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Marine oil pollution on the coast of Ghana

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MARINE OIL POLLUTION ON THE COAST OF GHANA

By

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The contents of this paper reflect my personal views and are not necessarily endorsed by the university.

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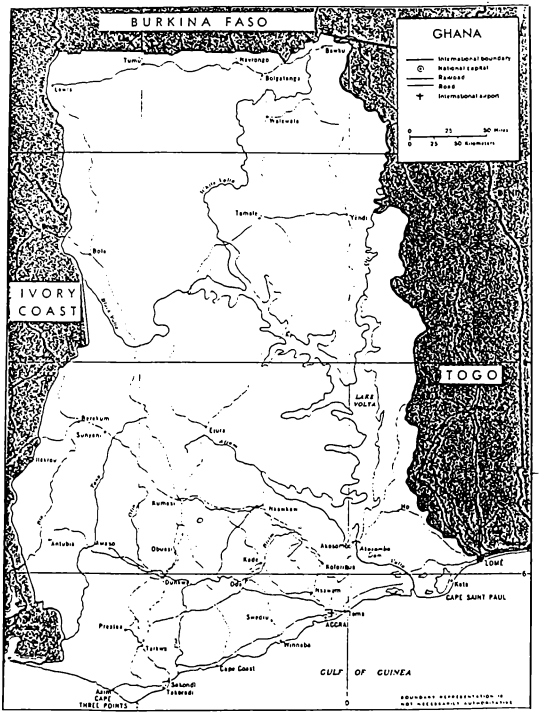
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Axim
CAPE THREE POINTS
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CAPE SAINT PAUL

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ABSTRACT

Marine pollution has been considered as one of the most serious environmental problems. Oil pollution is the most obvious and common form of pollution in the marine environment. Even though pollution of the environment from ship source is a small fraction of the total, it has attracted international concern.

Tankers and other major ocean going vessels travelling the near shore coastal waters of Ghana create a potential pollution risk for Ghana in the event a marine casualty should occur. Oil/tar balls on beaches, the result of tank washing residues or similar discharges from tankers passing offshore as well as oily wastes from refinery operations are a constant and major problem.

This project provides suggestions for suitable means of controlling, monitoring and combating the existing oil pollution as well as pollution from major disasters.

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ABBREVIATIONS

BOD	Biochemical Oxygen Demand
CLC	International Convention on Civil Liability for Pollution Damage
COW	Crude Oil Washing
CPC	Cocoa Products Company
CRISTAL	Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution Damage
DWT	Deadweight Tonnage
EEZ	Exclusive Economic Zone
EPC	Environmental Protection Council
FAO	Food and Agriculture Organization
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage
GHAIP	Ghanaian Italian Petroleum Company
GPHA	Ghana Ports and Harbours Authority
GTMC	Ghana Textile Manufacturing Company
GTP	Ghana Textile Printing
IAEA	International Atomic Energy Agency
IMO	International Maritime Organization
IOC	International Oceanographic Commission
IOPP	International Oil Pollution Prevention
LDC	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
LOT	Load-on-top
MARPOL	The International Convention for the Prevention of Pollution from Ships
MATS	Military Academy and Training School
MEPC	Marine Environmental Protection Committee
OILPOL	The International Convention for the Prevention of Pollution from Ships
OSC	On-Scene Commander

OSD	Oil Spill Dispersant
PNDC	Provisional National Defence Council
RSPB	Royal Society for the Protection of Birds
SBM	Single Buoy Moorings
SBT	Seggregated Ballast Tanks
SDR	Special Drawing Rights
TOVALOP	Tanker Owner Voluntary Agreement Concerning Liability for Oil Pollution
TTL	Tema Textile Limited
ULCC	Ultra Large Crude Carriers
UNEP	United Nations Environmental Programme
USD	United States Dollar
VLCC	Very Large Crude Carriers
WHO	World Health Organization

MARINE OIL POLLUTION ON THE COAST OF GHANA

INTRODUCTION :

The Republic of Ghana lies along the Gulf of Guinea on the West African coast. Its coastline stretches from Half Assini (in the west) to Aflao (in the east) covering a distance of 550 km. To the east of Ghana lies the Republic of Togo and to the west is Cote d'Ivoire.

The 550 km coastline of Ghana is generally a low lying area, not more than 200 m above sea level, with a narrow continental shelf extending outwards for about 30 km. The rocky and sandy shoreline is fringed by mangrove and coconut trees, interspersed by river estuaries and lagoons.

Coastal areas have always attracted man and his industries because of the advantages and the ease with which a diverse collection of natural resources can be obtained, the opportunities for waste disposal and recreation, and the growing use of the sea lanes for the exchange of commodities. Like most coastal states, the coastal zones of Ghana, especially at Accra, Tema, and Takoradi have been the major areas for industrial development. About 60% of all industries are located in the Accra-Tema metropolitan area, which covers less than 1% of the total area of the country. In these coastal centers of high population density and extensive industry, discharges into the marine environment consist principally of untreated effluent from the industries. These discharges are unregulated thus increasing the risk of localized pollution to the marine environment.

Oil that is extracted in the West and Central African region is regularly exported by sea to Europe and America. In addition, the coast of Ghana is a pathway for the shipment of petroleum from the Middle East to the western hemisphere. The total volume transported annually along the Gulf of Guniea and hence along the coast of Ghana has been estimated to be around 706 million tonnes (IMO/UNEP 1982). This combines to present an enormous risk of pollution along the coast. Some of the oil found on the coast has come from these ships discharging their tank washings into the marine environment.

The government of Ghana is at the moment engaged in serious exploration and exploitation of oil off-shore. At the moment oil is being exploited from some of the wells, and the result of the wells which are now being sunk is not yet known. Oil pollution will be increased due to this activity especially from well blow-outs.

This project deals with the sources of oil discharged into the sea and the effects of oil pollution on the marine environment. The part on the effect of oil pollution gives a brief account of the effect of oil on the marine environment. It gives some idea of the effects which could occur when oil is spilt and its repercussion to the state. The latter parts deal with how best oil pollution can be prevented or minimized and also the need to set up a satisfactory organization to deal with a major oil spill and get it organized before a major catastrophe actually arrives on our coast.

CHAPTER 1

SOURCES OF OIL DISCHARGED INTO THE SEA

INTRODUCTION:

In the last century, which might be called 'The Age of Oil', escapes of oil into the environment have increased. It is therefore necessary to examine the major sources of pollution. In 1973 the world oil production was over 2.8 billion tonnes and this increased to over 3 billion tonnes in 1979 (Source: Control of Oil Pollution by J.Wardley Smith).

During the transportation of oil, its refining and its use, oil can escape and enter the environment. Oil wells being drilled at times do get out of control and release quantities of oil into the sea or land. Crude oil tankers transporting oil can have accidents and lose part or all of their cargo. Loading and unloading of oil into and from tankers as well as tank washing can produce many oil spills. Shore storage tanks do leak, oil refineries discharge their effluent into the sea, the product can escape from pipe lines. Railwagons, road vehicles or tankers in the process of transport, cause quantities of oil to spill during accidents. Petrochemical plants discharge their effluent, containing some residual hydrocarbon products, into the sea, and industrial sewage always contains waste oil. Automobiles use a lot of oil.

Some of the oil is burnt and some is discharged as oil mist. At times automobiles which are not properly maintained drip oil on to the road or car park. Used lubricating oil from engine sumps is poured into drains or the ground by maintenance mechanics. Some of this oil may eventually arrive in the sea. Even gaseous discharges can be washed from the air by rain onto the ground and to the sea finally.

From the Institute of Petroleum World Statistics, the largest source of oil entering the ocean is from the land, either directly from effluent pipelines from refineries or from petrochemical plants as mentioned above. Their estimate is about 1.3 million tonnes a year. This figure can be reduced by avoiding deliberate discharges.

NATURAL SEEPS

Oil seeps naturally have been noticed in many parts of the world and these seeps still continue. Those which occur beneath the sea are a direct source of pollution. A recent examination made by R.D.Wilson gave an estimate of oil seeps ranging from 0.2 to 6 million tonnes per annum of which a higher percentage comes from the high seepage areas of the world like the Middle East. Oil seeps have been found in areas like California, Gulf of Alaska, Gulf area and the southern part of Australia (Source: National Academy of Sciences, Washington, 1973).

During oil exploration in 1988, Petro-Canada International Assistance discovered oil seeps on the Tano basin off the western coast of Ghana.

OFF-SHORE EXPLORATION AND PRODUCTION

Estimates of the amount of oil entering the sea from drilling and exploration off-shore has been difficult. Drilling in deeper and deeper waters in areas such as the Artic ocean, less favoured for drilling, increases potential for spills. On a world wide basis, losses from this source must be between 100 000 and 150 000 tonnes per annum (Source: Quantitative Estimate of Petroleum in the Ocean by D.B.Charter).

The government of Ghana has signed agreements with Petro-Canada International Assistance Corporation, Amoco Oil Company, Shell International Limited and Unical Oil Company for oil exploration both onshore and off-shore. One well was sunk off the coast of Saltpond in the Central Region of Ghana and at the moment the production rate from this well is about 4500 barrels a day.

The preliminary results of exploration activities by these companies show that there are proved oil and gas reserves in the Tano basin about 30 km off-shore in the Western Region of Ghana. Three wells have been drilled in the Tano basin and one is being drilled off the coast of Tema. According to reports released by the oil companies, there are promising prospects of oil and gas reserves.

Some of the oil found on the coast around these production areas comes from such activities even though the total amount is not yet known. Without effective oil pollution prevention mechanism in place in all the areas under exploitation it is apparent that increased pollution of the marine environment is imminent.

OIL SPILLS FROM OIL WELLS

Oil wells on land spill oil when equipment at the top of the well fails and the oil under pressure squirts out in a great fountain. Fortunately this occurrence is most infrequent. According to figures released from the United States National Academy of Sciences, some type of incident which may result in the discharge of a small amount of oil occurs approximately once for every thousand wells drilled, while a major out-of-control only arises once every ten thousand wells drilled. Oil spills have occurred in hazardous marine conditions such as those in Alaska and the North Sea and are due to adverse weather and sea conditions, it has been difficult to stop the oil escaping. Among these are the EKOFISK blow out in April 1977. This is a Norwegian oil field in the North Sea where about 30 000 tonnes of oil was released during the blow out. A major disaster occurred in the blow out of IXTOC 1 in the Gulf of Mexico off Yucatan Peninsula. The release of oil from this blow out was estimated to be 4000 tonnes daily for about 3 months. Apart from these there have been a number of smaller but still alarming incidents occurring in some of the oil fields around the globe.

Fortunately there has been no oil spill since production started on the Saltpond oil well in the Central Region of Ghana. Oil production started more than five years ago in this oil field. The authorities concerned are doing everything technologically possible to prevent such spills and to dampen its pollution potential should it occur.

DISCHARGE FROM TANKERS

One of the largest sources of oil in the sea comes from routine discharge from ships especially oil tankers. The reasons for discharge from tankers will be given succinctly below.

DISCHARGE DURING OPERATION

After a tanker has discharged her cargo at the unloading port it is so high out of the water that half of the propeller normally comes out of the water. Sea suction entries would be high above the water and possible air locks in the sea water systems occur if sea water pumps are able to take suction at all. All these would make the ship difficult to handle. Because of this most of the tanks are filled with water and usually about 25% of these tanks would be sufficient to sail the ship to the loading port to load. When the tanker arrives at the loading port to load, this ballast water must be discharged and as it is mixed with oil it would not be allowed by the authorities to discharge this oily water into the environment. Because of this something has to be done to replace the oily water in the tanks with clean water before the vessel arrives at the loading port where the clean water can be safely discharged.

A tanker cannot discharge 100% of its cargo. Some of the oil would be left on the bottom and the sides of the tank. The exact amount would depend on factors such as the type of oil, the efficiency of the stripping pumps, oil temperature, etc. There would also be some oil left over in the pipe lines. The ballast water in the tank then

mixes with the oil. The tanks are normally full of water to avoid free surface effect. If the water in the tank is kept for some days without the ship rolling or pitching then most of the oil will rise to the top of the water while the tank bottom will be almost left with clean water. This oily water in the tank would then be pumped overboard and the tank further cleaned with rotating jets of water mixed with some cleaning agents. The whole of the oily water is then pumped over the side again and the tank filled with clean water which would be discharged into the port without pollution on arrival at the loading terminal. The discharge of this oily water into the sea constitutes a large amount of oil. Hence, about two decades back the oily condition of the shores along tanker routes became intolerable so the major oil companies with large tanker fleets had to decide on how best the problem could be solved. They then came out with the load-on-top (LOT) method of tank cleaning.

In the load-on-top method the clean water below the oil is pumped overboard. An oily water monitor control system is fitted so that if the water being pumped out contains a certain amount of oil it will trigger an alarm and the pumping would be stopped. The remaining oily water is then pumped into a slop tank. The tank is then cleaned again and the contents discharged into the slop tank after which the tank is filled with clean water. All the tanks filled with ballast water are treated as such before the vessel arrives at the loading port to commence the next loading. The oily water in the slop tank is allowed to settle and the water at the tank bottom pumped out. Crude oil is pumped out from on top of the slop tank as normal cargo and the refinery will deal with the water mixture in this tank when they take delivery of it. Even though with

this process oil is still discharged into the sea it is at a reasonably accepted limit and has reduced the amount of polluting oil discharged by tankers. However, if the distance between the discharging and loading ports is too short there would not be sufficient time for the oil and water to separate adequately. If the voyage is rough the load-on-top method also cannot be used. In this case the tanker must keep this oily water mixture and discharge it at shore facilities on arrival. Once on shore oil water separators can be used and clean water can be discharged into the sea. The disadvantage with this system is running pipelines from jetties where the ship will berth to installations ashore. Pumping may at times delay the vessel especially with Very Large Crude Carriers (VLCC's) and Ultra Large Crude Carriers (ULCC's).

Another method for cleaning cargo oil tanks known as crude oil washing (COW) has been developed. With this method part of the crude oil is used to wash the tanks and so redisperse the residues remaining in the tanks. With this system the tanker must be fitted with an inert gas system to ensure that a flamable atmosphere will not exist in the cargo tanks. The inert gas system uses flue gases from boiler uptakes to replace the air on top of the oil in the tank as the oil is being unloaded. Part of the oil cargo being unloaded is used in washing machines which are rotated and the jets remove the residues. When a crude oil washing system is used, very little oil is left in the tank. The tanker then takes in ballast water into these cleaner tanks before sailing. After sometime the ballast water settles and the left over oil in the tank floats on top of the water. The clean water at the bottom of the tank is pumped overboard until its oil content detected by the oil monitoring system is such that the pumping is

discontinued. The dirty oil is pumped into a slop tank and the above process repeated until the tank is very clean and then finally ballasted. The clean ballast water is then pumped overboard on arrival at the the loading port. The crude oil washing system has been given world wide international acceptance as an alternative to the use of segregated ballast tanks (SBT). The tanks, SBT, are only used for carrying ballast water and not oil. The contents of these tanks are pumped out and remain empty when the tanker is fully loaded.

TANKER ACCIDENTS

Oil has to be transported from the producing countries to consuming countries. The increasing use of oil has led to the increase in size and number of tankers required to transport it. The figure in the appendix shows the size of tankers from 1886 to 1968.

The increase in number of tankers has increased the number of accidents. The TORREY CANYON disaster, the first major tanker accident, when the tanker ran on to the Seven Stones Rocks off the coast of England, spilled about one hundred thousand tonnes of crude oil. After this came another major tanker accident. The AMOCO CADIZ grounded off the coast of Brittany, in March 1979 and spilled about two hundred and twenty thousand tonnes of crude oil. A lot of major spills have taken place in many parts of the world but another catastrophe which recently occurred is worth mentioning. The recent worst oil spill in USA history, the super tanker, EXXON VALDEZ, ran aground on a reef near Valdez, in Prince William Sound, Alaska, on 24th March, 1989 and spilled about thirty-seven thousand tonnes

of crude oil.

Apart from grounding, which contributes a large amount of oil spilled, collisions involving laden tankers can also cause major spills. On 16th December, 1977, two sister ships (tankers), VEN OIL and VEN PET collided off Port Elizabeth, South Africa, and the total oil lost was about thirty thousand tonnes, which polluted the coast of South Africa. (Source: International Tanker Owners Pollution Federation Limited).

Fortunately there has been no tanker accident on the coast of Ghana yet but considering the heavy traffic from the Gulf along the coast of Ghana, a collision of two tankers resulting in oil on our coast is not to be ruled out.

OTHER SPILLS

Smaller oil spills come from machinery spaces of both tanker and dry cargo vessels. In actual fact oil-water separators must be used on board to separate oily water from engine room bilges. Because of lack of spare gears and proper maintenance most of this equipment does not operate satisfactorily so small quantities of oil are being spilled daily from the ships engine room.

The report by International Tanker Owners Pollution Federation Limited on measures to combat oil pollution from 1974 to 1979 came out with the data below.

World Oil Spills in Port and at Sea by Cause/Operation in Progress (1974-79). (Source: ITOPF)

	Spills in Port		Spills at Sea	
	No.	%	No.	%
Collision	87	2.1	27	0.7
Grounding	147	3.6	53	1.3
Ballasting/Deballasting	556	13.5	37	0.9
Load/Discharge	2120	51.5	141	3.4
Tank Cleaning	60	1.5	10	0.2
Bunkering	404	9.8	23	0.6
Bilge Pumping	95	2.3	13	0.3
Internal Transfer	95	2.3	11	0.2
Other	208	5.0	27	0.7
	3772		342	
Total	4114			

Most of the reasons for oil spills have been found to be human error even if the cause was due to an equipment failure. Statistics taken by the United States Coast Guard (USCG) attribute human error to be the cause of between 50% to 70% of all oil spills.

SHIPS OPERATIONS AT TEMA AND TAKORADI PORTS

In Ghana the most oil polluted areas along the coast are concentrated in the waters close to the port of Tema. Ghana has two sea ports, the port of Tema and the port of Takoradi. About 80% of the country's import passes through Tema port because of its strategic location in terms of its proximity to factories located in Tema and the capital, Accra.

In 1989, the number of ships that called at the port of Tema were 844 of which 65 were oil tankers of up to 50 000 DWT. The number of ships that called at Takoradi port the same year were 376, of which 28 were oil tankers (Ghana Ports and Harbours Statistics Report 1989). Apart from these merchant vessels, a number of smaller fishing vessels also call at the Tema Fishing Harbour. Because some of these fishing vessels that call at the fishing harbour are so small that they do not need a pilot to enter the port, there are no annual statistics on such vessels.

These ships, during normal routine operations, produced waste oil and dirty ballast water. Due to a lack of supervision and strict regulations in our ports, most of these ships pump out their machinery space bilges in port and pollute the harbour and the territorial waters. During the manoeuvring of vessels in the harbour the tides and waves created help in drifting any accumulated oil up on the beaches.

Another problem originates mainly from the fishing vessels sailing freely to and from the fishing port. They contribute to polluting the coastal waters with waste oil.

Most of these ships are very old and have no antipollution equipment on board. They are also operated by uncertified personnel who have no basic knowledge of marine pollution.

The amount of oil entering our waters from ships operations is not known but it can be imagined from the number of ships calling at the ports and the numerous fishing vessels without oily water holding tanks.

TEMA OIL TERMINAL

Ghana imports 1.2 million tonnes of crude oil annually and about 80 000 tonnes of product oil (gas oil, kerosine and petrol). All this oil is handled at the oil terminal adjacent to the fishing harbour within the port of Tema. These quantities were transported by 65 oil tankers, averaging one tanker per week.

The oil tankers discharge their cargo through underground and surface pipes into the tank farms at the Ghanaian Italian Petroleum Company (GHAIP) refinery which is state owned. Due to improper pipe flange connections, leakages occur, and these go directly into the waters. All the piping connections are made by personnel from the Ghana Ports and Harbours Authority (GPHA), and GPHA is responsible for controlling marine pollution at the ports and bringing offenders to book. Because they are the cause of pollution at this terminal, they have neglected elimination of pollution in this area so there is an oil slick all around the port from the oil terminal.

After the crude oil has been refined at the oil refinery some is pumped into smaller oil tankers at the same oil

terminal. These tankers then transport the product oil and marine diesel oil as well as residual fuel to tank farms at the port of Takoradi. It is at this port that all merchant vessels take their bunkers. Also the product oil is used to serve this part of the country as it is cheaper to be transported by sea than by rail or road.

Most of these small tankers have no segregated ballast tanks so they discharge all their oily water from cargo tank washings into the sea on their way to the loading terminal. There is a continuous hazard and threat to the marine environment around the harbour. Serious oil pollution is likely to occur in the event of tanker accidents due to grounding, equipment failure or careless handling which neglects precautionary measures.

TEMA SHIPYARD AND DRYDOCK CORPORATION

This shipyard is a state owned corporation and is located at the east coast end of the harbour. It has two slipways for dry-docking ships. The main dock can accomodate ships up to 100 000 tonnes deadweight and the smaller dock takes ships up to 3000 tonnes deadweight. Twenty to twenty-five vessels of about 10 000 tonnes deadweight are drydocked annually.

The yard is not provided with proper and adequate reception facilities to receive tank cleaning residues from ships. There are four rusted shore tanks each of about 7500 liters capacity to receive oil and oily water in case hot work is to be performed on any fuel oil tank. Most of the oily bilge water from ships machinery spaces goes directly into the dock which then flows into the sea.

Efforts are made by the shipyard personnel to prevent the oily-water from escaping into the sea but still oil escapes into the sea as evidenced by the oil slick around the dock gate. The smaller dock which is about 200 meters from the bigger dock is not provided with any reception facility to receive tank cleaning residues. Thus, in the absence of any strict rules and surveillance , most of these oily residues are disposed of into the port area, resulting in oil pollution of the marine environment.

OIL REFINERY AND OTHER FACTORIES

The main producers of industrial effluents include the oil refinery, GHAIP; the textile factories, GTMC, GTP and TTL; VALCO, and the food products industries, TFCC and CPC. Mineral exploitation also contributes to the pollution load.

All the above mentioned industries are sited at Tema and they all discharge their effluent into the Chemu Lagoon which flows into the sea at Tema New Town. Discharges from industries have created a great impact to the state of pollution on the coast of Tema. Observations have shown that materials in the form of municipal sewage and industrial effluent are discharged into the marine environment as a result of human and industrial activities (Middlebrooks et al 1981).

There are no oily water treatment plants at these industries, or even if there are they are not functioning properly due to poor availability of spare parts to maintain them. Thus, oily water is mainly discharged

untreated into lagoons, estuaries of rivers and the immediate inshore areas.

Of the 16 coastal lagoons studied in terms of biochemical oxygen demand (BOD) by Biney 1982, 2 were found grossly polluted. The grossly polluted lagoons, Korle and Chemu, located in Accra and Tema respectively serve as receptacles of both domestic and industrial wastes. Almost 60% of all industries in Ghana are located in these two cities.

The major source of oil pollution into the Chemu Lagoon is from the state owned oil refinery, GHAIP. The refinery, handling 1.2 million tonnes of crude oil annually, has no efficient working oily water treatment plant and therefore discharges a completely untreated effluent with an oil content of 1mg per liter into the sea. A new treatment plant may be installed soon to improve the efficiency of the refinery under its rehabilitation program which has already started.

With the installation of the treatment plant at GHAIP, there is hope that the grossly polluted Chemu Lagoon which flows into the sea at Tema New Town will reduce the state of oil pollution around the industrialized town of Tema.

Pollution of beaches by tar balls arises mainly from tanker traffic along the coast as well as from refinery and port operations (Portman 1978; UNEP 1982a). The distribution of tar balls is not uniform and where they occur, concentrations range from 0.2 gram to 30 grams per meter square (Biney 1982).

MONITORING OF DISPERSED PETROLEUM HYDROCARBON TAR BALLS ON BEACHES IN GHANA

A survey of the amount of tar deposited on two beaches in Ghana was conducted for 11 months between February and December 1987. A higher estimation was obtained using random sampling then sampling at reference points. Tar balls mainly accumulated at the backshore line and monthly variations did not follow any clear pattern. Compared to other countries in the West and Central African region, tar ball pollution along the coast of Ghana is rather low.

Petroleum hydrocarbons, when released into sea water, increase in viscosity as the lighter fractions are lost into the water and atmosphere and finally form tar balls, which are deposited by wind and current action onto beaches.

Tar balls are relatively biologically inert but persist for long periods and hinder the development of tourism by reducing the aesthetic quality of beaches. It has also been suggested (Blumer, 1972) that since such lumps of tar contain some of the immediately toxic lower boiling hydrocarbons, their presence on recreational beaches may constitute a public hazard through skin contamination. The quantitative estimation of tar on beaches is therefore a necessary prerequisite to the development of control measures.

The results of the 11 month monitoring of tar on two beaches in Ghana mentioned earlier which was undertaken

within the framework of the Joint FAO/IOC/WHO/IAEA/UNEP project on monitoring of pollution in the marine environment of the West and Central region is as below.

In the tables below are presented the range of concentrations of tar (g/m) on beaches for both reference and randomly sampled areas. The largest amounts of tar deposition in given areas occurred in December. These were 36.5g/m and 8.8g/m at Prampram and Accra-east respectively. The mean monthly concentrations of tar, reported as g/m and gram per meter square, are also presented in the tables. For the whole study period, randomly sampled tar occurred at a total mean rate of 3.1 plus or minus 3.8g/m at Prampram and 0.94 plus or minus 1.6g/m at Accra-east as against respective values of 0.53 plus or minus 0.66 and 0.20 plus or minus 0.26g/m for the reference points.

For both types of sampling, more tar balls occurred on the beaches of Prampram than at Accra-east. The true rates of tar deposition on both beaches, as given by sampling at the reference points, were about five times lower than those obtained by random sampling. Thus it is likely that most of the tar collected by random sampling had accumulated over a long period of time. Tar balls generally accumulated at the backshore line. Thus variation in distance from the waterline to the backshore line did not have any effect on the amount of tar collected.

On a monthly basis, there was no clear pattern of tar deposition on both beaches. Thus the high standard deviation in all cases (tables) indicate a wide variation in the monthly rates of deposition, as would be expected

with the periodic releases of petroleum hydrocarbons into the sea as a result of man's activities.

Concentration ranges of tar (g/m) on beaches

Month	Prampram	Accra-east
February 1987	0 - 10	0.03 - 0.07
March	0.64 - 3.6	0.0
April	2.6 - 5.0	1.5 - 2.9
May	0 - 0.36	0.37 - 0.75
June	0 - 8	0 - 0.73
July	0 - 0.33	0 - 0.22
August	0 - 0.7	0
September	0 - 11.2	0.2 - 0.9
October	0 - 2.1	0 - 0.5
November	0.1 - 0.5	0.23 - 0.6
December	0.5 - 36.5	0.65 - 8.8

Mean concentrations of tar balls (g/m) on beaches

	Random Sampling		Reference Point	
Month	Prampram	Accra-east	Prampram	Accra-east
February	5.0	0.05		
March	1.8	0.0		
April	4.0	2.2		
May	0.11	0.53	0.04	0.0
June	4.8	0.40	0.76	0.0
July	0.11	0.17	0.0	0.0
August	0.34	0.0	0.0	0.0
September	3.7	0.54	0.72	0.24
October	1.7	0.20	2.1	0.10
November	0.3	0.41	0.1	0.60
December	13.6	5.8	0.5	0.65

Mean concentration of tar gram per meter square on beaches

	Random Sampling		Reference Point	
Month	Prampram	Accra-east	Prampram	Accra-east
February	0.40	0.004		
March	0.14	0.0		
April	0.5	0.24		
May	0.007	0.076	0.003	0.0
June	0.44	0.057	0.069	0.0
July	0.012	0.043	0.0	0.0
August	0.038	0.0	0.0	0.0
September	0.20	0.049	0.036	0.022
October	0.013	0.015	0.16	0.008
November	0.03	0.051	0.01	0.075
December	1.36	0.50	0.05	0.065

Source: C.A.BINEY, INSTITUTE OF ACQUATIC BIOLOGY, ACCRA.

CHAPTER 2

THE IMPACT OF OIL POLLUTION ON THE ENVIRONMENT

INTRODUCTION

Marine oil pollution is a major hazard. At one extreme a major spill can severely damage local industry and kill thousands of sea birds; at the other a series of major spills or operational discharges can deface beaches and coastlines. The effect of oil on marine life is governed by many factors. These factors may include the type of oil whether crude oil, lubricating oil, diesel oil, etc., and its quantity, the duration of pollution on the marine life and the time of the year, especially in areas where there are seasonal variations. Any, or a combination of these types will affect marine life in different ways. The effect may be lethal or sub-lethal and can affect the behavioural activities which can prevent growth or reproduction.

Fish, the source of much food for man and his domestic animals, may be rendered unfit to eat or may die due to oil pollution. Fishermen may not be able to fish from the sea because of the pollution. This will result in a loss of income to them.

Nelson-Smith (Senior Lecturer, University College of Swansea) estimates that a man would require at least one kilogram of phytoplankton to gain one gram in weight.

This useful statistic highlights the fact that direct effects on fish stocks eaten by man are of much greater economic importance than equivalent damage in terms of biomass lost to the planktonic organisms on which the fish depend.

The presence of accumulated petroleum hydrocarbon compounds in fish, and whether they represent a threat to the consumer will be discussed later in this chapter.

THE EFFECTS OF OIL POLLUTION ON GHANA'S FISHING INDUSTRY

Along the West coast of Africa, Ghana is one of the leading fishing nations. Her catch in tonnes for the year 1986 was 269 157 as compared to her neighbouring countries, Nigeria and Cote d' Ivoire where the catches were 161 515 and 76 174 tonnes respectively (FAO Statistics 1986).

Artisanal fisheries are generally the most important sector in the fishing industry in terms of employment, contribution to fish production, and contribution to food supply and protein availability.

In most fishing towns and villages in Ghana, men are usually responsible for offshore fishing. The women are responsible for marketing the sea food caught by the men. The most popular fish caught by the artisanal fishermen are herrings. Tuna fishing has also of late become popular. Many tuna vessels have been brought into the country for this type of fishing because tuna is a common fish found in Ghana's territorial waters. Most of this delicious species caught are exported to earn the country

the most needed foreign exchange.

For the expansion and improvement in the fishing industry, the Ghanaian government has developed a number of 10 to 15 meter wooden fishing boats, suitable for local construction, that are adapted to Ghana's inshore ocean fishery. They operate much more efficiently than the beach canoes of the traditional fishery. With these improvements the total catch has increased to such an extent that it is able to meet the local consumption refinement, leaving a surplus that is exported to earn foreign exchange.

Oil pollution to fisheries is a potential threat for the following reasons:

(a) It may directly harm fish and shellfish stocks.

(b) Fish and shellfish which are polluted by oil may not be accepted by the consumer.

(c) Polluted waters may interfere physically with fishing operations.

(d) It may be a health hazard to the unaware consumer.

Naturally, demand for fish in an area where there has been a major oil spill is low. The direct financial costs for the fishing population in an area of spill for the number of days the fishermen will be unable to fish will be many thousands of cedis (One US Dollar is equal to three hundred Ghana Cedis). "The importance of the effects of oil to the socioeconomic structure have been studied with

reference to the market. The economy has shown itself to be sensitive to all types and sizes of oil spills ...." (Rosenblum Estimates of Socioeconomic Damages of an Oil Spill 1975).

A major oil spill will therefore affect the fishing industry, the consumers who depend on fish for the much needed protein, and the nation as a whole for some time.

SEABIRDS

Seabirds are vulnerable to a wide range of pollutants. Oil pollution presents a particularly serious hazard to seabirds because oil floats on the water where it comes into contact with the swimming birds. While the oil is liquid it soaks the birds plumage, destroying their buoyancy so that they tend to sink and become chilled. Birds encountering fresh oil may inhale fumes and may swallow oil after preening and this is dangerous to birds. As oil solidifies on the surface of the sea, small tar balls may be picked up by birds presumably in mistake for food, and this might as well cause harm.

Between August and September, every year, thousands of terns, warders and other seabirds migrate from Europe to the shores of Ghana, to escape winter and return when the weather improves in Europe (Source: Save the Seashore Birds Project-Ghana).

A survey undertaken on the entire coast of Ghana by a team of British ornithologists and staff of the Ghana Game and Wildlife Department identified key sites for terns and shorebirds. Some of the sites identified are Tema Fishing

Harbour, Essiama Beach, Sakumo Lagoon and Panbros Salt Pans. The numerous lagoons, river estuaries and salt pans along the coast of Ghana provide ideal feeding and roosting grounds for the birds. The birds are attracted to the shores of Ghana, as explained by Dr Yaa Ntiamoa-Baidu, the project officer of the Save the Seashore Birds Project in Ghana, between August and January each year by their main food, sardines and anchovies, which are in abundance in Ghana's coastal waters.

But our coastal waters are not so ideal, because a substantial number of these birds never get the chance to return to Europe to breed. Some of them are shot or trapped by young boys in our coastal villages for fun. Those that reach the Tema Fishing Harbour and other coastal areas (where the oil pollution rate is high), to feed on anchovies, die because of the toxicity of the oil and also due to loss of buoyancy, which causes them to sink.

Knowing Ghana to be a key site for wintering roseate terns, and aware of the large losses on our coast, the attention of ornithologists and conservationists was focused on Ghana in an attempt to save the roseate tern. An agreement has been signed by the government of Ghana and the Royal Society for the Protection of Birds-Britain (RSPB-B) to protect the seashore birds.

Much money has been pumped into this project by the government of Ghana. Most of the attention to save the birds is concentrated in training and educating the young boys who trap the birds. To minimise the high mortality rate of the birds, the authorities concerned must also be concerned with the marine environmental problems in order

to save these rare seabirds.

EFFECTS ON THE TOURIST INDUSTRY

Some conditions under which an oil discharge could produce serious consequences for a tourist district, some, are:

(a) The discharge is extensive and affects all beaches in the district.

(b) Wind conditions cause the oil to sweep on to the land for a number of days.

The probability that an accident fulfils the above conditions is small, but it still gives cause for concern in a lot of people who are dependent on tourism in areas exposed to the threat of oil spills.

The tourist industry in Ghana is one of the areas where the nation earns foreign exchange. Foreigners are attracted to the nice sandy beaches of Ghana. One particular beach needs mentioning, the Labadi Pleasure Beach in Accra on the Accra-Tema beach road near to the Military Academy and Training School (MATS). This beach attracts about 5000 foreign tourists annually, mostly Europeans. Most of the tourists visit the beach between December and February when the weather is very cold in Europe. September has been another peak season. During the peak seasons a lot of activities take place at the beach which generate a lot of income to the proprietor and the state. The most popular activity, code named "Meet Me There", which takes place at this beach attracts the average Ghanaian staying in Accra and surrounding towns

and some of the tourists who happen to be in the country at that time. The income from the one day show is in the region of 22 million cedis, which the tourist industry cannot afford to lose. This is not the only beach that has attracted attention. Busua Beach, Botiano Beach, to mention a few, are all nice beaches which have been developed to attract tourists and hence generate some income to the state.

Tar balls and oil have been found occasionally on these beaches, but are quickly cleaned to make them appear tidy to attract tourists. In case of any major oil spill on the coast, the beaches will be defaced and the above mentioned revenues will be a loss to the state.

SALT PANS

The salt industry in Ghana is another area where many of the people living along the coast earn their living. There are a couple of these small scale industries along the coast. The largest of them are the Panbros Salt Pans at Mendskrom in Accra, and the Elmina Salt Pans in Elmina. Salt is extracted from sea water by the natural evaporation method in large shallow artificial ponds. Mainly ordinary table salt is obtained and the annual production rate is high. Some of the salt is consumed locally and the rest exported to the neighbouring countries, especially Nigeria, to earn foreign exchange for the nation.

Any major oil pollution on the coast, from the sources discussed before, will render the "huge mountains" of stock pile in the producing areas along the coast unfit to

consume. It will also render workers in this small scale industry jobless and create economic hardships for some time until the oil is cleaned and production started. The country will lose the foreign exchange from the export of this commodity.

MANGROVES

Most of the Ghanaian coastline, is dominated by mangrove swamps. Mangroves are trees growing up to the extreme high water mark on sheltered shores and in estuaries throughout the tropics. They provide feeding and breeding grounds for a variety of fish and crustaceans. The prop roots and trunks usually support a varied fauna of oysters, snails, barnacles, crabs and other invertebrates. Mangroves are of commercial importance in the production of timber, firewood and charcoal. Its leaves have been used as livestock feed and are also used in various medicinal purposes for human beings and livestock.

Mangrove swamps are usually subjected to disturbances following oil well blow-outs, normal ships operations etc. From the author's own experience, the mangrove zone around the Chemu Lagoon at Tema where most of the industrial effluent flow through has shrunk. Some effects of petroleum hydrocarbons on mangrove systems following severe oil spills are high mortalities of invertibrates, defoliation of mangroves, and death of seedlings (Baker et al).

EFFECT ON HUMAN HEALTH

There have been various suggestions and warnings that petroleum hydrocarbons entering the marine environment may constitute a health hazard to humans. These concerns have been amplified as a result of several major maritime transportation and production accidents during the past years. Contact with the human population following such accidents may be acute or chronic. Clean up crews, members of the investigation scientific community, and coastal residents may be subjected to acute exposure following a local spill.

In such cases, human uptake may be by inhalation, skin contact, or even ingestion of the petroleum refined products. Exposures may also occur by direct contact with hydrocarbon components in the pelegic tars that are washed ashore frequently, such as the tar balls now found commonly on many of the world's beaches including Ghana. The U.S.A National Research Council, published, after a series of research, that chronic non occupational exposure may occur through the accumulation and transfer of potentially harmful hydrocarbons from contaminated seafoods. One potential route of oil contact with man is through eating oiled seafood.

Symptons characteristic of acute toxicity to petroleum vapours were reported following the AMOCO CADIZ oil spill along the coast of France. Among the symptons reported by workers and coastal inhabitants, as well as some of the scientific groups studying aspects of the oil spill, were headaches, dizziness, nausea, vomiting and abdominal pains. Workers coming in direct contact with the oil also reported skin irritations (Menez et al, 1978). But blood

samples taken from clean up personnel and inhabitants of that area showed no significant changes in their blood.

CHAPTER 3

PREVENTION OF OIL POLLUTION

INTRODUCTION

In the glamour of the high technology systems of the oil industry it is easy to lose track of the fact that the foundation of the whole business is people. We extract, transport, refine and use oil to serve human needs. These processes are designed and conducted by skilled humans and if something goes wrong it can only be because somewhere at some time one or more of these people made mistakes. There is no other cause of accidents or source of pollution (Professor W.T. Singleton, University of Aston, Birmingham).

From the above statement by Professor Singleton, it is clear that human error contributes to all pollution incidents. Therefore if all those involved in the oil industry, be it designers, manufacturers, operators, transporters, etc. take pains to discharge their duties efficiently, oil pollution will be prevented or greatly minimized.

For some time now it has been recognized that the amount of oil being discharged into the marine environment is becoming a hazard and nuisance to mankind, and attempts have been made to minimize operational pollution from ships, oil rigs etc. Much research has been carried out

on the effect of oil pollution into the sea, on means of preventing the escape of oil, and on equipment and methods to combat oil after its discharge. Measures such as better technical precautions, avoidance of tanker collisions, better development in shipbuilding and better navigational aids have been taken to prevent accidental oil pollution.

Some governments and tanker owners have introduced various measures to reduce operational pollution and tanker accidents. But as shipping is international in character, rules and standards pertaining to safety of life at sea and prevention of pollution must be discussed at the international level.

IMO, the United Nations specialized agency responsible for maritime affairs, has adopted a number of international conventions covering many aspects of maritime safety and pollution prevention. There is no doubt that these conventions have greatly reduced pollution on the world's oceans.

This chapter will therefore briefly examine the various international conventions which deal with oil pollution prevention, liability and compensation as well as surveillance, port state control, equipment and surveys.

THE INTERNATIONAL MARITIME ORGANIZATION (IMO)

Before the various conventions covering pollution prevention are discussed, it will be appropriate to describe briefly the organization that drafted these conventions.

The establishment of the IMO was adopted by a convention on 6 March 1948 by the United Nations Maritime Conference on 19 February 1948 in Geneva. The convention, then known as the convention on the Inter-Governmental Maritime Consultative Organization (IMCO) entered into force on 17 March 1958. IMO was inaugurated on 6 January 1959. The name of the organization was changed to the International Maritime Organization on 22 May 1982.

The main two objectives of IMO are to improve the safety of life at sea and to prevent and control marine pollution from ships. Hence, most of the IMO's actions have been focused on "Safer Shipping and Cleaner Oceans".

IMO has 134 member states and one associate member. More than 28 treaty instruments covering many aspects of maritime safety and pollution prevention have been adopted by IMO.

The IMO Assembly meets once every two years to adopt measures which are of mutual benefit. The Marine Environmental Protection Committee (MEPC), which consists of all the member states is a technical body of the organization which is empowered to:

(a) Develop and adopt the highest practicable standards for the prevention and control of pollution from ships.

(b) Promote co-operation among governments, particularly at the regional level, for combating pollution in emergency cases.

(c) Adopt and amend conventions and other regulations and measures to ensure their enforcement.

THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION OF THE SEA BY OIL, 1954 (OILPOL)

OILPOL was the first international treaty exclusively designed to deal with oil pollution control. It was adopted in London in 1954. It has now been succeeded by MARPOL '73/78 and is therefore, strictly speaking, no longer applicable. MARPOL came into force in October 1983, and has not been ratified by many states, including Ghana, so the OILPOL provision will still remain effective for those states that have not ratified MARPOL until they do so.

The main objective of the OILPOL was to protect the seas from oil pollution. It prohibits the international discharge of oil and oily mixtures by certain ships in specified areas of the oceans. Thus, ballast discharges have to be confined to permitted areas and all loading and discharging operations must be recorded in an oil record book, which is inspected at regular intervals.

OILPOL was amended in 1962, to narrow the permitted areas for pollutant discharges. It was amended again in 1969 in response to the TORREY CANYON disaster, which had illustrated some of the weakness in OILPOL. The 1969 amendment prohibited oil discharge through the normal operation of a ship except under the following conditions:

(a) The total quantity of oil which a tanker may

discharge in any ballast voyage must not exceed 1/15000 of the total cargo carrying capacity of the vessel.

(b) The rate at which oil may be discharged must not exceed 60 liters per nautical mile travelled by the ship.

(c) No discharge of any oil whatsoever must be made from the cargo spaces of a tanker within 50 miles of the nearest land.

Two further amendments were designed in 1971. One was designed to deal with the environmentally vulnerable waters of the Great Barrier Reef of Australia. The second amendment attempted to deal with tank sizes of tank-ships. It was felt that smaller tank sizes might result in less pollution, particularly due to collision or stranding. Both of the 1971 amendments have not entered into force.

Thus while OILPOL has now been superseded it will, nevertheless, continue to be a part of international marine pollution law for some time to come.

THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS,1973, AS MODIFIED BY THE PROTOCOL OF 1978, (MARPOL '73/78).

This convention, MARPOL '73/78, entered into force in October 1983 and effectively supersedes OILPOL 54. It ushers in a considerable change in the international control of marine pollution. It has been the most important international marine pollution convention to

enter into effect in maritime history. It not only deals with pollution by oil, but also pollution from chemical and other harmful substances, garbage and sewage, with the exception of disposal of land generated wastes into the sea by dumping.

MARPOL consists of a main body of the convention with 20 articles, two Protocols dealing respectively with reports in incidents involving harmful substances and arbitration, and five annexes which set out the actual prevention regulations as follows:

Annex I: Pollution by oil

Annex II: Pollution by noxious liquid substances carried in bulk

Annex III: Pollution by harmful substances carried in packages, portable tanks, freight containers or rail or road tank wagons etc

Annex IV: Pollution by sewage from ships

Annex V: Pollution by garbage from ships.

The first two Annexes are compulsory while the others are still optional.

The Convention reduces greatly the amount of oil which can be discharged into the sea by ships. Certain regions, the Mediterranean Sea, the Black Sea, the Baltic Sea, the Red Sea and the Gulfs area have been designated as "special areas" in which any discharge of oil or oily mixture into the sea is prohibited except segregated or clean ballast,

or when the oil content of the effluent without dilution does not exceed 15 parts per million.

Due to a series of very grave tanker accidents which took place in 1977/78, IMO convened an international conference on tanker safety and pollution prevention in 1978. This conference among other things, introduced further measures including requirements for such operational techniques as crude oil washing (COW) and a number of modified construction requirements such as ballast tanks located and arranged to protect cargo cargo tanks from damage.

The key to MARPOL is the prevention of pollution and it therefore sets out to eliminate operational pollution, which includes intentional as well as negligent pollution. Furthermore, the Convention also seeks to minimize accidental spills.

THE INTERNATIONAL CONVENTION RELATING TO INTERVENTION ON THE HIGH SEAS IN CASE OF OIL POLLUTION CASUALTIES, 1969 (INTERVENTION 1969)

The Intervention Convention was the result of the TORREY CANYON disaster in March 1967. It gives coastal states limited rights to take preventive measures on the high seas against vessels which are considered to present grave and imminent danger to coastlines and other coastal interests from oil pollution as a result of a maritime casualty.

There is no question that this Convention caused very considerable debate as it was a real departure from the traditional international legal principle which allowed no

interference in the legitimate operations of vessels on the high seas. Thus, for the first time, states other than the flag state were permitted to take preventive and mitigating action against foreign vessels, provided that there was a realistic concern that oil pollution might result in major harmful consequences.

The Convention has been criticized both for allowing too much discretion to coastal states and for limiting the rights of such states to take action. It has been in effect since 1975 and has been accepted by a large number of states. In 1973 a Protocol covering substances other than oil was added which entered into effect in 1983.

INTERNATIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE, 1969 (CLC 1969).

The purpose of this Convention is to provide a uniform set of international rules and procedures for determining liability and, as a consequence, provide compensation to those who suffer damage caused by the escape or discharge of oil. Only oil carried in bulk as a cargo is included. Tankers in ballast are thus not covered.

Liability for damage from pollution is placed on the shipowner. The shipowner has to prove that certain exceptions exist if he wishes to avoid liability. Exceptions are limited to war, natural phenomena of an exceptional nature, wrongful acts and negligence of the victim, as well as the failure of authorities in maintaining navigational aids.

However, in most cases where the shipowner cannot avail

himself of such exceptions, and where he is not held to be at fault, he can limit liability to approximately USD 160 per ton with a ceiling of approximately USD 17 million per incident. An amending protocol to the Convention, which entered into force in 1981, replaces the original gold standard of compensation calculation with the Special Drawing Rights (SDR) of the International Monetary Fund.

In order to be covered under the Convention the ship must carry certificates confirming the existence of such liability insurance. Such certificates are demanded by many states as evidence of adequate coverage.

The Convention only applies to damage caused in the territory and territorial sea of states which are parties to the Convention, although the flag state and the shipowner's state need not be parties to the Convention. Action against those liable under the Convention must be brought in the state where the damage occurred, and the shipowner wishing to limit liability must establish his fund similarly to the method used in other limitation proceedings. The court which assumes jurisdiction over such a fund will have sole responsibility for appointment and distribution of the fund.

As the CLC Convention was no longer able to fully meet the demands of major pollution incidents, a protocol was developed in 1984 at the IMO. The CLC Protocol raises liability limits for ships up to 5000 GRT to about USD 3.1 million (in SDR funds). For larger vessels, the limit is increased by tonnage-based formulas to a maximum of about USD 62 million for vessels of 140 000 GRT and above. If proven damages exceed the shipowner's liability the 1984 Fund Protocol would provide additional compensation.

THE INTERNATIONAL CONVENTION ON THE ESTABLISHMENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLUTION DAMAGE, 1971 (FUND 1974).

The FUND 1971 Convention, was a supplementary convention to CLC, to provide cover for catastrophic pollution incidents as marine insurance underwriters realized that for very large-scale pollution incidents the CLC limits might not be adequate. It came into force in 1978.

The FUND 1971 Convention consists of a fund financed from levies on the import and export of oil in contracting states. Only oil (cargo or bunkers) carried in bulk by vessels is covered. Parties to the Fund must also be parties to the CLC. Furthermore, for a shipowner to receive indemnities under the FUND, the flag state of the ship must be a party to the Convention. The FUND allows cover of about USD 54 million maximum aggregated with any available CLC cover but the FUND administration has the power to increase the maximum to USD 72 million.

Contributions to the FUND are made by crude and fuel oil cargo receivers in contracting states on a pro rata basis. There has been a protocol to amend the FUND Convention. The FUND Protocol 1984 revises the FUND Convention by raising the maximum of USD 208 million, providing the aggregate quantity of oil imported in three of the contracting states totalled at least 600 million tonnes in the preceding calendar year. This protocol has not entered into force yet.

TOVALOP AND CRISTAL

The Tanker Owners Voluntary Agreement concerning Liability for Oil Pollution (TOVALOP) was established by the tanker shipping industry and came into force on 18 September 1969 to augment the CLC. TOVALOP provides that a Participating Tanker Owner will compensate persons, including governments, who sustain pollution damage as a result of the escape or discharge of oil. The compensation provisions cover not only actual damage, but also costs incurred in mitigation and removal. Tankers, whether loaded or in ballast, are included, but only persistent oils (cargo or bunkers) are included.

TOVALOP is administered by the International Tanker Owners Pollution Federation based in London. Claims against the scheme must be brought directly against the vessel owner. In case of dispute, liability may be enforced through arbitration under the Rules of the International Chamber of Commerce.

TOVALOP is supplemented by CRISTAL - the Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution Damage, signed in 1971. CRISTAL is funded by contribution from cargo-owner parties and oil companies and liability is conditional upon the oil being owned by a Party and the tanker in question being enrolled in TOVALOP. The circumstances must be such that the Civil Liability Convention imposes liability on the tanker. The ceiling on liability under CRISTAL is the same as under the FUND Convention.

LEGISLATION RELATING TO MARINE POLLUTION PREVENTION IN GHANA

In the process of tackling environmental problems, environmental laws and legislation have been accepted worldwide as one of the effective methods of environmental management. In Ghana, the prevailing legal systems, as well as the majority of the laws, are a legacy of the colonial regime. The environmental laws which existed during the colonial era, though sectoral and fragmented, did make provision for the conservation of forest and wildlife, and activities that could damage the human environment. These laws went a long way towards maintaining a healthy environment for the local people.

In Ghana, however, one area that was left untouched by legislation during the colonial era was the marine environment. One can hardly find any pre-independence legislation, that deals with marine pollution prevention in Ghana. At present there is no law against the dumping of refuse or municipal waste into the marine environment. Go to some of our beaches after a rainy day and you will find the beaches littered with refuse that has been washed ashore. At Korle Gonno, a suburb of Accra, there is a tipping station which discharges raw sewage into the sea. The dumping site unfortunately is a good fishing ground for the fishermen. The proliferation of urban settlements and industrial complexes along the coastal areas have made it imperative that legislation be enacted to control the dumping of waste into the sea, especially because of the environmental health hazards posed by untreated sewage and other municipal wastes emptied on the beaches. The dumping of industrial wastes in coastal waters pollutes the sea and contaminates the marine fauna making them

unfit for human consumption. Unfortunately, there are no laws dealing with marine pollution from land based sources. This is something that requires urgent attention.

OIL IN NAVIGABLE WATERS ACT 1964 ACT 235

The earliest piece of legislation in Ghana that sought to deal with the problem of marine pollution was the Oil in Navigable Waters Act, 1964 (Act 235) which sought to give effect to the International Convention for the Prevention of Pollution of the Sea by oil, 1954 (OILPOL 1954). This is the statue that most expresses its concern for the control of marine pollution. Although this Convention was concluded before the independence of Ghana, Ghana deposited a document of acceptance of the Convention with IMO in 1962 and hence became obliged to implement the provisions of the convention.

Section 3 of the Act deals with discharge of oil into Ghanaian waters. Sub-section 2 provides that the section applies to:

(a) the whole of the sea within seaward limits of the territorial waters of Ghana.

(b) all other waters (including inland waters) which are within those limits and are navigable by sea going ships.

If any oil or mixture containing oil is discharged from any vessel, or from any place on land, or from any apparatus used for transferring oil from or to any vessel,

into such waters, then the owner or master of the ship, or the occupier of the place on land, or the person in charge of the apparatus for transferring the oil, as the case may be, is guilty of an offense and liable, on conviction, to a fine. Such fine is not to exceed two thousand cedis on summary conviction. But there is no maximum limit to the fine if the offender is convicted on an indictment. Conviction on indictment is usually in the High Court.

Section 3 of the Act, set out above, is wider than the Convention which is concerned with sea pollution. The concern of the Convention for sea pollution is reflected in section 1 of the Act which regulates the discharge of oil into prohibited sea areas extending beyond the territorial limits of Ghana.

Section 1 (1) provides as follows:

> If any oil to which this section applies is discharged from any ship registered in Ghana into a part of the sea which is a prohibited sea area, or if any mixture containing not less than one hundred parts of oil to which this section applies in a million parts of the mixture is discharged from such a ship into such a part of the sea, the owner or master of the ship shall, subject to the provisions of this Act, be guilty of an offense under this section.

The prohibited areas are spelt out in the First Schedule to the Act. These are all sea areas within 80 kilometers from land and outside the territorial waters of Ghana, with certain specified exceptions. The Act thus deals not

only with pollution of Ghanaian waters but even pollution of the high seas by ships registered in Ghana. Such ships registered in Ghana are also required by section 5 (1) of the Act to be so fitted as to prevent oil fuel from leaking or draining into bilges, unless effective means are provided to ensure that the oil in the bilges is not discharged in contravention of the Act.

PETROLEUM EXPLORATION AND PRODUCTION LAW 1984 (PNDC LAW 84)

The most recent piece of legislation on marine pollution prevention is the Petroleum Exploration and Production Law 1984 (PNDC LAW 84). Section 23 (17) and (18) of the Law provides that:

> (17) A contractor or sub-contractor carrying out petroleum operations shall maintain at the work site an establishment capable of dealing adequately with fire, oil spill blow outs, accidents or other emergency situations so as to prevent or control such situations and to minimize loss or damage there from.
>
> (18) A contractor or sub-contractor carrying out petroleum operations shall be responsible for any pollution or damage caused by or resulting from such operations as well as pollution or damage caused by or resulting from petroleum operations undertaken by an

agent or employee of such contractor or sub-contractor and shall take all necessary measures to remedy any pollution or damage so caused.

These provisions should ordinarily go a long way in abating marine pollution arising from oil exploration and production if effectively implemented. It is hoped that, in accordance with the provision of Section 23 (17), the Ministry of Fuel and Power, which is responsible for issuing licences for petroleum exploration and production along our shores, have the requisite equipment to deal with oil spills, blow outs and emergency situations that may arise. Section 23 (18) is similar to the provisions of the CLC Convention. Such a principle is likely to induce or at least encourage the prospective polluter who alone is in a position to control the situation to take adequate and reasonable measures to avert the pollution altogether or to minimize its effects. The polluter alone ought to be held responsible if he ignores such safeguards.

REGIONAL CONVENTIONS TO WHICH GHANA IS A PARTY

Environmental problems rarely affect one nation alone, particularly in coastal areas and the marine environment. Each country's pollution, whether from land based sources or off shore can degrade the environment of neighbouring states. In fact, oil has no respect for international boundaries. Within a region, fishing grounds are normally shared by several nations.

Most of the sea's environmental problems show up in

coastal waters and are often specific for a particular region. Therefore, as the UNEP planners saw, regional cooperation is needed to protect the coastal environment and the sea's resources, whether the problems are oil spills or pollution from land. Again take the problem of pollution from land based sources such as industrial waste, municipal sewage and agricultural run offs. Together they account for almost all the pollution reaching the coastal waters and considering the unequal state of world development it would appear impossible to unite all countries in a global programme to control such pollution. Within regions, it has proved feasible to unite countries to fight a common problem. Governments can see clearly their common interest in holding down such hazards to the marine environment where they all share the same water resources.

Realizing that Regional cooperation offers the best solution in dealing with marine pollution, the Governing Council of UNEP in 1974 endorsed the regional approach to controlling marine pollution. At the moment there are 10 Regional Seas Programmes including one for the West and Central African Region. For each of the 10 regions, UNEP has adopted a similar strategy aimed at tackling the causes as well as the consequences of environmental damage in coastal areas. The strategy is made up of the following:

(a) An Action plan setting out the activities for scientific research and cooperation including assessment and management.

(b) A legally binding convention embodying several commitments.

(c) Technical and specific protocols to deal with individual issues such as dumping, cooperation in pollution emergencies, land based pollution sources and conservation.

(d) Financial and institutional arrangements that provide the back up for the other parts.

For the West and Central African Region, a conference held in Abidjan, Cote d'Ivoire, in March, 1981, resulted in the adoption of the Plan of Action, a Convention, a Protocol on cooperating in fighting pollution emergencies and the hot pursuit resolution. In signing the Convention, West and Central African States gave a strong backing to the fight against oil pollution - a major menace in the off shore shipping corridor between the Indian Ocean and Europe. All the states approved a declaration giving naval vessels a right of hot pursuit against dumpers, even if this means entering a neighbouring country's national waters.

The Convention for the Cooperation in the Protection and Development of the Marine and Coastal Environment of the West African Region and the Protocol concerning Cooperation and Combating Pollution in cases of emergency were signed by 12 states including Ghana at the Abidjan Conference in March 1981.. In accordance with Article 29 of the Convention, The Convention and its Protocol will enter into force when 6 states have deposited their instruments of ratification with the depository, the Government of Cote d'Ivoire. Since the documents were signed in 1981, a number of countries have ratified the Convention and its Protocol. Ghana ratified the

Convention in 1984. With the ratification of the document by more than six countries, the convention and its protocol have all come into being and Ghana as a signatory, has obligations under its provisions.

With the ratification of the provisions of this Convention by Ghana, the nation is under an international legal obligation to ensure compliance of its provisions within its territory. The governments which have ratified the convention are also under an obligation to bring their national legislation on the environment and natural resources in harmony with its regional partners.

INTERNATIONAL CONVENTIONS ON THE MARINE ENVIRONMENT TO WHICH GHANA IS A PARTY

Ghana has ratified three major international conventions that give protection against pollution from ships through normal operation or dumping activities. The first of these is the OILPOL 1954. The second major convention is the CLC 1969 and the third is the FUND 1971 Convention.

There are two other important Conventions on the Protection of Marine Pollution to which Ghana is not a party. These are the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (LDC 1972) and the MARPOL 73/78 Convention.

The dumping of wastes and toxic chemicals and even nuclear wastes at sea is assuming alarming proportions, and there is the need for Ghana to join with other nations that have ratified this convention so that they all join together to ensure that the sea does not become the dumping grounds of

wastes and other matter that will destroy the marine ecosystem.

SURVEY OF SHIPS

Ships are built to comply with the requirements of national laws, international conventions and other instruments. In other to comply with the requirements, ships are subjected to a number of surveys by classification societies and administrations. These surveys are necessary to ensure safety of life at sea and prevention of marine pollution. There are a number of surveys, of which some are discussed below briefly.

INITIAL SURVEY

The initial survey includes a thorough and complete examination of a ship and its equipment in accordance with the requirements of Annex I of MARPOL 73/78. The survey consists of the following procedure:

Examination of the plans, specifications and other documents to verify that the design of the ship and its equipment comply with prevailing requirements.

Confirmation that the oil pollution prevention equipment is of the type approved as required by MARPOL 73/78.

Confirmation that the ship carries on board required certificates, oil record books, manuals

and other documents.

Survey of the condition of the ship and its equipment to ascertain that they are constructed and the equipment is installed in accordance with the approved plans and specifications, and that workmanship is all satisfactory.

The oil pollution prevention equipment approved under MARPOL 73/78 for ships' machinery space bilges ensures the following:

That the ship is fitted with oily-water separating equipment from which effluent discharge overboard should not be more than 15ppm.

That there is satisfactory installation of the oil discharge monitoring and control systems including the automatic and manual operation of the means provided to stop the discharge of effluent.

That indicators and recording devices installed in the monitor are operable.

That a sufficient supply of consumables for the recording devices are on board.

That the alarm for the oil filtering equipment operates satisfactory.

That the ship has an oily residue tank and its discharge arrangements.

After the surveyor has surveyed the ship and is satisfied that the vessel conforms to the standard required, an IOPP and other certificates are issued.

MANDATORY ANNUAL SURVEY

This survey is carried on to ensure that the condition of the ship and its equipment are being maintained in a satisfactory working condition. It is carried out three months before or after the anniversary date of the IOPP Certificate. The survey should consist of:

Examination of certificate, manuals and oil record book.

Visual examination to confirm that no unapproved modifications have been made to the ship and its equipment.

Visual examination of the ship and its equipment and certain tests to confirm that their condition is being properly maintained.

INTERMEDIATE SURVEY

The intermediate survey is a thorough examination to ensure that the equipment and associated pumping and piping systems, including oil discharge monitoring and control systems, oily-water separating equipment and oil filtering systems comply with applicable requirements and are in good working order. It also includes examination of certificates, oil record books, manuals and other

documents. This survey must be carried out at least once during the period of validity of the IOPP Certificate.

PERIODICAL SURVEY

The time interval between this survey must not exceed five years. It ensures that the structure, equipment, systems, fittings, arrangements and materials comply with the relevant requirements and serves as a basis for renewal of the IOPP Certificate for a period not exceeding five years.

SURVEILLANCE AND PORT STATE CONTROL

The main objectives of port state control is to ensure that ships comply to international standards regarding:

Safety of life at sea

Standards of training and certification of watchkeepers

Prevention of pollution of the marine environment

Working and living conditions of crew on board.

It is of utmost importance that the Government of Ghana appoints qualified personnel to carry out port state control on board all ships calling at her ports, to prevent pollution of her waters. As at the moment there are no maritime personnel at the Ministry of Transport and Communications which is responsible for maritime affairs

to carry out these inspections, the Harbour Masters at the two ports could be assigned these responsibilities.

It is also necessary to conduct surveillance for any sources of oil pollution and to identify the polluter. As the country has no Coast Guard to patrol the territorial waters, the Ghana Navy will be in a better position to conduct surveillance activities. Their duties should include monitoring of all vessels traversing our waters, as well as those in anchorage, to ensure that no oil is discharged into the waters of Ghana. Offenders should be made to face the laws of the country.

CHAPTER 4

CONTINGENCY PLANNING

INTRODUCTION

The number and size of oil spills cannot be automatically reduced by national and international laws. The risk of accidental oil spills will continue as long as oil remains as a major source of energy and is transported by sea. The operational and accidental discharge of oil cannot be totally eliminated due to human error, equipment failure or other factors.

Realizing this, it is an unfortunate but realistic fact that some pollution will always occur. In the early days of oil transportation, the general public was not all that worried about the environment. Users of beaches only grumbled about oil and tar balls found on the beaches. They presumed it was the price of progress for having an oil terminal or a refinery which was employing people in their locality, so no effort was made by the spiller or the public authority to clean the beaches. This opinion has changed, and organizations which are concerned with bird life, acquaculture, etc... have reacted furiously against spills where fish species and birds have been killed.

Tankers and many ocean going vessels traverse the near shore coastal waters of Ghana with many of them calling at the port of Tema. In addition, Nigeria exports about 0.2

million tonnes of crude oil daily and the tankers transporting this oil traverse the coastal shipping lanes of Ghana. This create a potential high risk of pollution. The two offshore wells at Saltpond fields also pose a threat to the coastal waters of Ghana from a blow-out or production accident.

Attention must therefore be directed towards the development of a national oil spill contingency plan, to deal with oil pollution on our shores whose gravity will justify the activation of the contingency arrangement. For the chronic oil pollution existing at the port of Tema (around the tanker terminal) the GPHA should come up with a routine oil cleaning program.

Response to accidental spillages of oil requires careful advance planning to ensure that the impact of an oil spill is minimized. Such a contingency plan may be defined as a predetermined communications and action sequence which can be quickly initiated to cope with an event of possible but uncertain occurrence.

In setting up a contingency plan particular attention must be devoted to high risk areas and the type and amount of oil that could be involved. This is particularly the case for static installations such as terminals, refineries, etc. The plan should define policy and responsibilities, and identify the authority or lead agency responsible for the preparation and implementation of the plan.

The responsibility for preparing a national contingency plan for oil spill response rests with the government. There must also be cooperation between government departments, industries and other interests. Certain

individuals will question why the oil must be cleaned and what would happen if nothing was done? In many circumstances, there is much merit in doing nothing to the oil spill, but leaving it to nature to remove it. But if the oil threatens amenities or the environment, then, obviously, it must be removed if possible.

The drawing up of the plan must be done before oil pollution arrives. It cannot be left until the threat of pollution is imminent because many mistakes will then be made, and the cost of clean-up will increase. As time is the essence of the whole operation it is essential that, if oil is spilled, all of the contingency arrangements move into action rapidly.

SCOPE AND CONTENT OF A RESPONSE ORGANIZATION

The IMO Manual on Oil Pollution Section II, states that, "The aim of a contingency plan is to provide a timely and adequate response when pollution incidents occur, so as to minimize in the public interest the extent of their damage".

An important function of the government is to ensure that plans and resources exist to cover all areas of activity from which pollution may arise. The structure of the plan should be flexible so that it can be made appropriate to the scope and complexity of a particular operation. The plan should cover small spills which can be dealt with locally as well as major and high impact spills which require highly coordinated response with the appropriate level of command, a large operation team and relevant resources. Local plans may form part of a district or

national plan. It may even be possible to integrate national plans into regional response arrangements. Plans should follow a similar layout whether they are local, national or regional in scope, with only their length and content varying with the size of the area covered and the degree of risk. The similarity will ensure smooth transition from one level to the other.

The contingency plan may be divided into two main parts, the STRATEGY and the OPERATIONAL PLAN.

STRATEGY

The strategy should define the policy, responsibilities and rationale for the operational plan. It should identify the authority or lead agency responsible for the formulation and implementation of the plan and should explain the statutory requirements upon which this responsibility is based. The geographical area covered by the plan should be defined. It will also be necessary to assess the risk of spills and in this case the expected frequency and size of spills, and the type of oil likely to be spilled.

For Tema and Takoradi ports, the number of calls made by tankers is relevant in assessing risks since most spills from tankers are small and occur in these locations as a result of routine operations such as loading, unloading or bunkering. A range of possible spill scenarios can be developed from an analysis of oil-related activities in the area and types of oil handled.

RESOURCES AT RISK

In the strategic planning, ecologically sensitive areas, amenity areas, fisheries, seabirds, marine mammals and other resources likely to be threatened should be identified. This will require consultation with experts in the various government departments such as the Fisheries Research Unit, Department of Game and Wildlife, National Tourist Board and the Environmental Protection Council. As it is unlikely that in a major oil spill all the resources at risk will be successfully defended, priorities for protection must be determined. This decision will normally be taken by high government officials since the economic and environmental values to the community will have to be assessed.

RESPONSE ORGANIZATION

Responsibility for oil spill control at sea usually rests with the government agency involved in maritime affairs. The Ministry of Transport and Communications must therefore be designated the lead agency to ensure that immediate action is taken to assess the whole situation.

The Ministry of Transport and Communications is recommended to be designated as the lead agency for the Administration of the National Oil Contingency Plan for the following reasons:

(a) The Ministry of Transport and Communications and the office of the Shipping Commissioner have the statutory authority of enforcement of the

"Oil in Navigable Waters Act 1964". For the purpose of the Act, the prohibited sea area, the "Atlantic Zone", is defined as "the Atlantic Zone shall be deemed to terminate at a distance of 100 miles from land". But with the declaration of the Exclusive Economic Zone (EEZ) this distance may further be increased to 200 miles.

Section 2 (3) of the Act continues;
"... the Minister, if he considers it necessary to do so for the purpose of protecting the coast and territorial waters of Ghana from pollution by oil, may by legislative instrument designate any area of the sea, outside the territorial waters of Ghana and outside the areas specified in the Act.

(b) The Ministry of Transport and Communications appoints delegation to non-ministerial IMO meetings at which oil pollution issues are discussed in detail. The delegates are, therefore, up to date on pollution and contingency planning matters.

ON-SCENE COMMANDER (OSC)

The Ministry of Transport and Communications must appoint the On-Scene Commander to be responsible for the operation. He will ensure that immediate action is initiated to assess the gravity of the oil spill incident by conducting surveillance of the affected area to determine the nature and extent of the pollution.

A senior officer from the Ghana Navy will be ideal for this post. He will ensure that the surveillance will consist of aircraft overflights at sea, observations from vessels and inspections of beaches.

The OSC will be in charge of the operation and will make sure that the effects of the oil spill are reduced or eliminated. When an oil spill is reported to him he will lead the initial response at the site of the incident to assess the whole situation. He will direct the whole operation and be responsible for the utilization of equipment and manpower. He must be well trained in the use of sophisticated pollution equipment. An overseas course will therefore be necessary as it is not offered locally.

TEAM LEADERS AND LABOUR FORCE

Two team leaders will be adequate. One at Tema and the other at Takoradi. They will be directly responsible to the OSC. They must also be trained in the use of all pollution equipment available and the proper techniques in controlling oil spills. An overseas course will also be necessary. The team leaders must be attached to manufactures of equipment to aquaint them with their proper use and care of this equipment. In this respect it will be advisable to purchase the equipment from manufacturers who will be prepared to train appropriately qualified selected staff in the use and maintenance of the equipment. Apart from the OSC and team leaders an appropriately qualified selected staff must also be trained.

The plan must be such that the OSC will be able to obtain labour as soon as there is an oil spill. The labour force will be mobilized at the beginning of the emergency and will be released at the end of the clean-up operation. The labour force will work directly under the supervision of the team leaders.

OTHER MINISTRIES AND AGENCIES

Attention must be given at the planning stage to immigration and customs clearance procedures. Delays may result from normal immigration and customs formalities and the plan should provide for urgent clearance in an emergency when personnel and equipment need to be brought into the country.

The Ministry of Local Government should coordinate any arrangement for customs and immigration clearance for entry of equipment and personnel from other nations.

The Ministry of Justice and Attorney General could then advise the Ministry of Transport and Communications on the procedure for any legal recourse concerning the spiller.

The Ministry of Finance and Economic Planning will take care of all funds expended during the incident. The completed records, as finalized by the Ministry of Finance, will be presented to the International Oil Pollution Compensation Fund as Ghana is a party to it.

The Ministry of Foreign Affairs will be responsible to notify any foreign government of activities which pertain

to the incident such as the vessels of foreign flag contributing to or causing the spill. The Ministry will be responsible for all negotiations between the vessel owners, cargo owners and insurers and will also conduct negotiations regarding compensation and indemnification. The Ministry of Transport and Communications in consultations with the Ministry of Foreign Affairs will solicit the aid of foreign governments to provide technical assistance and specialized equipment. The Ghana Ports and Harbours Authority will provide additional reception facilities,tugs which will be useful for spraying of chemical dispersants when necessary, and road tankers to convey the oil to the refinery. The oily-water recovered from the sea can be stored at GHAIP refinery where it can be separated after settling.

ENVIRONMENTAL PROTECTION COUNCIL

In Ghana, activities concerning the control of pollution, maintenance and improvement of the quality of the environment are coordinated by the Environmental Protection Council (EPC). This national focal point has been charged to come to grips with the complex problem of the environment keeping in mind the balance between the demands of rapid economic development and the need to protect the country's heritage and resources (EPC 1979). Amongst its functions are the assurance of proper safeguards in the planning and execution of all development projects; setting standards of environmental quality to be observed by industry and creating an enlightened public opinion regarding the environment and an awareness of the public's individual and collective role in its protection and improvement.

It is important, therefore, for the EPC to liaise with the Ministry of Transport and Communications to ensure the success of the clean up operation. The EPC must be in charge of public relations to deal with press, television and radio, and put out as rapidly as possible, and as frequently as possible, bulletins describing what has occurred and the action that has been taken. It is essential that rumour is not allowed to spread. Therefore immediate and authoritative statements must be made and accurate information should be given to the public.

LOGISTIC SUPPORT

To ensure that the clean-up operation runs smoothly, logistical support is an essential element in the contingency plan. Arrangements must be made for the provision of food, clothing, shelter and medical support for clean up crews. The availability of back-up resources, such as additional equipment, materials and transport should also be considered together with the names and addresses of suppliers, both within the country and from other countries.

Accurate records should be kept regarding the use of manpower, equipment and materials, and the related expenditure. It will be advisable that record forms are prepared and annexed to the operational plan. When the operation is completed, good documentation will help in formulating claims.

SPILL RECOVERY TECHNIQUES

An accurate assessment of a spill incident is essential before appropriate spill control and clean-up procedures can be implemented. Generally, containment and recovery are preferred, but in some instances, it may be necessary to use dispersant chemicals. Early incineration of refined products or light crudes which is receiving an increasing world-wide attention as an effective response mechanism could be used. Boom deployment sites should be designated only where containment and recovery of oil or its deflection to less sensitive areas is actually feasible. To ensure a rapid and effective response the equipment must be located at high risk areas. It is recommended that the equipment is stationed at the two ports, Tema and Takoradi. However, a balance must be found between stockpiling at central points with the inherent transport costs and delays, and the more expensive option of equipment packages at every potentially vulnerable site. An inventory of equipment available should be annexed in the plan as well as procedures for mobilisation.

In case of large spills, contractors will be needed to speed up the clean-up operation. The contractual terms acceptable in principle to the parties concerned must be clearly defined in the plan.

If it becomes necessary to remove oil and oily debris from beach areas some consideration should be given to methods of removal of oiled beach material and the possibility of future erosion in the coastal zones.

COMMUNICATIONS

The response operations are aided by good communications. It is therefore necessary to establish a communication centre and this must be included in the plan. The centre must have telephone and radio communications as well as walkie talkies. This will facilitate contact with vessels and aircraft engaged in the operation. The surveillance aircraft and helicopters should be able to communicate directly with the spray aircraft and recovery vessels. On the shore, the mobile command post and radio communications ensure a good flow of information along the chain of command, between the OSC, the team leaders and the workforce.

PERSONNEL SAFETY

Actual or potential polluting discharges that could have an imminent and substantial effect on both air and water can pose serious hazards to personnel health and safety. The OSC should be aware of this potential and should exercise caution in allowing personnel into the affected area without first verifying the nature of the substance discharged.

TRAINING AND REVIEWING

The organization to deal with an oil spill is not simple and depends on the cooperation and inter-relation of a number of individuals. Training is therefore essential in all its aspects and at all levels. All those working

particular pieces of equipment must know how to operate them, and this requires regular exercises. Therefore procedures for training and exercising, and reviewing and updating the plan should be defined.

The plan must be reviewed by the Ministry of Transport and Communications, the OSC and the Environmental Protection Council at least once in a year. Pollution statute and regulation changes may require a formal change of the plan on an immediate basis.

The training programmes should include both theoretical as well as practical instructions related to oil spill incident instructions. The Regional Maritime Academy can play a big role in arranging this type of course.

Response exercises for deploying equipment in open water shall occur at least annually to test the equipment and the contingency plan. These exercises should be held under realistic environmental conditions in which deployment and operation can be accomplished without endangering the safety of personnel. In addition, at least one hands-on drill should be conducted annually as part of a training programme and may include full deployment conducted in protected waters. Exercises that test the alerting/initial response mechanism and command, control, and communications should be held as frequently as necessary to demonstrate effectiveness to the OSC.

Events should be reviewed soon after the clean-up operation has been terminated and the plan should be revised on the basis of lessons learnt, when memories are still fresh.

MAINTENANCE

Maintenance has been a big problem in most of the industries in Ghana. Expensive equipment is often neglected and left at the mercy of the polluted atmosphere with high salt content. Maintenance of any equipment is necessary to keep it in good working order. Since special types of equipment will be needed for oil spill operations and they will be stored at the two sea ports where the atmospheric air has a high salt content. Proper maintenance will be needed to prevent corrosion. Therefore, the staff for maintenance must be included in the plan to carry out necessary routine maintenance to avoid any malfunctions of the equipment during emergency operation.

OPERATIONAL PLAN

This should describe the recommended procedures for responding to an oil spill with essential information included as annexes. If oil is spilt due to collision or grounding of a tanker the first information may come from any one of a number of sources. Our local fishermen who fish in our territorial waters stretching about 550 km from east to west, are in a better position to report any oil spill. Most of these fishermen are illiterates and may not know what to do if they see an oil spill. Part of the plan must include education of the fisherfolks to report any oil spill they may encounter to the nearest police station. The police should hold telephone numbers and radio frequencies allowing them to contact the agency designated to receive such information. The designated

agency would in turn transmit an initial report as soon as possible to interested parties. The format of such a report which must be included in the plan may contain the following:

- Date and time of observation
- Position (eg latitude and longitude or nearest landmark)
- Source and cause of pollution, (eg name and type of vessel; collision or grounding).
- Estimate of amount of oil spilled and likelihood of further spillage
- Type of oil spilled and its characteristics
- Weather and sea conditions
- Action, both taken and intended, to combat pollution and prevent further spillage
- Name and occupation of initial observer and any intermediate reporter and how they can be contacted.

The plan should state clearly that the initial report should not be delayed.

EVALUATION AND RESPONSE DECISIONS

The plan should be such that the OSC will be able to

evaluate the situation and assess the threat posed by the oil to the resources at risk and take action to:

- Identify the type of oil in terms of viscosity, pour point, specific gravity, etc...

- Consider arranging on-site surveillance using aircraft to verify predictions and obtain further details

- Identify threatened resources

- Inform the parties who might be affected by the spill.

If it is found that no resources are threatened then no response may be necessary and it may be left for nature to remove. Monitoring the movement of the slick may be necessary. If resources are threatened then a decision should be taken on how best to protect them. But if key resources have already been affected then priorities for clean-up must be decided. Manpower and equipment must be on stand-by and this should be included in the plan.

CLEAN UP OPERATIONS

Proper procedures should be laid down for the clean-up operations. Mobilization of clean-up equipment and related manpower is necessary. Deployment of equipment at sea and on shore to protect key resources, in accordance with the response decision is vital. Aircraft must be used for surveillance both at sea and on shore to control the clean-up operation and the most suitable disposal route should be selected depending on the nature of the collected oil. Accurate records should be

maintained daily, for each clean-up location, of all the actions taken, manpower and equipment deployed and the quantity of materials used. The clean-up operation must be terminated when the level of clean-up is achieved. A detailed report must be prepared to be used to support claims for clean-up expenses.

PREPARATION OF CLAIMS

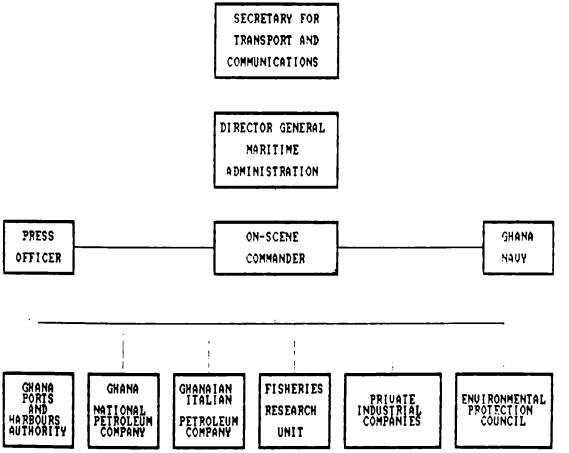
It is essential to prepare accurate records to support claims in order to minimize delays. Compensation for clean-up costs and oil pollution damage from shipping incidents is explained in chapter 3. Claims should be based on expenses actually incurred which are made as a direct result of the accident. Claims should contain the following information:

- Name and address of claimant
- Date and location of the incident
- Identity of the source involved
- Type, quantity and geographical impact of spilt oil
- Comparative figures of previous earnings and lost profits to prove economic lost
- Costs incurred or anticipated in replacing or repairing damaged items
- A break-down of costs related to specific clean-up activities eg. labour, equipment, material and

transport.

As claims handling can be complicated and lengthy, it is recommended that the Ministry of Justice selects lawyers who are experts in international maritime law to handle the case.

RECOMMENDED NATIONAL OIL SPILL RESPONSE ORGANIZATION



CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

INTRODUCTION

Going through the economic history of Ghana, there is no record of any significant oil spill incident along its coast to prompt past governments to initiate action that will combat an oil spill of any size. Most probably the small sizes of ships, the quantities of oil carried per ship and the carefullness of ship personnel could be credited with this oil spill success story. But with the dramatic and rapid development of ship size, in the past twenty years, with its attendant large amount of oil carried and unpredictable human element involved in this transportation process, can one confidently and safely assert that an oil spill incident cannot occur at our coast in the future? And if so wouldn't the country be caught unprepared for such an eventuality? What would be the impact on the socio-economic life of the country both in the short and long terms?

The preceding chapters have briefly reviewed the sources of oil polluting our coast, the harmful effects of oil and oil products when they are released on land and water, the national and international laws adopted to prevent oil pollution and the need to set up an oil spill contingency plan to deal with an oil spill.

In addressing some of the questions posed above the following conclusions are offered which are supported by the preceding chapters of this paper. As appropiate, conclusions are accompanied with a recommendation specifically addressing the particular deficiency.

CONCLUSION AND RECOMMENDATIUONS

1. Due to the tanker traffic along the Gulf of Guinea and offshore oil exploration and exploitation on the coast of Ghana, the marine environment is threatened from operational and accidental pollution. Any major marine oil pollution would result in contamination of the shore of Ghana and fishing grounds could be seriously damaged.

2. There is no properly organized contingency plan presently in existence for any oil spill in the country. It is therefore necessary to establish one and implement it.

3. There is no antipollution combating equipment available in Ghana to respond to accidental oil spill of any size. The government must therefore consider this seriously and provide the most essential equipment on stand-by.

4. Tankers berthing at the Tema oil terminal are polluting the harbour waters due to the absence of inspections and controls. Inspections and controls by the GPHA must be carried on regularly to minimize this.

5. There is no training course in the field of marine pollution, therefore it is necessary to arrange one immediately for control and clean- up operations for officers at the Ministry of Transport and Communications as well as the Ports and Harbours Authority.

6. It appears there is duplication of function with regard to the implementation of pollution legistration. The Ministry of Transport and Communications enforces the "Oil in Navigable Waters Act 1964"; the Ministry of Fuel and Power enforces the "Petroleum Exploration and Production Law 1984", Section 23 (18), as explained in chapter 3. This must be looked into and assigned to one ministry. This law may be ammended to give a clearly defined Authority to the Ministry of Transport and Communications with regard to oil spills within Ghana's Exclusive Economic Zone (EEZ).

7. The two sea ports, Tema and Takoradi have no local contingency plan in the event of an oil spill in the port. Therefore the GPHA must try to develop one and implement it immediately.

8. There is evidence that the industries around the port of Tema are polluting the sea with oil and other substances. The EPC must discourage this practise by enforcing the environmental protection laws and regulations and by punishing infringements of these to the extent that it will serve as a deterrent.

9. It is difficult for a developing country like Ghana to finance the required equipment to combat a major oil spill due to high cost and maintenance. It is therefore necessary to consider all the factors (initial cost, maintenance cost etc.) before acquiring specialised equipment. Due to the availability of cheap labour, it is only necessary

to have certain amount of such equipment to protect priority areas. Other spills may be dealt with using a minimum of equipment. The use of local absorbent material like coconut husk from copra and feathers, inspite of their disadvantages, should not be ignored as supplement because they are better than nothing at all.

10. There is offshore exploration and exploitation activities going on in Ghana. The government must ensure that offshore operations are carried out with proper spill prevention technology including blowout prevention, storage and pipeline construction methods.

11. A Maritime Administration must be set up under the the Ministry of Transport and Communications so as to create an adequate organization which can be responsible for the adoption, implementation and development of maritime affairs in the country.

12. There is the need to re-write the existing Merchant Shipping Act to make it so adequate as to provide for all the relevant provisions of MARPOL 73/78 particularly, and also other conventions. In addition, sector ministries which will be charged with the responsibilities of the implementation of these primary legislation should also be equipped with comprehensive rules and regulations (subsidiary legislation) to enable them to give a full and complete effect to the primary legislation.

13. Since accidental spills can easily cross national boundaries, the national contingency plan should be operative within the framework of a regional action plan. It needs to incorporate realistic worst-cases and to include adequate equipment and personnel to handle them. Organizational responsibilities must be clear, and personnel must be knowledgeable about their roles. Realistic exercises that fully test the response system must be undertaken regularly.

14. Courses and training programmes in the marine oil pollution field should be organized within the country or abroad. The Regional Maritime Academy can play a large role in this by including "Oil Spill Control and Combating Techniques" in their culicula to train personell locally.

15. Reception facilities should be provided at the two sea ports of Tema and Takoradi.

16. MARPOL 73/78 is the major Convention in the international field against marine pollution. Issues militating against the Government's desire to ratify the Convention should be seriously looked into with a view of finding acceptable solutions to them.

17. The Ghana Navy must be encouraged to continue their vigilant surveillance and enforcement regarding pollution prevention up to EEZ limits.

18. National and International liaison should be maintained with IMO, UNEP, IOC, WHO, FAO and other

organizations on all related matters concerning marine pollution. Active participation in seminars, conferences and meetings regarding marine pollution at the international and regional levels must be encouraged.

19. If Ghana's offshore oil exploration is successful, offshore single buoy mooring (SBMs) must be built at the port of Tema to berth tankers.

20. Regional cooperation, between Ghana and neighbouring countries should be given due consideration for dealing effectively with oil spills.

21. The government must prohibit entry into national waters of ships not conforming to acceptable standards.

22. It is most vital that all organizations and Government departments involved in the contingency plan are made fully aware of their specific roles and responsibilities. In this connection they should be provided with the plan and details of activities expected of them.

SUMMARY

Studies conducted along the coast of Ghana have shown that the coastal environment in some places is polluted. Efforts made to combat this problem have so far not been effective and recent data indicate an increase in pollution of the coastal zone.

Coastal waters account for most of the country's fish catches and therefore in terms of the protection of living marine resources, prime attention should be given to the coastal region. The Chemu and Korle Lagoons, for example, are so grossly polluted that the entire fisheries in them have been lost. We depend on the oceans for food, now, and in the future. Famine is a horrible thing to witness. Starvation and malnutrition are realities in a country with an ever-growing population. Protection of the oceans now will insure their availability as sources of food for future generations.

The present level of oil pollution could be said to be moderate but, without control measures, dangerous levels may be achieved in the future in view of efforts being made in exploration of petroleum hydrocarbons offshore.

There is also the need for public education at all levels of pollution. A society which is aware of the hazard of a deteriorating environment will be more cooperative in environmental matters. It should be widely appreciated that pollution control problems cannot be considered in isolation, but that there should be cooperation at all levels to ensure success.

Effective pollution control legislation is necessary. Pollution control laws are often ineffective without companion legislation to assign responsibility and supervision and to provide penalties. If control is to be effective, some form of policing action will be necessary to ensure compliance.

Now is the time to develop a national oil spill

contingency plan and implement it. The adage goes that procrastination is the chief thief of time. Each year that we wait, the task will become harder to fulfill. Contingency planning cannot be left until the threat of pollution is imminent because many mistakes will then be made, and the cost of clean-up will increase. Oil, whether spilt on land or water spreads rapidly. It is therefore essential that measures are taken as soon as possible to prevent the oil spreading. This can be achieved effectively if equipment is in place and can be applied as quickly as possible. The people concerned must know what they have to do, where they are going to do it, and they should have had practice in doing it. No matter how small the plan may be, regular training exercises are essential.

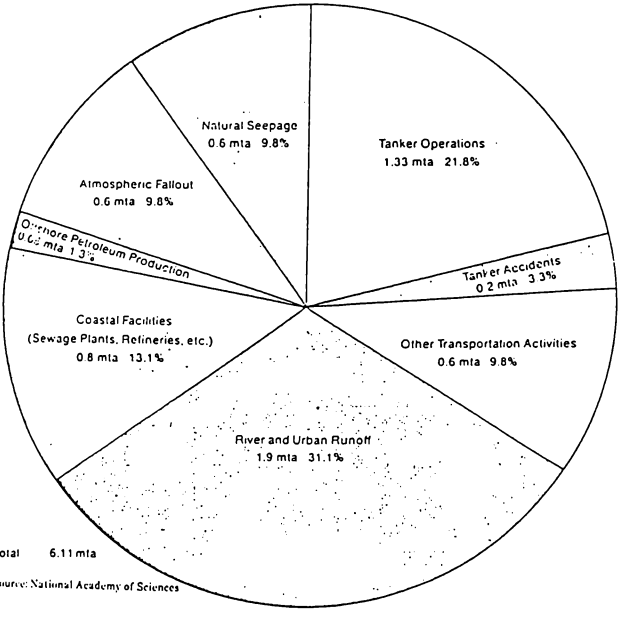
Ghana has been very fortunate in that we have never experienced or suffered from a major pollution incident. We now have the opportunity to ensure the future protection of our environment, neither through good fortune nor luck, but by planning to cope with a major incident if (or when) it occurs. It is essential that we seize this opportunity.

The Ghana Ports and Harbours Authority must endeavour to clean up the oil around the port of Tema, especially the tanker terminal. When the port is cleaned up any discharge of oil by a ship after this can easily be detected and the polluter brought to book.

APPENDIXES

SOURCES OF OIL POLLUTION

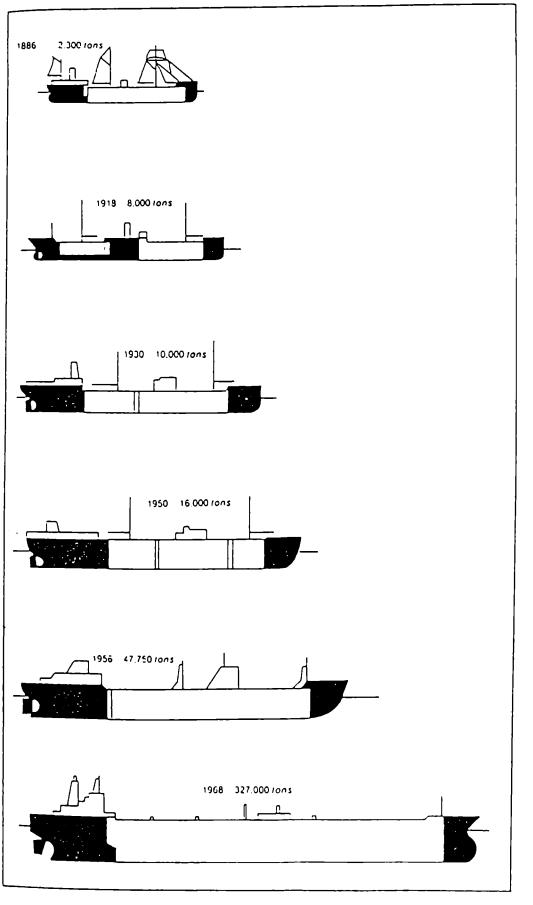
SOURCES OF PETROLEUM GOING INTO THE OCEANS,
MILLION METRIC TONS ANNUALLY (mta)



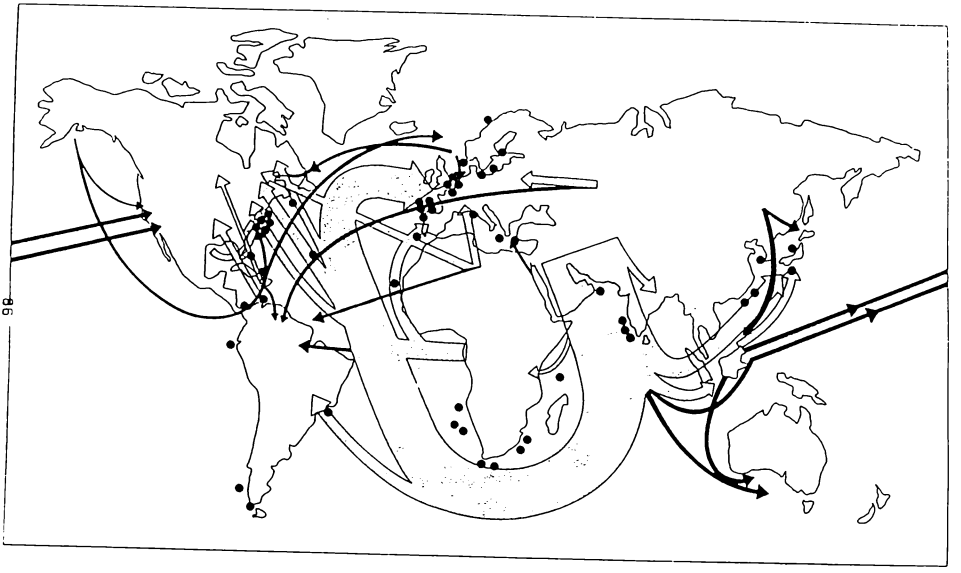
Total 6.11 mta

Source: National Academy of Sciences

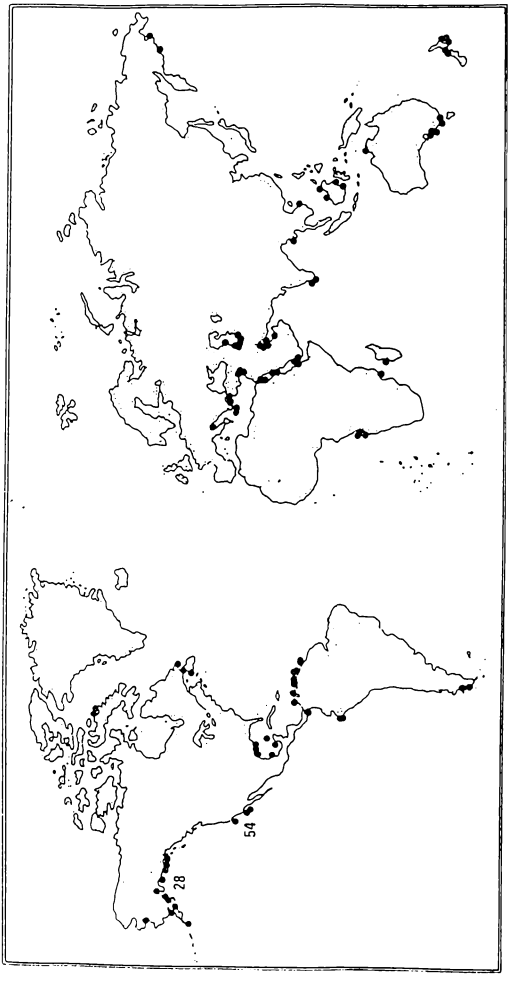
Petroleum in the Marine Environment, Washington, D.C., 1975.

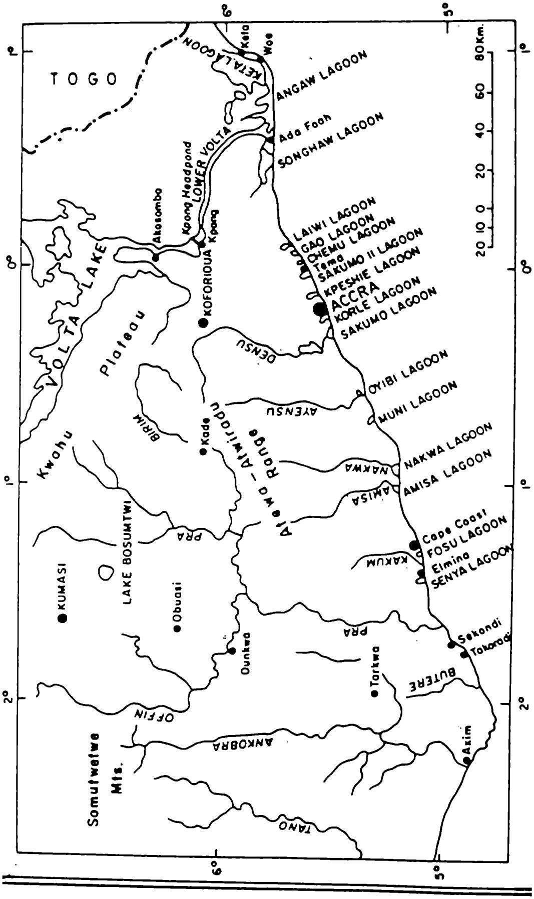


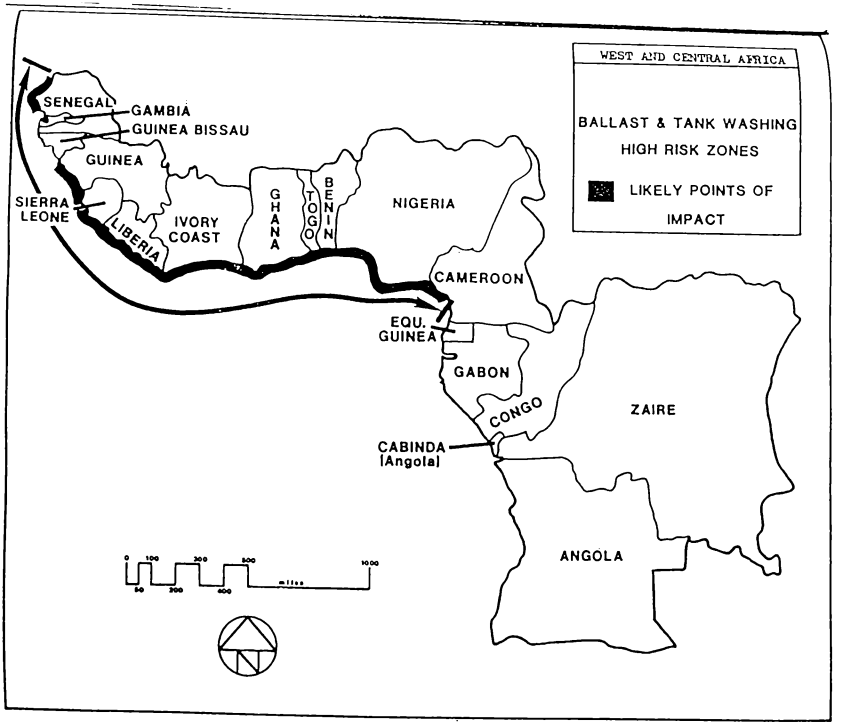
Relative size of oil tankers 1886 - 1968.

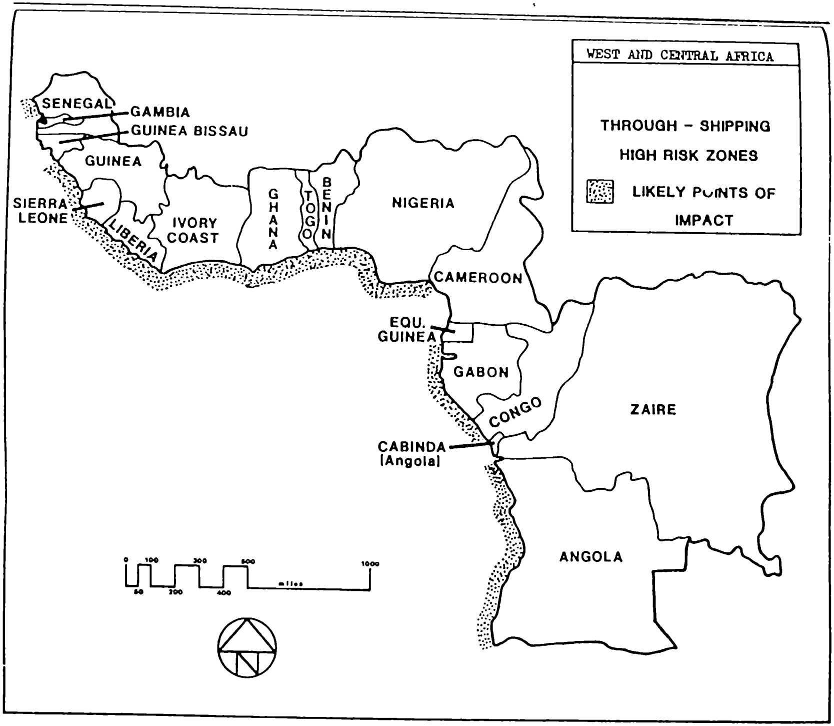


Major oil movements and major tanker spills since 1974


54
28


TOGO
KETA LAGOON
Keta
Woe
ANGAW LAGOON
Ada Foah
SONGHAW LAGOON
LOWER VOLTA
Kpong Headpond
Akosombo
Kpong
LAIWI LAGOON
GAO LAGOON
CHEMU LAGOON
Tema
SAKUMO II LAGOON
KPESHIE LAGOON
ACCRA
KORLE LAGOON
SAKUMO LAGOON
VOLTA LAKE
Plateau
KOFORIDUA
DENSU
OYIBI LAGOON
MUNI LAGOON
AYENSU
BIRIM
Kade
Atewa - Atwiradu Range
Kwahu
NAKWA LAGOON
NAKWA
AMISA LAGOON
AMISA
LAKE BOSUMTWI
PRA
Cape Coast
FOSU LAGOON
KAKUM
Elmina
SENYA LAGOON
KUMASI
Obuasi
Dunkwa
Sekondi
Takoradi
Tarkwa
BUTERE
OFFIN
ANKOBRA
Axim
Somutwatwa Mts.
TANO
80 Km.
60
40
20
0
10
20
6°
5°
2°
1°
0°


WEST AND CENTRAL AFRICA
BALLAST & TANK WASHING
HIGH RISK ZONES
LIKELY POINTS OF
IMPACT
SENEGAL
GAMBIA
GUINEA BISSAU
GUINEA
SIERRA
LEONE
LIBERIA
IVORY
COAST
GHANA
TOGO
BENIN
NIGERIA
CAMEROON
EQU.
GUINEA
GABON
CONGO
ZAIRE
CABINDA
(Angola)
ANGOLA
0 100 300 500 1000
50 200 400
miles

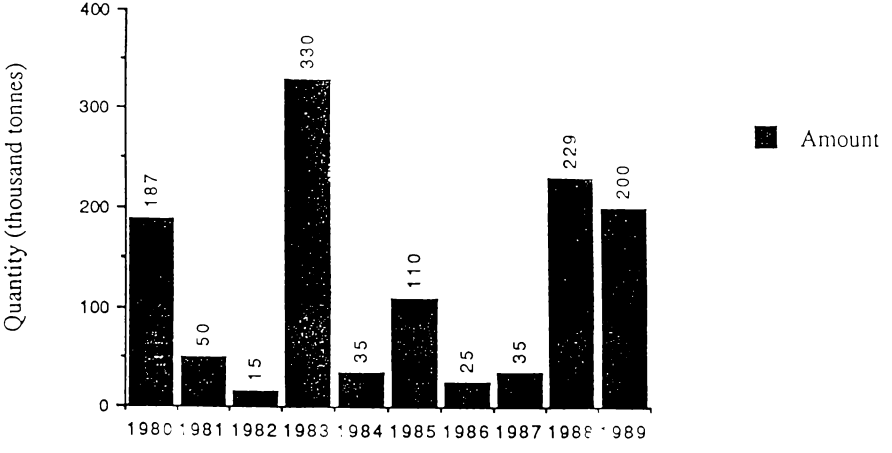

WEST AND CENTRAL AFRICA
THROUGH - SHIPPING
HIGH RISK ZONES
LIKELY POINTS OF
IMPACT
SENEGAL
GAMBIA
GUINEA BISSAU
GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GHANA
TOGO
BENIN
NIGERIA
CAMEROON
EQU. GUINEA
GABON
CONGO
CABINDA (Angola)
ZAIRE
ANGOLA
0
50
100
200
300
400
500
1000
miles

MAJOR TANKER OIL SPILLS

	SHIP	TONS
1967	*Torrey Canyon*	100,000
1968	*Ocean Eagle*	45,000
	World Glory	45,000
1969	*Keo*	c. 25,000
	Pacocean	30,000
1970	*Ennerdale*	40,000
	Chryssi	31,000
1971	*Wafra*	64,000
	Texaco Oklahoma	31,500
1972	*Sea Star*	65,000
1973	*Napier*	30,000
1974	*Metula*	56,000
1975	*British Ambassador*	50,000
	Spartan Lady	25,000
1976	*St. Peter*	c. 30,000
	Cretan Star	28,500
	Argo Merchant	32,000
1977	*Irene's Challenge*	36,000
	Caribbean Sea	35,000
1978	*Amoco Cadiz*	230,000
1979	*Betelgeuse*	25,000
	Aegean Captain/Atlantic Empress	145,000
	Burmah Agate	31,800
	Independente	86,000

SOURCES: 1967–1978. IMCO News, No. 1 of 1979
1979. Center for Short-Lived Phenomena

1980-1989 Oil Spills Due To Tanker Accidents

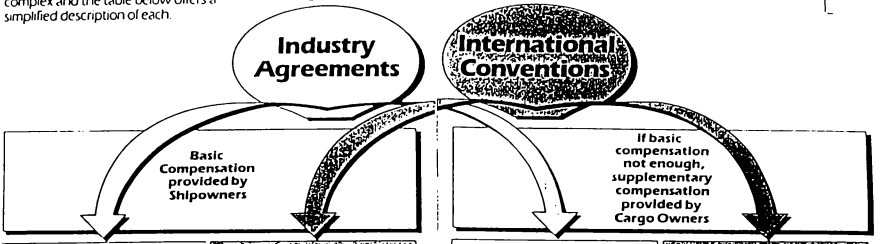


Source: ITOPF

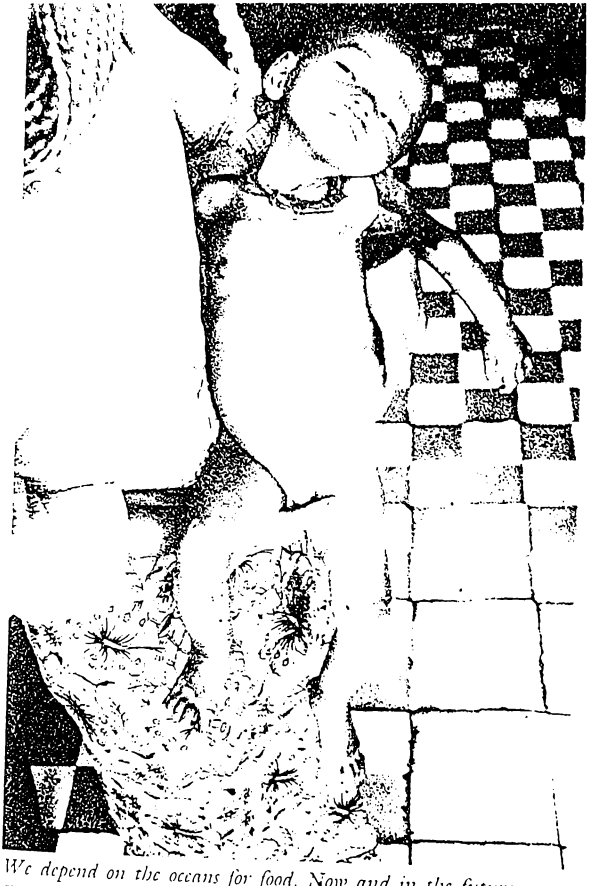
Summary of Known Long Term Biological Effects of Some Major Marine Oil Spills

Spill	Effect	Reference
Torrey Canyon[a] 1967	Continued community perturbations during recovery, 1967-1978.	Southward and Southward (1978)
Searsport 1971	C-flux abnormalities in Mya, 1976. Suppressed recovery of Mya population, 1976.	Gilfillan et al. (1976) Mayo et al. (1978)
Arrow 1970	Intertidal species abnormalities, 1976. Population abnormalities in Mya, 1976. C-flux depression in Mya, 1976. Abnormal shell formation in Mya, 1976.	M.L.H. Thomas (1978) Gilfillan and Vandermeulen (1978)
Florida[a] 1969	Community abnormalities. Changes in genetic structure of Urosalpinx populations, 1976. Mussel sterility, 1970. Long term inhibition of recruitment and low population densities in Uca pugnax. Behavioral disorders.	Sanders (1978) Sanders et al. (1980) Cole (1978) Blumer et al. (1970) Krebs and Burns (1977) Michael et.al. (1978)
Metula 1974	Slow marsh recovery. Alteration of total microbial ecology.	Gundlach et al. (1982) Colwell et al. (1978)
Bouchard 1974	Impaired reseeding and rhizome growth in salt marsh vegetation, reduced interstitial fauna, increased marsh erosion.	Hampson and Moull (1978)
Argo Merchant 1974	No known long term effects.	

The four compensation arrangements are complex and the table below offers a simplified description of each.



	TOVALOP	CLC	CRISTAL	FUND CONVENTION
	Tanker Owners Voluntary Agreement concerning Liability for Oil Pollution	**International Convention on Civil Liability for Oil Pollution Damage 1969**	**Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution**	**International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971**
When does each apply?	When persistent oil from a tanker covered under TOVALOP either threatens to cause or does cause pollution damage to the territory of a state where CLC does not apply	When persistent oil escapes from a laden tanker causing pollution damage to the territory of a state party to the CLC	When persistent oil owned by a CRISTAL member and carried in a tanker covered under TOVALOP threatens to cause or does cause pollution damage to the territory of a state not party to the FUND Convention	When persistent oil escapes from a laden tanker, causing pollution damage to the territory of a state party to the FUND Convention
What is the maximum compensation available per incident?	Up to $16 8 million depending on vessel size	Up to $18 million depending on vessel size	Total made up to $36 million	Total made up to $58 million



We depend on the oceans for food. Now and in the future. Famine is a horrible thing to witness. Starvation and malnutrition are a reality in a world with ever-growing populations and less land available for cultivation. Protection of the oceans now will insure their availability as a source of food for future generations.

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