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## Impact of Oil Spillage and Response Management in National and International Arena

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### ABSTRACT

Sea and Ocean floor and the sub-soil thereof as well its resources, are the common heritage of mankind. More than 3.5 billion people depend on the seas and ocean for the primary source of food. With the growing use of sea and the different ways, in which the world's use of energy can damage the marine environment, the most vivid for many people is oil spillage. Oils have toxic properties, spillage of oils pose serious threat to the public health and the marine environment. The Bay of Bengal is potential habitations of marine life. Our coastal area constantly polluted by oil spillage from tanker collisions/grounding, ships wrecks, oil refinery; ship-breaking industry and bilges of ships and trawlers. The mangrove forest Sundarbans and vast coastal communities are being threatened by oil spillage. Both the sea ports (Chittagong and Mongla) do not have facilities to receive and treat bilge and ballast water, and thus ships throw wastewater into the sea. Bangladesh is now considering for adoption of some contingency plan to implement IMO conventions which specially address pollution from ships.

**Keywords ;** Oils, marine, heritage, spillage, environment, sea, natural, Pollution, surface. Habitations, emission.

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### 1.Introduction

Ocean is a common heritage of mankind. Seas and oceans cover an area of 361 million square kilometer, which is about 70% of the world surface and offer one of man's great hopes for future as a source of endless resources and foodstuff supply. Marine environment surrounds more than 90% of the planet's living bio-mass. With the growing use of sea lanes of communication by cargo ships and tankers and the use of sea bed for mineral extraction, the importance of the sea is increasing day by day. The different ways, in which the world's use of energy can damage the natural environment, the most vivid for many people is the oil spillage. On a seemingly regular basis, our newspapers and television screens are filled with pictures of listing tankers spilling crude oil and oil soaked sea-birds in various stages of death. While these oil spills may be the most publicized (the Exxon Valdez for example), accidental spills from tankers account for only about 12% of the crude oil discharged into the world's oceans each year.

Oil is a general term used to denote petroleum products which mainly consist of hydrocarbons. When crude oil is spilled into a marine environment it eventually breaks down into several components, each of which have their own eventual fates and cause their own problems for the environment. In many tankers or offshore oil wells, some of the oil spilled initially catches fire. When crude oil burns, it results in atmospheric emission of gasses, which contribute to acid rain (SO<sub>2</sub>, NO<sub>x</sub>), as well as large quantities of toxic ash.

Bangladesh has a coast line of 710 km including the world's largest mangrove forest 'The Sundarban'. The Bay of Bengal, a potential habitation for marine life and vast coastal communities, is constantly polluted from land and sea based sources. About 180 ships visit Bangladeshi ports every month and a large number of coasters and fishing trawlers operate in the coastal area. Moreover Bangladesh imports 100 percent of her oil through sea and 85 per cent domestic needs of fuel travel through the sea and river routes. This article mainly focuses on the impact of oil spillage and response management basing on the analysis of related factor affecting marine environment, causes and sources of oil spills in the world ocean, its behavior at sea and the effect on marine environment.

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### Definition

**2.1** **Marine Pollution.** The intergovernmental Oceanographic Commission (IOC) described Marine Pollution as: "The introduction by man directly or indirectly, of substances or energy into the marine environment (including estuaries), resulting such deleterious effects as: harm to living resources; hazardous to human health; hindrance to marine activities including fishing; impairing the quality for the use of sea water and reduction of amenities.

**2.2** **Oil.** "Oil" means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products. Oil as, "a naturally occurring, complex mixture of organic components, resulting from the transformation of plants and animal remain under special geological conditions that is high temperature and pressure.

2.3 **Oil Pollution Incident and Oil Spillage.** "Oil pollution incident" means an occurrence or series of occurrences having the same origin, which results or may result in a discharge of oil and which poses or may pose a threat to the marine environment, or to the coastline or related interests of one or more States, and which requires emergency action or other immediate response.

**BEHAVIOUR OF OIL AT SEA AND ITS EFFECT**

**3 Behaviour of Oil at Sea**

3.1 Oil, when spilled at sea, normally breaks up, dissipates or scatters into the marine environment over time. This petroleum then reacts with sunlight and oxygen to form greenhouse and acid gasses. The dissipation is a result of a number of chemical and physical processes. The processes are collectively known as weathering and oil weathers in different ways. Light products such as kerosene tend to evaporate naturally and dissipate quickly, and thus rarely need cleaning-up. Factors which affect the ability of an oil spill to spread include surface tension, specific gravity, and viscosity. There are eight main processes that cause oil to weather.

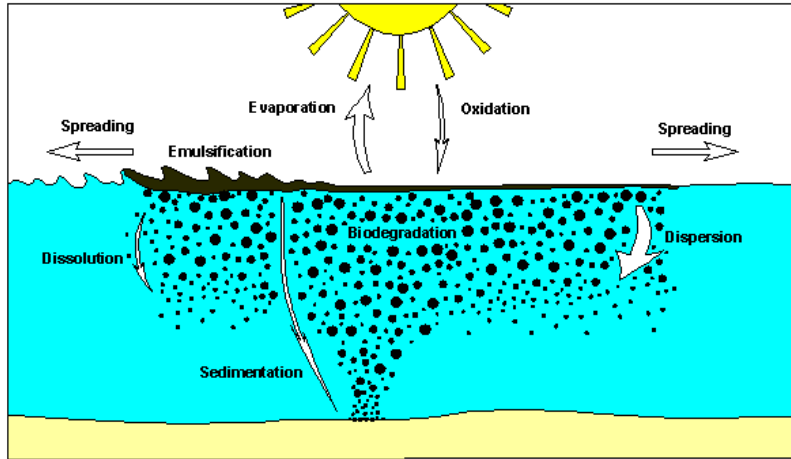


Figure 1: Fate of oil spilled at sea showing the main weathering processes

3.2 **Combined processes:** The processes of spreading, evaporation, dispersion, emulsification and dissolution are most important during the early stages of a spill whilst oxidation, sedimentation and biodegradation are more important later on and determine the ultimate fate of the oil. To predict this, some simple models have been developed based on oil type. Oils have been classified into groups roughly according to their density.

Group	Density	Examples
Group I	less than 0.8	Gasoline, Kerosene
Group II	0.8 - 0.85	Gas Oil, Abu Dhabi Crude
Group III	0.85-0.95	Arabian Light Crude, North Sea Crude Oils (e.g. Forties)
Group IV	greater than 0.95	Heavy Fuel Oil, Venezuelan Crude Oils

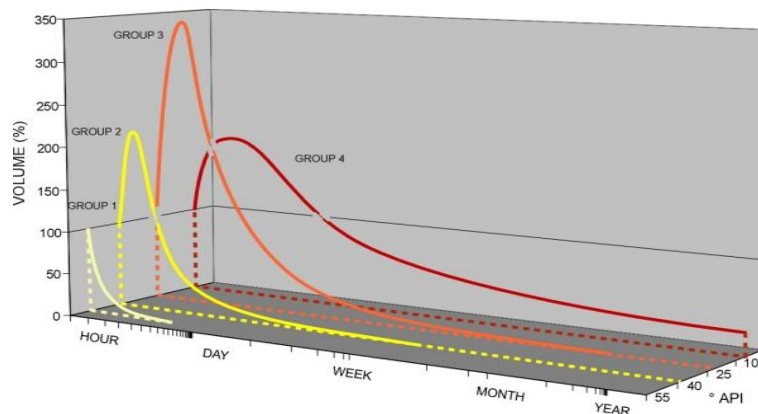


Figure 2: The rate of removal of oil from the sea surface according to type

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## 4 Effects of Oil Spillage

**4.1 Impact of oil on coastal activities:** Oil spills can have a serious impact on coastal activities and on those who exploit the resources of the sea. In most cases such damage is temporary and is caused primarily by the physical properties of oil creating nuisance and hazardous conditions. The impact on marine life is compounded by toxicity and tainting effects resulting from the chemical composition of oil, as well as by the diversity and variability of biological systems and their sensitivity to oil pollution.

**4.2 Impact of Oil on Specific Marine Habitats:** In coastal areas some marine mammals and reptiles, such as turtles, come into contact with sea surface may be particularly vulnerable to adverse effects from oil contamination because of their need to surface to breathe and to leave the water to breed. Oil may block the openings of the air breathing roots of mangroves or interfere with the trees' salt balance, causing leaves to drop and the trees to die. Protection of wetlands, by responding to an oil spill at sea, should be a high priority since the physical removal of oil from a marsh or from within a mangrove forest is extremely difficult.

**4.3 On Fisheries and Mariculture:** An oil spill can directly damage the boats and gears used for catching or cultivating marine species. Floating equipment and fixed traps extending above the sea surface are more likely to become contaminated by floating oil. The use of dispersants very close to mariculture facilities is ill-advised since tainting by the chemical or by the dispersed oil droplets may result.

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## 5 Causes and Sources Of Oil Spillage

**5.1 Causes of Oil Spillage:** Accidental or deliberate, operational discharges and oil spills from ships, especially tankers, offshore platforms and pipelines, is the most obvious and visible cause of oil pollution of the marine environment. The kind of oil spill usually thought about is the accidental or intentional release of petroleum products into the environment as result of human activity. Examples would be things like well blowouts, pipeline breaks, ship collisions or groundings, overflow of gas tanks and bilge pumping from ships, leaking underground storage tanks and oil-contaminated water runoff from streets and parking areas during rain".

**5.2 Sources of Oil Spillage:** Sources of oil input to the marine environment are often divided into natural, sea-based and land-based sources. Hydrocarbons also enter the ocean not merely as "wet" oil products but also as gaseous air pollutants. Hydrocarbons from vaporous deriving from the loading and unloading of oil at different stages, from extraction to consumption and also from incomplete combustion are the main category of gaseous hydrocarbons that enter the marine environment as oil pollution.

The major sources of oil spill are:

- a. Natural seeps: 46%
- b. Discharges from consumption of oils (operational discharges from ships and discharges from land-based sources): 37%
- c. Accidental spills from ships: 12%
- d. Extraction of oil: 3%

**5.3 World Wide Oil Spillage:** According to the Oil Spill report, published by Southern Cross University, Australia, Oil spills in the size range of at least 34 tonnes have occurred in the waters of 112 nations since 1960. However, oil spills happen more frequently in certain parts of the world. Those areas are identified as 'hot spots' for oil spills from vessels, the Gulf of Mexico (267 spills); the northeastern U.S. (140 spills); the Mediterranean Sea (127 spills); the Persian Gulf (108 spills); the North Sea (75 spills); Japan (60 spills); the Baltic Sea (52 spills); the United Kingdom and English Channel (49 spills); Malaysia and Singapore (39 spills); the west coast of France and north and west coasts of Spain (33 spills); and Korea (32 spills)".

**5.4 Operational Discharges from Ships:** Ship-related operational discharges of oil include the discharge of bilge water from machinery spaces, fuel oil sludge, and oily ballast water from fuel tanks. Cargo-related operational discharges from tankers include the discharge of tank-washing residues and oily ballast water. Before international regulations were introduced to prevent oil pollution from ships, the normal practice for oil tankers was to wash out the cargo tanks with water and then pump the resulting mixture of oil and water into the sea.

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## 6 International Co-Operation and the Legal Frame Work

**6.1 International Conventions Addressing Oil Pollution:** The international community's first consideration of oil pollution was reflected in the International Convention for the Prevention of Pollution of the Sea (OILPOL 1954). The purpose of this convention was to reduce intentional "operational" discharges of oil from routine ballasting and tank cleaning operations. It did not address the problem of accidental spills. Several conventions adopted in more recent years address directly or indirectly the problem of accidental oil spills from ships. The International Convention on Load Lines of 1966 (ICLL), the International Convention on Safety of Life at Sea 1974 and its 1978 Protocol (SOLAS) and the International Convention for the Prevention of Pollution from ships (MARPOL) all address same aspect of the problem.

**6.2 MARPOL:** The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. To implement this protocol Bangladesh Government has already taken some step by drafting “The Marine Environment Conservation Act, 2004” which is waiting for government approval.

**6.3 UNCLOS III:** UNCLOS III is unique its formulation of a structure of principles governing all aspects of marine pollution, prevention and control. This convention is also known as Constitution of the Ocean. Coastal states shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment and to establish internal and regional rules and standards.

**6.4 Oil Pollution Preparedness, Response and Co-operation(OPRC):** OPRC was adopted in November 1990. The Convention is designed to facilitate international co-operation and mutual assistance in preparing for and responding to a major oil pollution incident and to encourage States to develop and maintain an adequate capability to deal with oil pollution emergencies. Operators of offshore units under the jurisdiction of parties are also required to have oil pollution emergency plans or similar arrangements which must be co-coordinated with national systems for responding promptly and effectively to oil pollution incidents.

**6.7. STCW:** The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW), 1978, as amended, sets qualification standards for masters, officers and watch personnel on seagoing merchant ships. The convention was amended in 1995, largely in response to major spills of the M/V Braer (1993), the M/V Aegean Sea (1992) and the S/S Scandinavian Star (1990).

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## 7 Oil Spill Response Management and Compensation

**7.1 Contingency Plan:** Contingency plan is the legislation or policy for an organization or a country to enhance the effective response to mitigate environmental damage. Careful planning is an essential preparation for any successful operation to oil spill response. With increasing risk of oil spill, all the developed and developing countries like, USA, Japan, UK, Singapore, Malaysia, India etc have already developed their contingency plan to combat the oil spill in an organized manner.

**7.2 Response Organization:** Contingency planning should follow the tiered response concept. In oil handling organization like oil tanker or refineries or merchant ships for any oil spill scenario, the activities of On Scene Coordinator (OSC) is very important. He is the person who quickly predicts the fate of the oil spill, assess the risk and adopt the appropriate strategy with available resources.

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## 8 Oil Spill Management

**8.1 Response Steps:** These steps were developed by a panel of international oil spill representatives under the auspices of the IMO. There are nine basic response steps or activities for which the OSC is responsible:

- a. Assess the Situation
- b. Activate the Contingency Plan.
- c. Activate the Organizational Response.
- d. Activate the Operational Response.
- e. Manage the On-Going Response.
- f. Deactivate the Response.
- g. Consolidate the Costs
- h. Debrief and Report.

**8.2 Response Methods:** There are two approaches for responding to marine oil spills at sea: the enhancement of natural dispersion of the oil by using dispersant chemicals, and containment and recovery of oil using booms, barriers, skimmers, and synthetic Sorbent materials. Dispersants agents are most useful in helping to keep oil from reaching shorelines and other sensitive habitats. Mechanical containment is used to capture and store the spilled oil until it can be disposed properly. Chemical and biological methods can be used in conjunction with mechanical means for containing and cleaning up oil spills. In some cases it is not possible to prevent the oil reaching the shoreline.

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## 9 Compensation

**9.1 Liabilities and Cost of Recovery:** As oil spill causes severe loss of civil properties and environmental damage thereby the provision of public compensation and environmental restoration due to oil spill impact has also been taken into consideration. For example, Torrey Canyon oil tanker accident, a big marine pollution occurred due to oil spill. She was carrying 110000 tonnes of crude oil and grounded in UK and polluted UK and France Coast line which caused severe loss of marine environment and public properties. Nathuna Sea Oil Tanker was grounded in Singapore Strait which caused severe oil spill in Singapore and Malaysian Coast line.

### Bangladesh Perspective

#### 10 Oil Spillage in Bangladesh

**10.1 Sources of Oil Spillage:** Bangladesh has the coastal area of about 36000 sq km with a population of about 25 million. The coastal area has one of

the largest mangrove ecosystems in the world. The unique ecosystem today is threatened because of negligence of the people in exploiting the nature. Chittagong and Mongla are the two seaports of the country and deals with about 2000 sea going vessels and 12,000 to 13,000 coastal cargo vessels annually. These ports, however, do not have facilities to receive and treat bilge and ballast water, and thus ships throw wastewater into the sea. Oil and lube oil spillage also happens during refueling of vessels and cargo handling. In addition, there are innumerable mechanized trawlers and fishing boats plying, about 20,000, in our coastal areas. The operators of these vessels dump burnt oil, into the water, because of their ignorance about its adverse effect on environment. As the seaports are located near shallow water, large oil tankers carrying crude oil and refined oil cannot enter. Therefore, oil spills also take place in the anchorage during the transfer of oil from large oil tankers to lighter tankers. The floating tar in the Bay of Bengal is about 1100 tonnes, where as the oil density in the Bay of Bengal per sq/m is 3 times more than Arab sea. The international oil tanker routes situated in the south of Bay of Bengal also contributes some amount of oil pollution in the marine environment of Bangladesh. As a result rich fishing resources in the coastal areas of Bangladesh have drastically reduced and some of the species have already depleted.

**10.2 Oil Spillage Incidents in Bangladesh:** There have already been several environmental disasters due to heavy spillage from oil tankers in outer anchorage and along coastal areas. In late 1989, a Greek-owned Cypriot flagship chartered to bring crude oil for the Bangladesh Petroleum Corporation caused about 3,000 tonnes of oil slicks along the coast of Chittagong and Cox's Bazar. A huge oil slick was also detected around the coast near Khulna in 1992, which was dumped from foreign ship, caused oil spreading over a large area about 40 miles from Putni Island to Char Khasiakhali. Ship-breaking industries in Chittagong, is another source of oil spill and several accidents have also been occurred.

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## 11 Contingency Plan and Response Management System of Bangladesh

**11.1 National Contingency Plan:** A National Contingency Plan is contained within the provisions of the Marine Environment Act (1990), which is aimed at prevention, control and response to marine pollution<sup>1</sup>. This has not yet been enacted but would be the basis of future response. There are more than 40 laws regarding environmental issues in Bangladesh but there is no single law regarding marine pollution. As per Coast Guard Act, 1994, Bangladesh Coast Guard has been empowered to look after the marine pollution but without any legislative authority. As a member of IMO, Bangladesh is now considering for adoption of the five IMO conventions which specially address pollution from ships.

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## 12 Oil Spill Response Management System

**12.1 Risk Assessment:** In Bangladesh, there are many operational oil spills below 7 tonnes which occurs mainly for human error, mechanical failure and, and with the increasing of oil consumption, these will increase in future. The threat of large oil spill above 700 is not so high in Bangladesh because only few and small crude tankers are operating. But the medium spill 7 – 700 tonnes are quite high in Bangladesh for mainly lack of preventing facilities and administrative preparedness. Response to the minor spills Tier –1 should be well within the capacity of port authorities, using port resources, or such spill which can also be dealt by the oil industry itself.

**12.2 Protection Priorities:** Protection priorities to be employed during a response action to an oil spill are, in order of descending priority:

- a. Human safety and health
- b. International protective area
- c. Habitant and cultural resources
- d. Commercial resources
- e. Amenities

**12.3 Response Option:** There are many factors that affect the result of oil spill response, but the basic factors to get good result of oil spill are mainly: presence of appropriate contingency plan, proper response equipment/materials, trained personnel and cooperative spirit. In the event of an oil spill in Bangladesh marine environment, the following measures should be employed according to the circumstances of the spill and conditions prevailing:

- a. If possible prevent, control or stop outflow of oil from source.
- b. if coastal or marine resource is not threatened or likely to be threatened, need to monitor the movement and behavior of the oil spill.
- c. If, coastal and marine resources are threatened, active response operations to protect sensitive resources.
- d. If, due to weather and sea conditions, response at sea is not feasible or protection of sensitive areas is not feasible, determine appropriate clean-up priorities and other response measures

**12.4 Oil Spill Response Organization** Overall administration of pollution control lies with the Ministry of the Environment, although the Director General Shipping has the responsibility to organize clean-up operations particularly in the event of an incident outside port limits. Small spills in port are the responsibility of the Port Authority. In reality the Director General will rely on the Port Authorities, notably Chittagong, which has people with some knowledge of response techniques. No special equipment is available in Bangladesh. A limited stock of dispersant is held by the CPA. Bangladesh navy also possesses few offshore Patrol vessels equipped with oil dispersant equipment.

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## 13 Conclusion

13.1 The effects of spilled oil into the marine and coastal environment have been an issue of environmental concern for many decades. "Oil" means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products. Crude oil contains many thousands of different chemical components. When we think of oil spills, we usually think of oil tankers spilling their cargo in oceans or seas but which is very small percentage of the total quantity of oil spill. Oil, when spilled at sea, normally breaks up and dissipates or scatters into the marine environment over time. The processes are collectively known as weathering. Lighter components of the oil will evaporate to the atmosphere.

13.2 Operational discharges and oil spills from ships, especially tankers, offshore platforms and pipelines, is the most obvious and visible cause of oil pollution of the marine environment. However, oil spills occur more frequently in certain parts of the world like the Gulf of Mexico, the northeastern U.S. the Mediterranean Sea, the Persian Gulf, the North Sea etc. These areas are identified as 'hot spots' for oil spills from vessels. Careful planning is essential for any successful operation to oil spill response. With increasing the risk of oil spill all the developed and developing countries have already developed their contingency plan to combat the oil spillage.

13.3 The Bay of Bengal is now constantly polluted from land and sea based sources which is a potential habitation of marine life. As a result, rich fishing resources in the coastal area of Bangladesh have drastically reduced. Considerable quantity of oil discharged in our coastal area from various sources like, bilge water, sludge, and oily ballast water from fuel tanks of ships, oil refinery and land based sources. Sea going ships, including a large number of coasters and fishing trawlers operate in our sea area. The Ship-breaking industry at Fouzderhat, Chittagong is also another source of pollution in our coastal area. As the seaports are located near shallow water, large oil tankers carrying crude and refined oil cannot enter harbor.

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## 14 Recommendations

14.1 In order to ensure optima outputs from the oil spill response management programme following are recommended:

- a. Development of Oil spill response strategy and operational planning as well as port environment management need to be standardized.
- c. Sea ports should be fully equipped with the facilities to receive and treat bilge and ballast water, and proper monitoring system within and outside the port limit.
- d. Bangladesh Coast Guard and Bangladesh Navy may be delegated for the purpose of watching whether the IMO convention is properly abided by or violated and adopting the legal action against the violation.
- e. For protection of Sundarbans inter-departmental and multi-disciplinary cooperation and coordination will be needed.
- h. Ecological monitoring stations for ecosystem and survey can be established.

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