forefront in addressing the oil pollution issues. It is a party to all the relevant IMO instruments including OPRC and has actively pursued measures to implement them in the national legislation. However, despite being a net exporter of oil, it has only recently ratified FUND, 92 which is yet to come into force for the country. The practical implementation of the oil spill response measures took a relatively longer time. Although there were arrangements set up in the ports with the help from oil handling companies to combat any oil spill, there was no consolidated plan either at regional or at national level with the responsibility divided between various agencies. However, during 2002, a national plan for oil pollution preparedness, response and cooperation was framed and approved by the government which was developed with the support of the IMO. Thus, the Ports and Shipping Organisation (PSO) was designated as the national

authority responsible for coordinating response in Iranian Waters (PMO, 2009).

The response is organised through a National Coordination Centre set up under PSO. A network of provincial coordination centres in each province has also been set up for efficient implementation of the plan. In addition, all the governmental and non governmental bodies using the sea and the coastal areas are also required to establish local centres for oil pollution response under information to the national authority. While the national centre is run by the PSO, the provincial centres are managed by the relevant provincial authority which is generally the Directorate General of Ports and Shipping in that province. The local centres are managed by the agencies themselves under supervision of provincial authorities. Each authority is mandated to have a separate contingency plan for its area of responsibility, which is fully integrated with the plan at next higher level (PMO, 2009).

The response is modelled on Tiered concept. The spills up to 50 tonnes are classified as Tier-I and all the local centres have the capability of responding to such incident with their own equipment and resources. The spills of Tier-II between 50 and 500 tonnes are the responsibility of the provincial centres. However, the resources and equipment may be required to be mobilised from other provincial centres or national centre, in which case national structure is activated. In case of Tier-III spills of more than 500 tonnes, the responsibility of coordination of response lies with the national authority. Some of the local centres which are subject to higher risk of oil spills due to large volumes of oil loading / discharge operations, have been equipped with the capability to deal with a much larger spill than that mandated in the national plan on the direction of national authority.

Thus, there is a well structured organisation for activation of oil pollution response. There are significant amount of resources and equipment available with PSO as well as the National Iranian Tanker Company. The country also has good experience of dealing with large oil spills due to its long drawn out conflict with Iraq and the worst oil spill ever during the first gulf war in 1991

(ITOPF, 2009c).In addition, a well developed technical expertise is build up by regular training of personnel undertaken both in-house as well as with the support from the regional organisation existing in the region and the IMO. It also has an institutionalised system for conducting exercises at national and regional level to fine-tune the system. Thus, over the period of time, an efficient response system has been developed in the country for oil spill response. The only lacuna in the overall picture, the non ratification of FUND, 92, has also been rectified and thus is likely to contribute in complementing the existing efforts towards setting up better infrastructure.

4.6.2 Oman

The concern regarding protection and preservation of environment has historically been part of the national policy in the country since 1984 when Oman became the first Arab country to set up a ministry exclusively concerned with the environment to give thrust to the implementation of the first ever environmental legislation enacted by the Sultanate in 1974 & 1979 (Oman Embassy, 2009). In line with these policies, the first national oil spill contingency plan was promulgated in 1985 which was followed by an update in 1992 called the Action Plan for combating marine oil spills. Both of these plans were superseded by the Oman national oil spill contingency plan of 1995 (IMO, 2002). The plan has recently been revised again in 2004 with the support from IMO and ITOPF to address the international developments on the issues.

The overall responsibility for coordination of response to an oil spill incident is entrusted to the erstwhile Ministry of Regional Municipalities, Environment and Water Resources which is now shifted to the newly formed Ministry of Environment and Climate Affairs (MECA). The response is organised in a tiered concept which strangely includes Tier 0. An oil spill with potential impact requiring no action under the plan and managed by the polluter is classified as Tier 0. Spills of less than 100 tonnes classified as Tier –I are required to be dealt with using local resources while Tier –II spills between

100 and 500 tonnes would require assistance from the resources under the plan. Tier-III spills of more than 500 tonnes would most likely include seeking of international resources (Al-Busaidy, 2008). The organisational structure is slightly confusing as there is no distinct agency or centre designated as the coordinator at national level other than the concerned ministry. Tier-I incident is looked after by the pollution control operations centre (PCOC) of the ministry while for Tier-II incident, a higher coordinating committee (HCC) consisting of ministerial members belonging to various ministries is convened. Any action by the PCOC needs to be approved by the HCC. Tier –III incident is considered as a national disaster and thus it is responsibility of National Committee for Civil Defence (NCCD) which also consists of the HCC members (ITOPF, 2009c).The operational control of the response effort lies with the PCOC. In addition, the Petroleum Development Oman, the main exploration and production company in the country also is responsible for maintaining adequate response capability along with suitable contingency planning in its oil facilities.

Oman has a considerable quantity of response equipment which is maintained by various agencies involved in response operations. Although it has not experienced any major oil spill in its region , it has build up technical expertise to handle response operations by regular training .Periodic exercises are also conducted to test the country's emergency response with participation from national and regional resource agencies, the latest in the series conducted in Dec 2008 (Oman MEA, 2008).

Incidentally, it is the only country in the region which is a party to all relevant IMO instruments, although it ratified the OPRC recently in Jun 2008. Thus, it also has the requisite legal framework to support response capability.

4.6.3 United Arab Emirates

The country is a federation of seven emirates and hence the response infrastructure developed in the UAE reflects this political organisation. It was quite slow in addressing the concerns about oil pollution despite being a major

producer and handler of oil. Incidentally, it was not a party to the primary oil spill control instrument , the MARPOL convention for a long time and ratified it only recently in 2007. It is yet to ratify OPRC. However, till 1998, the national oil company, Abu Dhabi National Oil Company (ADNOC) was mandated to organise the response around its facilities and a well equipped response centre was maintained by ADNOC at Ruwais. There were gaps in the strategies for launching response at national and regional level due to absence of any other infrastructure and organisation and no contingency planning existed against the risks in area. Further, the issue was left to the individual emirates with no national focus. Thus, a federal law on protection and development of the environment was promulgated in 1999 which also addressed the issue of marine oil pollution. The national contingency plan for the control of marine environment pollution was drafted and approved in 2002 (ITOPF, 2009c). The Federal Environmental Agency (FEA) is responsible for coordinating response to the oil spills through six operational oil spill centres established around the country. The local facilities dealing with oil have also been mandated to have their own contingency plans (McKenzie, 2003).

The response is organised on a tiered structure where Tier-I spills of smaller size affecting local area are required to be tackled by the local facility e.g. ports, oil companies. Tier-II spills of up to 2000 tonnes are the responsibility of individual emirates. However, the response will be organised through a committee with members drawn from various stakeholders including FEA, local government, ports, oil companies etc. FEA is responsible for Tier-III spills affecting more than one emirate and require support of international agencies for coordinating response.

Sufficient quantity of equipment is generally maintained in the country, though not only under FEA, but also largely with ADNOC and other stakeholders. Incidentally, two out of the six operations centres are operated through arrangement with ADNOC (McKenzie, 2003). Adequately trained manpower is generally available with the operators of the equipment through in- house training but largely under training arrangements with the leading industry and regional intergovernmental organisations. The country had experienced some oil spills during the Iran-Iraq war, but not with major effects.

However, it has started taking part in periodic exercises conducted under the regional framework with neighbouring countries. The liability and compensation system is also in place to support the response arrangements.

4.6.4 Saudi Arabia

The Kingdom of Saudi Arabia is the largest producer and exporter of oil in the world. It lies in an area of the highest traffic congestion in shipping routes in the Arabian Gulf and the Red Sea. However, it has been slow to address the environmental concerns related to oil pollution. Incidentally, it was not a party to any major IMO instruments related to marine pollution till recently and has ratified the MARPOL and CLC, 92 in 2005. It is yet to become party to other important related IMO instruments e.g. OPRC, Intervention. Further, despite being a net exporter of oil, it is not a party to FUND convention which restricts its capability towards claiming liability and compensation in case of an oil spill.

Although the first national oil spill contingency plan was approved in 1991, it basically depended on the agencies with marine and coastal facilities or activities to develop their own local oil spill contingency plans and provide adequate equipment and manpower to organise response (Saber, 1998). Thus, the leading oil company, the Saudi Aramco, established a well structured response infrastructure with contingency planning, necessary equipment and manpower arrangements. The national plan has been revised and now designates the Presidency of Meteorology and Environment (PME) as the overall coordinator of response arrangements. The response is organised through Area Operations Committee and Environment Protection Committee with membership of various other government organisations and departments (ITOPF, 2009c).

Although it is understood that the response is coordinated on the tiered concept, the details about the capability are not available. However, it has the largest pollution response capability in the region mainly due to private efforts. A significant quantity of equipment is held with PME and various port

authorities. In addition, Saudi Aramco maintains a large stockpile of equipment. A highly skilled trained manpower is also available mostly due to private efforts. Regular large scale exercises are also arranged at national as well as international level. The country has gained extensive experience in spill response techniques while handling spills during first gulf war. PME and Saudi Aramco coordinated a major response effort during which more than one million barrels of oil were recovered (ITOPF, 2009c). Thus, despite the lacuna in not being a party to OPRC and delay in acceding to other marine pollution conventions, it has set up an efficient response mechanism.

4.6.5 Yemen

The country is the lowest producer of oil in the Middle East. However, the Gulf of Aden experiences significant oil traffic close to the country. Although the details regarding environmental awareness and initiatives by the national government are very limited, the country has not been a party to any IMO instruments concerning marine pollution other than Intervention Convention for a long time and has not even ratified the MARPOL. However, it has recently ratified the CLC, 92 in 2006.

The maritime affairs authority has been designated as the agency responsible for marine environment and pollution issues. However, there is no formal national oil spill contingency plan and there is no statutory requirement for ports or oil handling facilities to have such plans in place. Incidentally, a few companies have developed their plans on voluntary basis. Thus, in the event of an oil spill, no coordinated response is possible and the individual companies will be left to deal with such situation. The availability of response equipment is extremely limited in the country with only a few sets available with government and public agencies. There are also lack of training resources and constraints of qualified manpower for undertaking efficient operations (ITOPF, 2009c). Currently, IMO is acting as a facilitator towards development of a national oil spill contingency plan and strengthening of the response infrastructure in the country (OSTC, 2009)

4.6.6 Qatar

The country is located in the area enclosed by the Arabian Gulf and lies in a high risk zone for oil pollution. However, it has not proactively addressed the issue and like most of the other countries in the region, it was not a party to major IMO instruments on marine pollution for a long period. With the encouragement from IMO and the regional organisation operating in area, it has ratified MARPOL, OPRC CLC 92 and FUND 92 and is now among the few countries to do so. The information about the origins of the response mechanism to an oil spill incident has been quite limited. However, there has been contingency planning undertaken by the local oil companies and port authorities with provision of supporting response infrastructure and equipment. Currently, the national contingency plan has been revised in 2005 and is yet to be approved by the government (ITOPF, 2009c).

It draws a set up for organising response which is slightly different from the conventional one. Although the overall responsibility is designated to the Environment Protection Committee (EPC) consisting of members from various concerned government and private agencies, most of the infrastructure depends on the Qatar Petroleum (QP) resources. It maintains all the response equipment and resources and also mans the operations centre for reporting of oil spill incidents. Incidentally, the provisions also require QP to provide adequate resources to respond to all incidents within the country's waters including its own facilities. The equipment earlier maintained by the port authorities have also been transferred to QP (ITOPF, 2009c).

The response for a small spill within a local area is coordinated by the local authority with assistance from QP while for larger spills, EPC will convene and nominate on scene commander. QP will however, deal with the response arrangements (ITOPF, 2009c). QP maintains a considerable stock of equipment with arrangements for necessary vessels and helicopter resources. The training requirements are met generally using international and regional resources and participation in regional exercises is also undertaken regularly to improve capability of response organisation.

4.6.7 Bahrain

It is an archipelagic country formed of 36 low lying islands located in the Arabian Gulf. The national contingency plan for an oil spill has been developed but very limited details are available about the implementation of response mechanisms. The department of Environment Affairs (DEA) is the agency responsible for coordinating response operations which is organised on tiered concept with three levels of response. The small spills of Tier-I is tackled by the facilities of Bahrain Petroleum Company (BAPCO) and port authorities with their resources and equipment. However, Tier-II and III is coordinated by Director General, DEA through establishment of Incident Command Centre. The larger spills are tackled through assistance from international resources. A few of the local facilities have their own contingency plans in place (ITOPF, 2009c).

DEA has a substantial stockpile of response equipment but there is no organised structure for maintenance and training and periodic exercises. For the larger spills, resources from private sources will also be tasked to augment those from the government. The vessels and aircraft are utilised from a host of government agencies including defence forces and coast guard. BAPCO also maintains a major stockpile of such equipment. Thus, overall, sufficient equipment is available to deal with a medium sized spill in the country.

The country has ratified MARPOL recently in 2007 and is not a party to OPRC. However, it is a party to CLC and FUND conventions, thus, successfully addressing the liability and compensation issues.

4.6.8 Kuwait

The country lies at the head of the Arabian Gulf and has suffered the worst oil pollution incidents ever in the world during the first gulf war in 1991. As with the other countries of the region, it was also not a party to the major marine pollution conventions of IMO for a considerable period of time and ratified MARPOL in 2007 and CLC in 2004. It is yet to ratify OPRC and FUND

conventions. The availability of details about response infrastructure is quite limited despite the presence of the headquarters of the Regional Organization for the Protection of the Marine Environment (ROPME) located in the country. Although there is a national contingency plan in place nominating Environment Protection Authority (EPA) to be responsible for coordinating response, it is organised through a national committee dealing specifically with oil issues with members drawn from various government and private agencies. A minor spill is dealt with by the local agencies in the area e.g. Kuwait Oil Company (KOC), local ports, while the major spills is coordinated by the committee using resources from different regions. Further, KOC and ports have their own contingency plans to deal with any such incident (ITOPF, 2009c).

The country has a substantial stock of response equipment maintained by the users or operators, who also hold the resources owned by EPA. The requirement of vessels and aircraft is met by relevant agencies including KOC, ports, defence forces and coast guard. All these authorities have adequately trained manpower utilising the resources of the regional organisation and participate regularly in the exercises conducted at the national and international level.

The country has experienced a large number of oil spills, not necessarily from tanker operations or casualties and gained considerable expertise and experience in handling response to such situation.

4.6.9 Iraq

No information is available on current infrastructure and capability as state of the existing response mechanism after the gulf wars is not widely available.

4.6.10 Jordan

The country is located at the head of Red Sea and has a very small coastline with only one major port at Aqaba. It has been slow in developing

arrangements for oil spill response and was not a party to many IMO instruments on the subject. It has recently ratified MARPOL and OPRC and is a party to CLC, 69 and not CLC 92, FUND and Intervention conventions. The national contingency plan has been developed but yet to be approved by the government. The responsibility for coordinating the response to such an incident is given to the Ports Corporation located at Aqaba. The corporation has adequate resources and equipment to combat a spill up to 200 tonnes in area. Larger spills are responded jointly with the neighbouring countries, Egypt and Israel with whom the country has a bilateral arrangement for such cooperation (ITOPF, 2009c).

4.7 Industry / Private Capabilities for Oil Spill Response

4.7.1 National Oil Companies

Most of the major oil companies operating in the region maintain a large stockpile of equipment and resources on their own which is essentially much bigger than the capability maintained by the government sources. Saudi Aramco has the world's largest stockpile of oil spill response equipment among the oil companies in the world which includes specialised vessels, aircraft, helicopters and trained personnel (ITOPF, 2009c). ADNOC is responsible for stocking and maintaining two out of six national oil spill centres in the UAE (McKenzie, 2003). QP also provides almost all of the Tier-II response equipment available in Qatar and undertakes the operational response to any oil spill incident in the country. Petroleum Development Oman, National Iranian tanker Company and Bahrain Petroleum Company also have considerable capability in their respective areas of operations which supplements the national setup.

4.7.2 Industry Cooperatives

The oil companies operating in area also tend to rely on the services of third party private organisations for Tier- II & III response than their respective national governmental capabilities. These organisations are generally the oil

industry cooperatives (Moller, 1997). Two important organisations operating in the region are as follows:

(a) **Regional Clean Sea Organisation (RECSO)** It is an oil industry cooperative organisation formed by 13 major oil companies in the region with an objective of launching oil spill response through mutual aid by pooling of resources. It has become an important player not only in sharing of equipment and resources among the members but also in addressing the larger issue of capacity building in the field through training of personnel, conduct of joint exercises and providing technical support (RECSO, 2009).

(b) **Oil Spill Response Limited (OSRL)** All the major oil companies are members of this UK based organisation which provides full response services including trained manpower, (response team and technical advisors), equipment and other resources. It maintains three Tier-III pollution response centres at Southampton, Singapore and Bahrain respectively. In addition to the resources positioned at Bahrain, the equipment from other centres can also be provided within 24 hours, if needed. It also undertakes training and capacity building through exercises (OSRL, 2009).

4.7.3 Other Trade Associations

The Petroleum Association of Japan (PAJ), a non profit trade association, also has a number of stockpiles of oil spill response equipment strategically located along the tanker routes from the Middle East to Japan. The equipment can be borrowed free of cost whenever needed and returned after cleaning and repairing / replacing the damaged items. It has six domestic and five overseas bases, two of which are located in the Middle East at Saudi Arabia and Abu Dhabi respectively (PAJ, 2008).

4.8 Regional Cooperation in Middle East for Oil Spill Response

Although the individual countries in the region were quite slow in developing national environmental legislation and ratifying the related IMO instruments, the necessity of mutual cooperation to combat oil spills was recognised by them. With the encouragement from the UNEP, the following two regional frameworks have been worked out:

4.8.1 PERSGA

It is the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), which is an intergovernmental organisation dedicated to the conservation of the coastal and marine environment. It was established consequent to the adoption of the Jeddah Convention, formally titled "Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment" in 1982. Although the convention came into force in 1985, the PERSGA was created in 1995 and now provides a platform for intergovernmental cooperation on environmental issues. A revised PERSGA /IMO action plan for the development of national systems and regional mechanisms for preparedness and response to major marine oil spills in the Red Sea and Gulf of Aden was formulated in Jun 2005 which supports development of national plans and systems in the countries that do not have these and to establish a regional mechanism for achieving coordinated response to any major oil spills. Its members include Saudi Arabia, Jordon and Yemen in Middle East and Djibouti, Egypt, Somalia and Sudan in Africa. It is not a provider of response equipment and undertakes capacity building through technical support and training for implementation of necessary measures (PERSGA, 2009).

4.8.2 ROPME and MEMAC

The Marine Emergency Mutual Aid Centre (MEMAC) is based in Bahrain and was formed through the Kuwait Action Plan, under the Regional Convention for Cooperation on the Protection of Marine Environment from Pollution, 1978 which provided the background for development of the Regional Organisation for the Protection of Marine Environment (ROPME). Thus,

MEMAC is the operational centre of ROPME which provides a platform for cooperation among members to launch joint efforts against oil spills. It also supports revision or development of national contingency planning, relevant implementing legislations and technical support through training and exercises. The members include Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and UAE (MEMAC, 2009).

4.9 Strengths and Weakness of Response System in Middle East

The mechanism for delivery of efficient response to an oil spill in this high risk area is found to be quite different than the conventional system where the governments undertake major responsibility in setting up the infrastructure and resources. Further, the countries in the region except a very few, have lagged far behind in ratifying even basic IMO instruments concerning marine pollution like MARPOL. Despite recent efforts by the regional organisations and the IMO, there is still some lacuna in this area. The region has definitely developed an operational model for arranging better preparedness and response due to experience with some of the largest oil spills. The overall strengths and weaknesses of the oil spill response mechanism are discussed below:

Sr.No	Strengths	Weaknesses
1.	**Contingency Planning** Major countries in the region have a sufficiently well developed contingency planning supported by regularly updated national plan and related local level plans.	**Contingency Planning** A large number of states do not have a valid national contingency plan well supported by national governmental agency. Yemen does not have such a plan in place. Jordan has a draft plan yet to be approved.
2.	**Tiered Response Capability** The response is generally organised clearly in a tiered concept for efficient delivery in all the states except Qatar, Yemen and Jordan.	**Tiered Response Capability** In many states, the tiered response is not followed properly either due to lack of capacity or due to single private agency tasked for operational response.

Sr.No	Strengths	Weaknesses
3.	**Equipment and Resources** A large stockpile of specialised combat equipment including vessels and aircraft to launch effective response is maintained in the region which is generally available for use in different states.	**Equipment and Resources** Very limited equipment and resources are available with governmental agencies in majority of states. Limited equipment and resources are available with Yemen.
4.	**Competent National Authority** All countries except Yemen now have a clearly defined command structure in place with a designated national authority for oil spill response.	**Competent National Authority** In most states, the nominated authority does not have real control which is generally exercised by national oil company. In few countries, the command structure becomes confusing in Tier-III when there is an overlap with the national disaster response organisations.
5.	**Training and Exercises** The region has moderate capability in having a structured training programme and undertakes regular exercises at national and international level.	**Training and Exercises** Limited in-house training expertise exists in most of the states which generally depends on private resources or those provided by the regional organisation. Limited exercises at national or local level.
6.	**Regional Cooperation** Intergovernmental cooperation exists at regional level in the form of two regional organisations in the region. Successful in supporting members to improve response capability by improving ratification of IMO instruments and developing national contingency plan.	**Regional Cooperation** Failure to develop any regional contingency plans for the region. Cooperation generally limited to training and technical support and no mechanisms for sharing of resources or launching joint operations.

Sr.No	Strengths	Weaknesses
7	**OPRC** The recent efforts by IMO and regional organisations have resulted in a few states ratifying OPRC.	**OPRC** Most of the states have not ratified the OPRC. A few have recently ratified but are yet to implement it in national legislation.
8.	**Other Issues** -The region has one of the largest capabilities set up by the private entities for oil spill response. -The provisioning of Tier- II & III equipment through industry cooperatives ensures quick response in bypassing bureaucracy of inter-governmental organisations.	**Other Issues** -Despite being a net exporter of oil, most of the states have not ratified FUND convention which restricts liability and compensation claims. -Many countries have recently ratified MARPOL and there are a few states that are yet to ratify this basic convention on marine pollution.

4.10 Oil Spill Response Measures in the North-east Africa

This group covers the countries that are located along the Red Sea and the Gulf of Aden on the north east part of Africa. The countries south of Somalia are considered part of the Western Indian Ocean and thus excluded from this study. The countries in this group have a similar risk profile as those of the Middle East; however, the approach adopted by them is quite different.

4.10.1 Egypt

The country due to its strategic location in the Red Sea and the Suez Canal had been in the forefront in addressing the issue of marine oil pollution. it is one of the few countries in the region which has ratified all the relevant IMO instruments except FUND convention. The first national oil spill contingency plan was prepared in 1986 and then was reviewed and updated in 1998 to conform to the requirements of OPRC. The Egyptian Environmental Affairs Agency (EEEA) is designated as the overall coordinator for oil spill response.

A National Contingency Planning Committee (NCPC) advises and assists EEEA and in the event of a major spill, an Emergency Response Committee (ERC) may be convened to advise and assist EEEA (JICA, 2008).

The response is coordinated in a tiered concept. Tier-I spills up to 100 tonnes are coordinated by the local facilities with their own resources. In Tier-II spills up to 1000 tonnes, EEEA will take responsibility for response but may delegate it to another body. Also, Tier-II response originating in petroleum sector will continue to be directed by the Egyptian General Petroleum Corporation (EGPC) unless it is specifically requested for assistance. Tier-III spills of more than 1000 tonnes will be looked after by EEEA and ERC will also be convened. A considerable stockpile of equipment is maintained in the country with one EEEA response centre and four centres maintained by EGPC. In addition, Suez Canal Authority and other ports also possess adequate equipment for launching response in their area. The EGPC, Suez Canal Authority and Red Sea Authority have been mandated to have their own contingency planning for their area (JICA, 2008). The country is capable of undertaking in-house training of personnel and carries out regular exercises at national and international level.

4.10.2 Sudan

The country presently does not have any capacity to respond to an oil spill incident. Although it has designated the Sudanese Maritime Administration Corporation (SMAC) as the national authority for coordinating response, it has negligible equipment available in the country(ITOPF,2009c). It also has not ratified any of the IMO instruments related to marine pollution including MARPOL and has no legal framework in its national legislation for addressing marine environmental issues. The regional organisation, PERSGA has provided support for developing the national system for oil spill response. In the first stage, a national oil spill contingency plan was formulated and has now been approved by government in 2004. However, no information is available whether any supporting infrastructure in terms of organisation, equipment and legislation has been developed to support the plan.

4.10.3 Djibouti

The country has relatively been quite responsible in addressing issues concerning marine pollution and is among the few countries in the region which has ratified all major IMO instruments on this issue. The Maritime Affairs Authority (MAA) is designated as the national coordinator for oil pollution occurring outside port limits. The national plan for oil spill contingency is quite old and was approved in 1990 and has very limited information about the response strategies and actions for undertaking an oil spill response. The responsibility of coordination is divided among two agencies. Oil spills within the ports are handled by port authorities using their own resources while those outside are handled by MAA. In addition, local oil companies have their own contingency plans along with supporting equipment and manpower for their area of operation. A limited number of resources are available with the agencies (ITOPF, 2009c). IMO had established a stockpile of pollution control and clean up equipment at Djibouti in 1980 with the support of Norway, for use in Gulf of Aden waters of Djibouti, Yemen and Somalia. However, the operational readiness of this equipment is doubtful. Hence, a project has been commissioned by PERSGA for assessment of this stockpile and to suggest actions fro making it operationally available for use (PERSGA, 2009).

4.10.4 Eritrea

The political developments in the country and frequent conflicts with neighbouring country have affected the overall development. It has restricted the national policy in taking due note of the risks of marine oil pollution in the area. Incidentally, it has not ratified any of the IMO instruments related to marine pollution including MARPOL. Further, limited information is available on the response capabilities against an oil spill. A draft national oil and noxious substances spill contingency plan was formulated in 1995 in which the department of maritime transport was designated as the coordinating agency (ITOPF, 2009c). However, no information is available whether any supporting infrastructure in terms of organisation, equipment and legislation has been developed to support the plan. A negligible quantity of response

equipment is held in the country and even sufficient quantity of equipment is generally not available with the oil companies.

4.10.5 Somalia

No information is available regarding any national organisational structure for dealing with marine oil pollution.

4.11 Industry / Private Capabilities for Oil Spill Response

Egypt is the only country in the region which has adequate response capability while other countries have negligible resources. The majority of equipment in Egypt is maintained by EGPC which has four centres for Tier –II response with necessary equipment and resources. In addition, Suez Canal Authority has significant stocks including lightering barges and tugs available for use outside the canal. Port authorities also have specialised equipment at four main ports to launch quick response (ITOPF, 2009c).

4.12 Regional Cooperation in North Eastern Africa for Oil Spill Response

All countries except Eritrea are members of the PERSGA, the details of which are mentioned at Para 4.8.1. However, the development of cooperation is quite slow due to political factors.

4.13 Strengths and Weakness of Response System in North Eastern Africa

Out of the five countries of the region, only Egypt has a well developed infrastructure for oil spill response while a minimal structure might also exist in Djibouti. There is no such capability in Sudan, Eritrea and Somalia. Incidentally, these three countries do not have any national legal framework supporting marine pollution response and are not party to any of the IMO instruments on the subject. Thus, overall there is no capability for response in major part of the region. The lack of any effective cooperative arrangement at regional level also excludes the possibility of addressing

this lacuna by seeking assistance of countries lying on the east coast of Red Sea, mainly Saudi Arabia.

4.14 Oil Spill Response Arrangements in Other Oceanic Areas

The capability of oil spill response in northern Indian Ocean in the three sub groups discussed in this dissertation can be compared and contrasted with those in other similar sub regions in the world. The arrangements in two such regions are summarised below:

4.14.1 North Sea

The agreement for cooperation in dealing with pollution of the North Sea (Bonn Agreement) is the mechanism by which the North Sea states provide mutual assistance to each other in combating pollution. Belgium, Denmark, France, Germany, Netherlands, Norway, Sweden and UK are the members of this agreement.

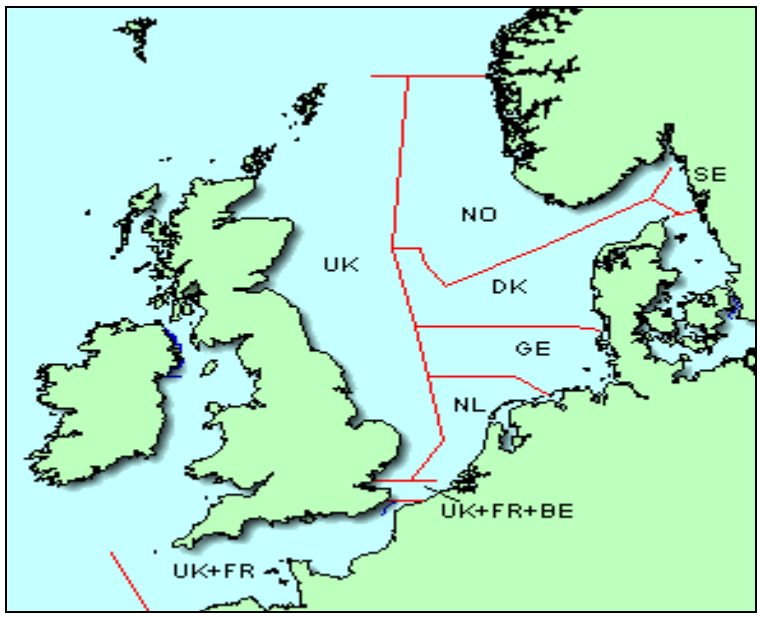

Figure 17 : Area covered by Bonn Agreement.

Source: http://www.bonnagreement.org/,2009

All these countries have a well developed national oil spill response mechanism. This includes a contingency plan which is comprehensive and updated regularly with clearly defined organisational structure and responsibilities, necessary stockpile of equipment and resources, well trained and exercised personnel and legislative arrangements for supporting current liability and compensation regime. However, to address the need for creating a joint response structure for a large spill, a regional cooperation agreement has been developed which is operational. The area has been divided into eight zones for the purpose of oil spill monitoring and control and supervisory responsibilities have been assigned to various states. The operational arrangements of cooperation have been codified in the Counter Pollution Manual which is updated regularly. The details of equipment and resources is maintained and a state can request assistance from other state which is obliged to comply with the request and fully support the operations of the requesting state. However, the requesting state will reimburse the cost of these resources to the assisting state. Detailed arrangements are already worked out regarding command and control, procedures, financial costs, communication, other administrative and operational issues. The guidelines for joint surveillance are also in place. A database of all national capabilities and arrangements is maintained and updated regularly. Arrangements for joint training and exercises have been institutionalised and utilised frequently (Bonn Agreement, 2009).

Thus, the efficiency of response in this region is very high compared to the three subgroups in Northern Indian Ocean due to competent national arrangements supported by strong regional cooperation among the states.

4.14.2 Baltic Sea

The Baltic Sea is one of the most important sea area threatened by marine pollution. Thus, the convention for the protection of the marine environment of the Baltic Sea area was developed in 1974 and revised in 1992. The governing body of the convention is the Helsinki Commission- Baltic Marine Environment Protection Commission- also known as HELCOM. The member

states to HELCOM are Demark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden.

All these countries have a well developed national oil spill response mechanism. This includes a contingency plan which is comprehensive and updated regularly with clearly defined organisational structure and responsibilities, necessary stockpile of equipment and resources, well trained and exercised personnel and legislative arrangements for supporting current liability and compensation regime.

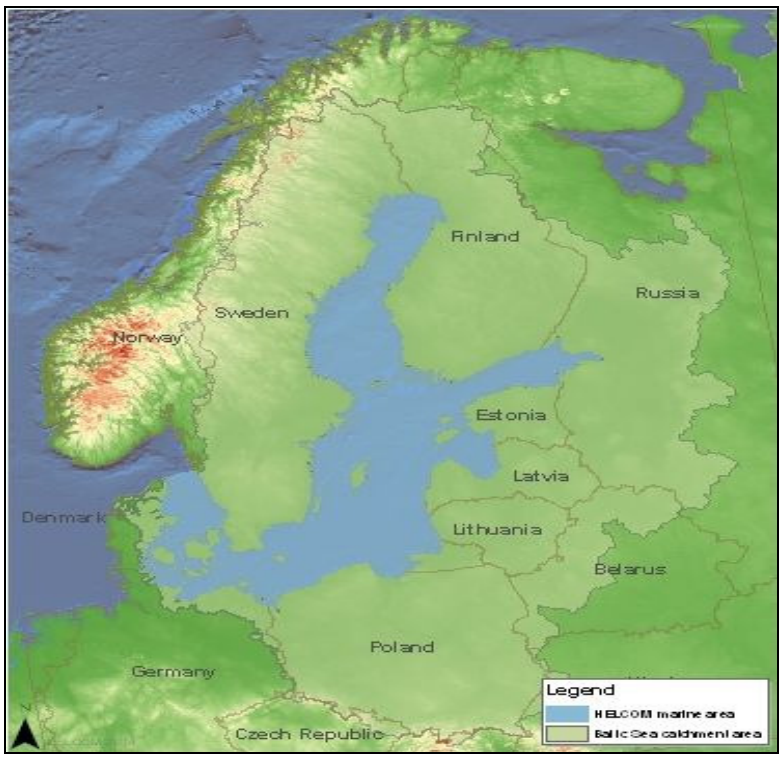

Figure 18 : Area covered by HELCOM.

Source: http://www.helcom.fi/,2009

Regional cooperation is worked out by a group called HELCOM Response. An arrangement similar to the one mentioned at Para 4.14.1 in Bonn Agreement also exists in this area (HELCOM, 2009).

Thus, the efficiency of response in this region is also very high compared to the three subgroups in Northern Indian Ocean due to competent national arrangements supported by strong regional cooperation among the states.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This dissertation attempted to address the issue of response to a marine oil spill incident in the Northern Indian Ocean region. At the outset, the background of oil emerging as a premier source of energy and its need for transportation over the sea was looked into to understand the origin of the issue. It has been found that oil has progressively become the major source of energy in all the regions of the world since its discovery and is likely to continue for a long time. The geographical distribution of oil rich countries away from the major oil consuming nations has generated the need for transportation of a large quantity of oil from the producers to consumers. Due to its cost effectiveness and suitability to provide logistical link between different continents separated by oceans, shipping has emerged as the primary source of transportation of this oil. Further, the development of offshore oil exploration and production facilities has also contributed to the oil coming in close contact with marine environment. The problem of oil pollution especially in marine environment in the initial years was met with strategies to prevent the intentional spillages of oil and oily wastes within harbours and areas located close to the coastline. Further, the problem was considered more as a nuisance than having any long term environmental or health hazards.

However, over the period of time, it has been understood that oil pollution has much larger effect on the marine environment. The overall effect varies greatly depending on different types of ecosystems. The short term effects include loss of animal and

plant species, fish and other fisheries resources while there may be serious long term effects in terms of loss of breeding grounds, impairment of food cycle and loss of habitat. Apart from these environmental effects, there are large economical costs concerning contamination of coastal amenities, industries and tourism. It has been found during the research that shipping or maritime transport is not the major source of the oil entering into the sea and land based sources account for a much larger share. However, due to the risk of an extremely large quantity of oil likely to be released in a small area in case of a marine casualty, the public attention definitely focuses on the shipping as a major source of such pollution.

The efforts to deal with this problem include setting up of a global mechanism which addresses not only the intentional discharges but also the accidental pollution. Incidentally, the thrust towards the development of such mechanism was given by the oil spill resulting from the Torrey Canyon disaster. Thus, IMO became a forum for supporting development of international instruments to address this issue. The focus of this effort was both on preventive as well as response measures. The regulating framework has been supported by the primary IMO convention on marine pollution, MARPOL and later augmented by OPRC. However, important parameters of the mechanism concerning operational practices, design standards of ships and right of intervention by the coastal state in case of threat of oil pollution, are also relevant and provided by SOLAS and Intervention Conventions respectively. The major problem in the implementation of an efficient response framework for an oil spill incident involves costs of funding the equipment and resources and the clean up operations. Thus , a suitable three tiered liability and compensation regime has been developed through CLC and FUND conventions and its relevant protocols to enable recovery of costs from the polluter on globally recognised ‘Polluter Pays’ principle.

The author considers that although there is a difference between the preventive and response measures to an oil spill incident, a clear distinction cannot be made between them as there is certainly an overlap between the two. To develop an effective response mechanism, the availability of legislative framework to support the response organisation along with suitable liability and compensation mechanisms is as much necessary as the provisioning of contingency planning, combat equipment, resources

and infrastructure. Thus, the study of the efficiency of any response mechanism in such a case would only be complete by addressing all these aspects.

The next step in the research was to develop a risk profile for an oil pollution incident in the northern Indian Ocean. The essential ingredients for a risk situation are a combination of the probability of occurrence of a hazardous situation and the consequences of that occurrence. This dissertation has identified a number of factors that contribute towards developing this risk profile.

The main oil producing countries of the world are located in the area and two important transportation routes for oil tankers pass through the region which carries about two-thirds of the global seaborne oil trade. Although there are not many marine casualties experienced, a significant quantity of oil enters into the sea through operational discharges from ships. A majority of global ship recycling yards are operating in the Indian subcontinent and hence there is steady flow of ships transiting the area on their last voyages. Many of these ships are not seaworthy and pose a threat for collision or grounding especially in severe weather conditions leading to oil pollution from the ships they collide with. However, no major accidents involving such ships have been reported.

The region also has ecologically sensitive and fragile ecosystems located in many countries surrounding the area. These include mangrove areas home to one of the largest number of species and coastal & backwater lagoons, mudflats and estuaries. The coral areas are reported to contain one of the largest numbers of species in the region. Any major oil spill in the area will certainly have a drastic effect on these ecosystems. The region also experiences seasonal rough weather affecting ocean areas.

The countries in the region generally have limited implementation of pollution prevention measures thereby increasing the risk of an oil spill. These include less stringent FSI and PSC inspection and regime, inadequate reception facilities in ports and lack of strong enforcement mechanism. The lack of resources in these developing nations has also greatly resulted in degrading the public concern about environmental issues in general and oil pollution in particular. Thus, the national policies reflect focus on developmental issues rather than oil pollution.

A number of geo-political factors have also been identified that impinge on the risk situation. The political and diplomatic considerations have led to conflicts, war and hostilities. Incidentally, this was the cause of the largest oil spill ever experienced in the world during the first gulf war in 1991 when Iraqi soldiers deliberately dumped thousands of tonnes of oil into the sea. The presence of a failed state, Somalia, poses a gap in implementation of measures against risk of pollution. It has also led to the region becoming the hotspot for piracy attacks. Although these attacks have not resulted in any oil pollution incident, the use of heavy military weapons by the pirates may sometimes result in damage to the ship leading to pollution. The risk of terrorist attacks in this area is quite real with two such attacks witnessed on USS Cole and tanker Limburg in Gulf of Aden.

A critical analysis of these factors was undertaken by the author and it was found that various factors have different weightage on the probability and consequences part of the risk matrix with some having low probability but high consequences and vice versa. Further, the area has certain regions, especially in the Middle East, where the risk is relatively higher than others. Overall the risk of a major oil spill incident in the region is estimated to be a medium risk.

To study the oil spill response mechanisms in the Northern Indian Ocean, the author divided the area into three subgroups namely South Asia, Middle East and North-eastern Africa. It was observed that these subgroups have distinct factors affecting them in terms of existing risk, economic development, political set up and enclosed or open ocean areas. This arrangement also helped in studying the regional arrangements among the countries as these are generally based on geographical locations.

During the research for the dissertation, it was observed that the Northern Indian Ocean has not been given sufficient attention by the scholars and researchers compared to other oceanic areas of the world. Incidentally, the information and data availability regarding marine oil pollution was not only larger in traditional developed regions in Europe and North America but also in East Asia and Western Indian Ocean islands. Further, most of the information available related to the technical aspects of oil pollution rather than administrative or operational set up in the countries or the

region. Hence, the author attempted to cover these gaps by soliciting information directly from the national maritime administrations, oil spill response agencies, and national environmental agencies, regional organisations working in the field of oil pollution, academic institutions and ocean research institutes. Although it was quite demanding and cumbersome process, it succeeded in generating significant quantity of information concerning the issue. However, there are still certain areas with insufficient information.

The capability of the states was examined basically on four factors - organisational structure with designation of responsibilities for launching response, comprehensive plan addressing all contingencies, availability of adequate equipment & other resources and technical expertise in terms of adequately trained personnel. A few other factors were also looked into to support the findings. The existing set up of regional cooperative arrangements along with capabilities available with industry and private entities was also considered. Based on these factors, the strengths and weaknesses in the existing mechanisms were identified separately in each sub region.

The analysis of the South Asian region brings out that all countries, except India, have a very limited capability of response. While Maldives does not have any capability, Pakistan has recently started instituting the required framework after experiencing a major disaster in the Tasman Spirit oil spill. Sri Lanka, on other hand, has the implementing mechanism in place but lacks sufficient equipment and resources. India being the largest country in the region has adequate resources and a well developed organisation structure to respond to Tier –II spills up to 10000 tonnes. Although, there are no formal cooperative arrangements at regional level, informal cooperation exists between the countries to support joint operations. There is no private capability in any country except in India where a significant number of private agencies and contractors maintain response equipment stockpiles. The national legal set up and the ratification of relevant IMO instruments is satisfactory with relatively few gaps. However, greater thrust is needed in implementing liability and compensation measures in all countries except India.

The Middle East sub- region is the most important area among the three groups in this study due to the highest risk experienced. The analysis of the capabilities of various

countries presents an interesting picture. Although, the region has witnessed some of the largest oil spills in the world, and is home to a large number of major oil producing and exporting countries, it is quite strange that the issue of marine oil pollution was not provided the required attention. The majority of the countries have been quite slow to establish a mechanism for oil spill response and were not party to even the basic IMO convention related to marine pollution, MARPOL for a considerable period of time. Due to the efforts of IMO and the regional organisations operating in area, this lacuna has been addressed and many of them have now become party to MARPOL and other relevant conventions. However, this aspect still leaves a lot to be desired. Another peculiar finding of the study was that despite being a net exporter of oil and thus facing almost negligible contribution costs, many countries have not become a party to FUND convention which restricts their ability to recover costs in oil spill response concerning third party liability.

The organising structure for oil spill response in many countries, although well defined, still leaves a few gaps in implementation as the designated national coordinator does not have the required capability and thus does not effectively control the operations. It is the national oil companies or other organisations, which are essentially controlling the operations. In Qatar, UAE and Oman, the respective national oil company has a much larger capability than the national coordinator and also effectively coordinates the operations. In Saudi Arabia, the Saudi Aramco maintains a much larger inventory of equipment and resources than government coordinator. Thus, it is generally observed that the national coordinator provides only guidance while the operational control is given to operating facilities. However, this system has a lacuna in a sense that the companies focus on their own requirements and do not essentially cater for a contingency plan at national level. Thus, in case of a tanker accident outside these facilities within national waters, the organisational response would be severely restricted. Limited information about current status of implementation of measures for oil spill response was available for Yemen, Bahrain and UAE while no information was available for Iraq. However, Yemen is the only country other than Iraq which is yet to ratify MARPOL and other relevant IMO instruments on the subject.

There are two regional organisations established in the area, PERSGA and ROPME, which provide a framework for cooperative arrangements among the countries. The efforts have been basically restricted to training and exercises, technical support and other administrative arrangements rather than sharing of resources or launching joint operations. However, these organisations, with the support from IMO, have been successful in encouraging members to become party to IMO instruments and assisting in strengthening of national response infrastructure through development of contingency plan and other supporting structure in the countries that do not have these arrangements.

The study also found that there is quite significant capability existing with the private entities. Incidentally, Saudi Aramco maintains the largest stockpile of equipment among the private operators worldwide. There are also cooperative arrangements among the oil companies operating in area under RECSO for mutual sharing of resources and at global level with OSRL which also maintains a Tier –III oil spill response centre in Bahrain. In addition, the PAJ also has two stockpiles in the region at Abu Dhabi and Saudi Arabia and six others located worldwide along the tanker route to Japan which can be requisitioned by these oil companies. Thus, overall the industry has access to a large inventory of equipment and resources. The author considers that these cooperative arrangements are much more effective than the inter-governmental cooperative arrangements due to less bureaucratic approach, quick response time and free from political and commercial issues.

Thus, the study highlights that the approach followed by the countries in this region is different than the conventional approach where the governmental agencies remain a dominant player in the oil spill response infrastructure in a country. In this case, the major oil companies have a much larger role in organising response and contributing resources than in other regions. The region is found to have sufficient capability to respond to larger oil spills complementing adequately the high risk situation. However,

the existing lacunae in implementation of recently ratified IMO conventions and gaps in capabilities of a few countries may affect the efficient delivery of response to a large oil spill involving such countries.

The North eastern African region presents an interesting contrast to the other two sub regions in our study. While Somalia can obviously be disregarded in our study due to absence of political entity administering the country, Eritrea has witnessed many conflicts since independence which has seriously affected development efforts. This has resulted in total lack of any effort towards marine conservation issues including oil pollution .Sudan has also been focussing more on basic developmental activities than environmental issues due to lack of resources. Incidentally, Eritrea and Sudan are not a party to any of the IMO instruments related to marine pollution.

Djibouti is the only country which is party to all the relevant IMO instruments on the subject. However, very limited information is available about the implementation of these instruments in national domain. It has negligible capability to organise a response to an oil spill incident due to lack of resources. Egypt is the only country in this region with sufficient response capability. There is a clear defined organisational structure with contingency planning arrangements. However, the majority of equipment and resources are maintained by the major oil company.

With no capability existing in a major part of the region, the regional cooperative arrangements have limited role in seeking joint operations or mutual assistance and focuses on establishing a framework of response infrastructure in these countries through technical and financial assistance. Overall, the capability to launch an effective oil spill response is negligible or non- existent in most of the region except around the coast of Egypt.

Thus the capability of the three regions in Northern Indian Ocean can be summarised in Figure 19.

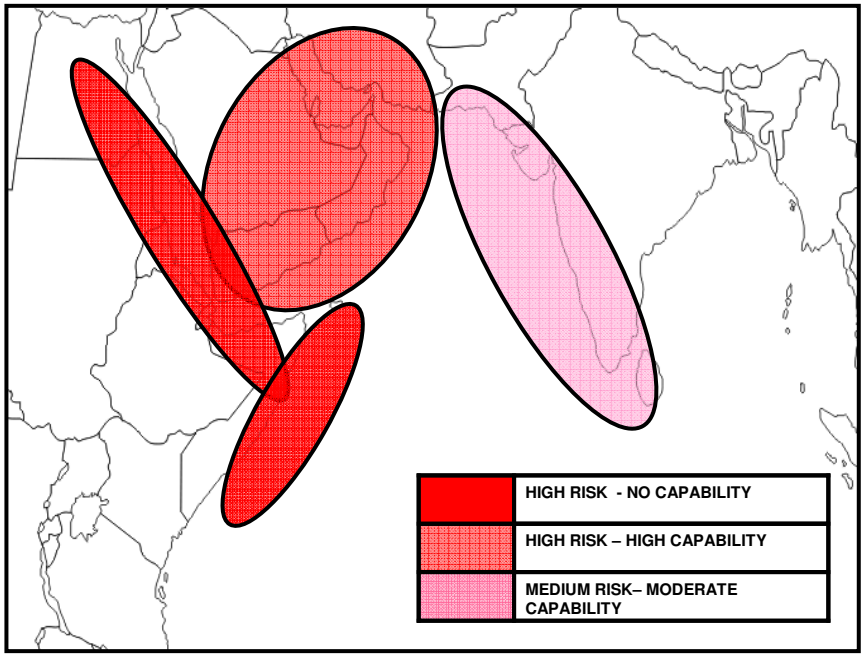

Figure 19 : Capability of oil spill response in Northern Indian Ocean.

Source: Author, 2009

The status of ratification of conventions on oil pollution in the region is placed at Appendix 'C'.

The capabilities in two other oceanic regions, North Sea and Baltic Sea, were also looked into to compare the mechanism in responding to oil spills. It has been found that unlike in Northern Indian Ocean, all the countries in these regions are highly proactive in ratifying relevant IMO instruments and developing a national response infrastructure. The most notable difference between the two systems is the highly developed regional cooperation which is functioning at operational level with sharing of resources and equipment. The significant difference between the development standards of the countries of Europe in comparison to countries of Northern Indian Ocean makes it unsuitable to use this set up for comparison and analysis. However, certain nuances of cooperative arrangements can be utilised to make a rational judgement about effectiveness of regional organisations.

5.2 Recommendations

(a) There is a need for evolving formal cooperative arrangements at regional level in South Asia. As most of the countries other than India have limited resources and expertise, this would benefit in improving the overall system of response not only in respective individual countries by gaining from Indian experience, but also at regional level in organising joint response. The current regional plan worked out under the auspices of UNEP South Asian Seas Programme needs to be operationalised without further delay.

(b) A special initiative needs to be considered by the IMO and PERSGA to build up national capacity of North-eastern African states on priority to address the large gap in response capabilities in a high risk region.

(c) It is recommended to explore feasibility to provide financial as well as technical support to the developing nations challenged by lack of resources, through international organisations like IMO, UNEP, regional organisations and industry associations. The provision of developmental funding especially is critical for sustainability of any mechanism for non- priority areas in their context like environment protection.

(d) The old stockpile of oil spill combating equipment provisioned through IMO at Djibouti needs to be operationalised without any delay to be available for use in the Gulf of Aden.

(e) Regional cooperative arrangements need to be worked out in the region for operational level activities similar to those existing in the North Sea or Baltic Sea enabling sharing of resources and launching joint operations in addition to the existing arrangements for training and capacity building.

(f) A special initiative needs to be considered by regional organisations in Middle East to encourage improvement in liability and compensation mechanisms in individual countries by ratification of FUND convention.

(g) There is a need for developing the national coordinating authority for oil spill response towards accepting greater role and responsibility in the Middle East. This will reduce the confusion in command and control structure during response operation and prepare suitable ground for successful implementation of the national contingency plan in all areas.

(h) Article 6 of OPRC calls for parties to provide information to IMO about the details regarding the competent national authority responsible for oil pollution preparedness and response, availability of response equipment & expertise and the national contingency plan. However, none of the countries in the region, which are party to the OPRC, have done so. There is a need for the countries in the region to provide such information to IMO to encourage mutual cooperation through dissemination of requisite information to all concerned.

(i) A further research is recommended for addressing specific topics affecting overall response capabilities in the region in areas of national legislative framework and contingency planning arrangements.

(j) During the research, it was found that there is no global database maintained for recording all marine oil pollution incidents. While ITOPF data is generally used for guidance even by IMO, it covers oil spills caused by oil tankers and not by any other ships. Oil Spill Intelligence Report - International Oil Spill Database is also known to maintain a database of oil spills in the world from all sources. However, it is not widely available and does not sufficiently address the requirement. Thus, there is a need for such a database to be maintained by any shipping or marine organisations e.g. International Chamber of Shipping (ICS).

The response to a marine oil spill is a complex process involving a combination of operational capability and the supporting administrative and legislative framework. The challenge of balancing the developmental needs in a developing country with the requirement of addressing the environmental concerns cannot be resolved comprehensively. The argument for considering their effects on the ability of a

country to effectively develop and implement any mechanism addressing these concerns has a sound basis but has not been explored for resolution. The conventional response organisation structure calling for a dominant role of a governmental agency is also being challenged by new arrangements developing increased reliability on private efforts. The Northern Indian Ocean needs an increased focus from the surrounding states and the regional & international bodies towards a more responsible approach about the oil pollution issue.

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Appendix – A

PROPERTIES OF OIL INFLUENCING ITS BEHAVIOUR AT SEA

1.	Specific Gravity	The specific gravity of oil is its density in relation to pure water. Most oils are lighter than water and have a specific gravity below 1.
2.	Distillation Characteristics	The distillation characteristics of oil describe its volatility. As the temperature of oil is raised, different components reach their boiling point in turn and are distilled. The distillation characteristics are expressed as the proportions of the parent oil which distill within given temperature ranges.
3.	Viscosity	The viscosity of oil is its resistance to flow. High viscosity oils flow with difficulty whilst those with low viscosities are highly fluid. Viscosities decrease at higher temperatures and so sea water temperature and the extent to which the oil can absorb heat from the sun are important considerations.
4.	Pour Point	The pour point is the temperature below which oil will not flow. If the ambient temperature is below the pour point, the oil will essentially behave as a solid.

Source: Response to marine oil spills, ITOPF, 1987.

Appendix – B

LIST OF MAJOR OIL SPILLS FROM TANKERS*

South Asia

Vessel Name	Quantity Spilled		Country	Year	Cause
	Tonnes	Type			
Tasman Spirit	30,000	Crude	Pakistan	2003	Grounding
Cretan Star	29,000	Crude	India	1976	Hull Failure
Cherry Vinstra	16,000	Crude	India	1974	Hull Defect
Aviles	11,000	White Product	India	1979	Fire/Explosion
Transhuron	5,200	Crude	India	1974	Grounding

Middle East

Vessel Name	Quantity Spilled		Country	Year	Cause
	Tonnes	Type			
Nova	70,000	Crude	Iran	1985	Collision
Assimi	52,500	Crude	Oman	1983	Fire/Explosion
Pericles G C	46,000	Crude	Qatar	1983	Fire/Explosion
Seki	16,000	White Product	UAE	1994	Collision
Pontoon 300	5,500	Crude	UAE	1998	Sinking

North-eastern Africa

Vessel Name	Quantity Spilled		Country	Year	Cause
	Tonnes	Type			
Limburg	12,200	Crude	Gulf of Aden	2002	Terrorist Attack

* Over 5000 tonnes since 1974.
Source: ITOPF, 2009.

Appendix - C

STATUS OF RATIFICATION OF CONVENTIONS ON OIL POLLUTION

South Asia

Country	MARPOL	OPRC	CLC	FUND	Intervention
India	Yes	Yes	Yes	Yes	Yes
Maldives	Yes		Yes	Yes	
Pakistan	Yes	Yes	Yes		Yes
Srilanka	Yes		Yes	Yes	Yes

Middle East

Country	MARPOL	OPRC	CLC	FUND	Intervention
Bahrain	Yes		Yes	Yes	
Iran	Yes	Yes	Yes	Yes	Yes
Iraq					
Jordon	Yes				
Kuwait	Yes		Yes		Yes
Oman	Yes	Yes	Yes	Yes	Yes
Qatar	Yes	Yes	Yes	Yes	Yes
S.Arabia	Yes		Yes		
UAE	Yes		Yes	Yes	Yes
Yemen			Yes		Yes

North-eastern Africa

Country	MARPOL	OPRC	CLC	FUND	Intervention
Djibouti	Yes	Yes	Yes	Yes	Yes
Egypt	Yes	Yes	Yes	Yes	Yes
Eritrea					
Somalia					
Sudan					

Source: IMO, 2009