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Oil contingency plan for Costa Rica

Jorge Adolfo Gallegos

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THE OIL CONTINGENCY PLAN FOR COSTA RICA

by

Jorge Adolfo Gallegos Castro
Costa Rica
November 1985

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements of a Master of Science degree in GENERAL MARITIME ADMINISTRATION.

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

Signature:
Date: 01 November 1985

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THE OIL CONTINGENCY PLAN FOR COSTA RICA

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October 1985
The aims of a contingency plan are to minimize, prevent or reduce the possible damages of a pollution incident involving harmful substances in the marine environment and in the socio-economic welfare of a country by an adequate on time response.

Due to the actual risk of pollution, there is a need of every country and region in the world to have a Response Organisation responsible of the formulation and development of a contingency plan for every harmful substance handled in and transported by its waters; and also to know about international laws, rules and conventions related to marine pollution in order to cope physically and politically with the problem in the best way, individually or collectively as a region.

The strategic development of the plan is essential and requires joint efforts of government, industry and research institutions, because its adequate planning will positively affect the operational action plan when an incident occurs.

The difficulties which any developing country will face concerning the formulation and development of such a plan are embraced in the Costarican case. These difficulties can be summarized in:

- Lack of knowledge on international governmental and industrial agreements and laws,
- Lack of research and data on our marine environments,
- Scarcity of concern of the general public, industry and governors with the problem of pollution,
- Lack of conservationist policies, decisions and planning of our governors,
- Lack of expertise, material resources and financial funds,
- The fact of slightly socio-political integration in the region,
- A mad industrialization process of our nations.

The ways to overcome those difficulties are suggested and recommended, but the decision is ours to cooperate and fight against the pollution damage of the maritime assets of our future generations.
ACKNOWLEDGMENTS

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J.A.G.C.

Malmo.

1985.
THE OIL CONTINGENCY PLAN FOR COSTA RICA

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1-INTRODUCTION:

1.1-What is a contingency plan?

The contingency plan, as it is defined in section II of the Manual on Oil Pollution (IMO; 1978), is a plan for an on time and adequate response when pollution incidents occur, so as to minimize damage to the environment. It must set the procedures by which all elements and resources available can be rapidly commanded, coordinated and organized by a designated and responsible authority, in order to avoid, prevent or minimize the possible damages that can occur by a spill of oil, or any other harmful substance. However, this paper is only dealing with oil pollution.

1.2-Justification:

The increase of the exploitation of resources from the sea bottom such as the petroleum, the increase in the traffic of tankers and general cargo ships and the increase in the awareness of the people concerning the problem of pollution makes it necessary for every country to take the pertinent measures for an on time adequate action in the case of an oil spill.

Also, the possible construction of an oil pipe line across Costa Rica has been discussed for many years, and recently it seems that is going to be a reality. Naturally, with its construction, the volume of traffic of large tankers will increase and also the possibility of incidents along the route on the high seas, on our ter-
ritorial waters or inside the oil or pipe line terminals, where oil spill more frequently occur. These incidents can involve oil spills of different sizes and types.

Due to these oil spills, the economy and wellfare of a coastal town, a region or a country could be affected seriously, and, in the long and short run the different marine ecosystems are going to suffer or be lost.

Although, in order to organize an oil contingency plan it is not necessary to rush; it must be formed step by step as the resources are obtained. However, it is important to remember that oil spills do not wait for plans. In that respect, it is important to make everyone concerned with the production, transportation and use of the oil aware of the need to prevent the contamination of our waters by oil.

1.3-Definitions:

Marine Pollution: "The introduction by man, directly or indirectly of substances or energy into the marine environment (including estuaries) resulting in such deterius effects such as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality or use of sea water, and reduction of amenities".1/

Action: any activity or measure taken to counter-act or combat an oil spill.

Contingency: any act, organization or plan settled for unforeseen problems.

Spill: any escape, overflow, leak or dump of oil, deliberately or accidentally.

Incident: any phenomenon that cause an oil spill.
Bilateral Plan: agreement between two governments in order to carry out joint actions against the oil pollution.

Oil: petroleum in any form, including crude oil, fuel oil, sludge, oil refuse and refined products (other than petrochemicals).

1.4-Objectives:

In this paper I am going to present, what I believe, are the fundamental steps and resources required to establish a contingency plan and organization in Costa Rica, to deal with harmful substances such as oil, to give an idea of the latest developments on equipment and methods to deal with the problem and to inform about the related International Law and schemes available for the compensation or recovery of expenses and damages due to an oil spill.

1.5-Scope of work:

This Contingency Plan applies to the Costa Rican jurisdictional waters until the 200 miles from our baselines, and covers both, the Pacific and Caribbean Coasts, by protecting their natural resources, amenity sites, commercial and industrial activities, animals and human lives and welfare from pollution by oil, its subproducts and other harmful substances. Also, it stipulates the basic rules for the intervention beyond our waters in cases of accidents in the high seas, and for the participation in regional agreements for the aim of combating pollution.
NOTES:


- See also IMO Publications *Regulation for the Prevention of Pollution by Oil*, Sales N-5258219 E and its Supplement Sales N-5278506 E.
2. INTERNATIONAL LAW RELATED TO THE PREVENTION AND COMBATING OF POLLUTION OF THE SEA.

The concern of the people on the prevention of marine pollution by oil from ships started early this century with the expansion of the international merchant shipping and the growing need for marine transportation of oil in bulk by sea. In 1926, at the so-called "Preliminary Conference on Oil of Navigable Waters," held in Washington, U.S.A., the first set of rules was drafted prohibiting ships to discharge oil residues at short distance from land. These rules, however, never entered into force.1/

Within the preceding span, the world shipping has changed a lot. By 1959, there were about 36,000 ships of 100 gross register tons (grt) and more, adding about 125 million grt. Today, the number of ships has increased to about 70,000 and the total tonnage exceeds 400 million grt. Some of the cargoes carried today by ships are potentially dangerous, such as oil. These ships have to move from one point to another, they have to navigate in the same waters used by other vessels, and this increases the probability of maritime accidents with the subsequent possibility of loss of lives and pollution damage to oceans and beaches. Also, the amount of oil transported by sea has increased from 250 million tons in 1954 to more than 1,700 million tons in 1983. Most of this consists of crude oil which is exported from the country of origin to refineries in distant locations.

As it is appreciated in Figure 1, the major oil producing countries are not the major users of the oil products, so that
a great deal of oil has to be transported by sea in very large tankers (in order to take advantage of economics of scale), in defined sea routes.2/

To carry this oil, the world’s fleet of tankers has also changed. In 1954 the tanker fleet consisted of just 3,500 ships totalling 37 million dead weight tons (dwt). Today there are around 7,000 tankers in operation, totalling 349 million dwt. One feature of this expansion has been the great increase in the size of tankers. The largest tanker in 1954 was approximately 30,000 dwt, today there are ships of more than 500,000 dwt.

With the increasing number of tankers and other types of ships navigating at sea, more accidents have occurred, so the largest tankers have also been involved in the major oil spills. See Figure 1.

Tanker accidents can happen anywhere along the routes and the pollution caused by them is referred to as ACCIDENTAL POLLUTION.

Another danger to marine environment and coastal states, is the oil coming from cleaning operations carried out by crewmen. It is recognised that the amount of oil being pumped into the sea is too great for the ocean to absorb, and a variety of laws, regulations and requirements have been introduced in an attempt to eliminate the problem of what is normally called OPERATIONAL POLLUTION.3/

Because shipping and specially the transport of oil is an international business, it is widely accepted that the problem of marine pollution can only be properly solved at an international level. The establishment of the International Maritime Organization, which is the United Nations Maritime Agency, in 1958, was an event of great importance in that respect. Its two prime responsibilities are
the promotion of safety at sea and the elimination of marine pollution from ships.

The work programme of IMO in the field of prevention, control and abatement of marine pollution is directed towards the following:

1. To prohibit the deliberate discharge of oil and other harmful substances into the sea by regulating ship operations such as tank cleaning and deballasting and also by adopting standards for the design, construction and equipment of ships;

2. To minimize pollution arising from maritime accidents by adopting standards for construction, equipment, navigation, cargo handling and crew qualifications;

3. To mitigate the effects of pollution, once it occurs, by adopting certain ship construction and operational requirements and by adopting an international legal regime for intervention in the case of emergencies;

4. To establish schemes whereby victims of pollution are compensated for their financial loss;

5. To develop procedures for the effective implementation of conventions, including survey and certification of ships, port state control and sanctions against discharges in contravention of convention requirements;

6. To develop and implement technical assistance programmes to facilitate the implementation of conventions and to promote national and regional arrangements.

In an analysis made in 1974 by The International Tanker Owners Pollution Federation, the following world-wide trends in oil spillages were found:

- Most spills are small, 89% being less than 50 barrels (bbl), 9% between 50 to 5,000 bbl and only 2% being greater than 5,000
Figure 1
Major oil movements and major tankers spills

Figure 2
Reason for Spill

<table>
<thead>
<tr>
<th>Reason for fault</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment failure</td>
<td>34.4</td>
</tr>
<tr>
<td>Human error</td>
<td>46.0</td>
</tr>
<tr>
<td>Hull failure or defect</td>
<td>8.8</td>
</tr>
<tr>
<td>Offence denied</td>
<td>3.6</td>
</tr>
<tr>
<td>Shore fault</td>
<td>1.4</td>
</tr>
<tr>
<td>Other and not known</td>
<td>5.8</td>
</tr>
</tbody>
</table>

/J.Wardley Smith(1983)page 12 from ITOPF
Most spills (92%) occur during normal operations, loading, discharging and deballasting, rather than from accidents.

-83% of all spills over 5,000 bbl were the result of collision or grounding.

-Most spills (74%) resulting from groundings or collision occur in port, port approaches or restricted waters.4/

Also, it has been found, that the human error is the major reason for these spills as it is appreciated in Figure 2. However, the greatest human error comes from those working in the Maritime Administration of a country, because although they ratify and implement International Conventions, they rarely care about the application and observance of the regulations and standards in the real practice.5/

Because of these trends and reasons of the occurrence of oil spills at sea, every government must set up in its National Legislation the minimum safety practicable standards, which are stipulated in International Conventions such as the Safety of Life at Sea Convention (1974) and protocol (1978), the Load Line Convention (1966), the Prevention of Collisions at Sea Convention (1972) for the conduct of ships when navigating, and the Merchant Shipping (minimum standards) Convention (ILO Umbrella Convention 147) (1976) for the working and living conditions for seafarers.

Also, the minimum requirements for the good training and good practical performance of its seafarers, which are stipulated in the Standards for Training, Certification and Watchkeeping for Seafarers Convention (1978).

After the implementation, each government must look after the compliance of national and foreign ships with these minimum standards by a well organized PORT STATE CONTROL, in order to
prevent substandard ships, which are a threat to human life and property, and to the marine environment, from calling at their ports.

2.1. International Law related with Marine Pollution prevention

Solas

In 1929, the first effective convention for the Safety of Life at Sea was done. This was subsequently reviewed and revised by international conferences in 1948, 1960 and 1974.

The SOLAS Convention is the most important convention aimed at the protection of human life at sea. It contains provisions in respect of:

- Construction of ships, including subdivision, stability, machinery and electrical installations, and fire safety;
- Life saving appliances;
- Radio-communications, including radio telegraphy and radio telephony;
- Safety of navigation, including the carriage of shipboard navigational equipment;
- Carriage of grain;
- Carriage of dangerous goods;
- Nuclear ships;
- Survey and certification.

Load Line (1966)

Overloading is often the cause of maritime casualties, particularly for cargo ships. In 1930, an International Convention on Load Lines was adopted, which laid down the minimum freeboard
The 1930 Load Line Convention was replaced by a new convention adopted by a conference convened by IMO in 1966.

**Preventing Collisions at Sea (1972)**

It sets out basic rules which regulated the behaviour of vessels at sea in respect of other vessels, in order to prevent collisions. It deals with such matters as steering and sailing rules, lights and signals, sound signals and conduct in restricted visibility, etc.

The 1972 Convention is the revision of the Collision Regulations adopted in 1960, and takes account of sizes and characteristics of modern vessels, particularly large tankers. This convention makes mandatory traffic separation and other routeing schemes.

**STCW (1978)**

It has been generally recognised that the substantial majority of maritime accidents are caused by human error. In 1978, the first Convention ever to establish basic requirements on training, certification and watchkeeping for seafarers on an international level was adopted by a conference convened by IMO.

Briefly described, the Convention lays down basic principles to be observed in keeping navigational and engine room watches, mandatory minimum requirements for the certification of masters, chief mates, officers in charge of navigational watches, chief and second engineers and engineer officers in charge of watches, and radio officers, radio operators and radio-telephone operators. Manda-
tory minimum requirements are also stipulated for ratings forming part of a navigational and engine room watch, and minimum knowledge requirements for certificates are also incorporated in the Convention.

Merchant Ships Minimum Standards (1976)

The regulatory requirements of the ILO Convention Number 147 specify minimum standards of health, safety and conditions for crews of merchant ships world-wide. The convention is an umbrella type of treaty.

Those countries accepting it are obliged to have National Legislation covering safety standards, including standards of competency, hours of work and manning, and social security. In addition, shipboard employment and living conditions must be covered by legislation or collective agreements between the shipowners and the seafarers concerned, or by court awards, and must be substantially equivalent to standards set by certain specified ILO Conventions:

- Shipowners Liability Convention 1936 (ILO Convention #55).
- Medical Examination (seafarers) Convention 1946 (ILO Convention #73).
- Accommodation of Crew Convention 1949 (ILO Convention #92).
- Food and Catering (ships’ crew) Convention 1946 (ILO Convention #68).
- Seamen’s Articles of Agreement Convention 1926 (ILO Convention #22).
- Repatriation of Seamen Convention 1926 (ILO Convention #23).

The flag State must exercise EFFECTIVE control over its ships in all of these matters, including adequate procedures for the engagement and training of seafarers.

The operative parts of these instruments give the norms which must be controlled in the different fields. In a seminar held in Bangkok in 1983, Mr. Braida from the ILO Office in Geneva, summarised these operative parts of the instruments as follows:

- Minimum age.
- Shipowner’s liability in case of sickness, injury or death of seamen.
- Social Security.
- Medical examination.
- Prevention of occupational diseases:
  i. Structural features of the ship.
     ii. Machinery.
     iii. On and below deck.
     iv. Loading and unloading equipment.
     V. Fire protection and prevention.
     Vi. Anchors, chains and lines.
     Vii. Dangerous cargo and ballast.
     Viii. Personal protective equipment.

- Crew accommodation:
  i. Sleeping rooms.
  ii. Mess rooms.
  iii. Sanitary facilities.
iV-Miscellaneous.

- Food and catering.
- Certificates of competency.
- Articles of agreement.
- Repatriation.
- Freedom of association and protection of the right to organise, and to bargain collectively.7/

The Port State Control on manning and certificates of competency is probably the most important part of the control work, because "if the crew on-board is not safe and well trained; the environment, the cargo and the ship would not be safe either.8/

The port state control officers must check that:
- Children under 14 years shall not be employed or work on-board,
- Water and food supplies are suitable in quantity and quality,
- Crew accommodation might be usually inspected,
- Take interest in certain technical details related to accident prevention and occupational health.

As it is appreciated, the work towards the minimization of pollution is carried out within the general framework of maritime safety. Thus, the two principal functions of IMO, namely maritime safety and pollution prevention, are closely inter-related and contribute to the protection of human life, property and the environment arising from maritime activities.

All activities of IMO in relation to the prevention and control of operational and accidental pollution from ships, are shown in the schematic diagram in Figure 3.
POLLUTION PREVENTION AND ABATEMENT

OPERATIONAL POLLUTION

DISCHARGE CONTROL
- DISCHARGE CRITERIA
- DESIGNATION OF SPECIAL AREA
- RECEPTION FACILITIES

CONSTRUCTION & EQUIPMENT
- SBT
- CBT
- COW
- SEPARATOR
- MONITOR

ACCIDENTAL POLLUTION

PREVENTION
- CONSTRUCTION & EQUIPMENT
- NAVIGATION
- CARGO HANDLING
- CREW TRAINING

LIMITATION OF OIL SPILL
- DAMAGE STABILITY
- PROTECTIVE LOCATION OF SBT

COMBATING POLLUTION
- REGIONAL ARRANGEMENTS
- ANTI-POLLUTION MANUAL
- RIGHT OF INTERVENTION BY COASTAL STATES

LIABILITY & COMPENSATION

Activities in IMO for the prevention of marine pollution from ships / Y. Sasamurai (1983) page 30
2.2. International Law related with Accidental Pollution from Ships

The only way to reduce the accidental pollution from ships is ensuring that these are built, fitted, equipped, manned and operated in the most efficient manner. Of course, this cannot be achieved if every single country decides which are, in their belief the safety and maritime protection minimum standards which national and foreign ships calling at their ports must comply with. This will lead to confusion and international legal disputes.

This is why an international organization such as the IMO, through its conventions, rules and recommendations, has to stipulate those minimum requirements which ships of those contracting parties must comply with.

However, in spite of these safety and marine environment protective measures, accidents still occur. In that sense, every country must know how to cope with pollution resulting from accidents, how to mitigate the adverse effects of such pollution, and which is the international legal framework established through which they must work, individually or collectively.

Mr. Bergmeijer in a paper given in a seminar held in Malmo in August 1985, mentioned several measures taken by countries in this connection:

- Regional Arrangements, such as the Convention on the protection and development of the marine environment of the Wider Caribbean Region, and its protocol concerning Cooperation in combating oil spills in the Wider Caribbean Region, signed in Colombia in 1983;
- The IMO’s anti-pollution manual, containing sections on contingency planning, salvage and recovery.
of spilled oil;
- The International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969;


The convention started first by defining which areas were within its scope, the so-called CONVENTION AREA. This is outside the internal waters of the Contracting Parties and covers "the marine environment of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent thereto, south of 30 grades north latitude and within 200 nautical miles of the Atlantic Coasts of the States." 9/

The general provisions are to conduct bilateral or multilateral agreements for protection of the marine environment, but without affecting obligations under other previous agreements.

The Contracting Parties are obliged to take all appropriate measures to prevent, reduce and control pollution of the Convention Area, and to ensure "SOUND ENVIRONMENTAL MANAGEMENT". Also, ensure that those measures do not cause pollution of the marine environment outside the Convention Area, and assist each other in fulfilling their obligations under this Convention and Protocol.

The Contracting Parties must protect their marine environment from pollution (general obligation under customary law) 10/, coming from discharges from ships (article 5), dumping of wastes from ships, aircrafts or man-made structures (article 6), coastal disposal or by discharges emanating from rivers (article 7), ex-
ploration and exploitation of the sea-bed and its subsoil (article 8), and from discharges into the atmosphere from activities under their JURISDICTION.

The Convention points out as well the need of Contracting Parties to:

- Define SPECIALLY PROTECTED AREAS, to protect and preserve rare or fragile ecosystems, endangered species' habitats, and to establish protected areas without affecting the rights of other Contracting Parties and Third States (article 10).
- Cooperate in the response operation on emergencies or pollution; individually or jointly develop CONTINGENCY PLANS; and the obligation to notify other States that may be affected and the competent International Organizations (United Nations Environment Protection-UNEP, IMO) (article 11).

One very important aspect in the Convention is the one mentioned in article 12, ENVIRONMENTAL IMPACT ASSESSMENT. Nowadays, the subject is studied all over the world and people are becoming increasingly aware of the negative effects that the changes on natural sites bring to the perfectly stable ecological equilibrium of the earth and marine environments, because of the so-called PROGRESS. The article by itself promotes the analysis of the possible negative effects that projects, on our coastal and marine environment, can bring; this calls for a WISE AND WELL PLANNED PROGRESS.

The article stipulates the need of Contracting Parties "to develop technical and other GUIDELINES to assist the planning of their major development projects, in such a way as to prevent or minimize harmful impacts on the Convention Area. To assess the
POTENTIAL EFFECTS of such projects on the marine environment, particularly in coastal areas, so that APPROPRIATE MEASURES may be taken to prevent any substantial pollution of, or significant and harmful changes to the Convention Area."

It suggests that Contracting Parties must adopt appropriate rules and procedures, which are in conformity with International Law, in the field of liability and compensation for damage resulting from pollution of the Convention Area (article 14).

Protocol concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region.

The protocol stipulates the need of establishing Contingency Plans by every individual party, and gives the basic guidelines to achieve such purposes. Furthermore, it encourages the conclusion of bilateral or multilateral subregional arrangements on such a matter (article 8). It defines the Wider Caribbean Region as the Convention Area already mentioned. It applies to all spill incidents within this region; and gives basic general provisions to the Contracting Parties:

- Cooperate in taking preventive and remedial measures.
- Establish and maintain means of responding to oil spills incidents and shall endeavour to reduce the risk thereof:
  a. ENACTMENT OF RELEVANT LEGISLATION.
  b. PREPARATION OF CONTINGENCY PLANS.
  c. IDENTIFICATION AND DEVELOPMENT OF THE CAPABILITY TO RESPOND TO AN OIL SPILL INCIDENT.
  d. DESIGNATION OF AN AUTHORITY RESPONSIBLE FOR THE IMPLEMENTATION OF THIS PROTOCOL.

In the Institutional Arrangements of the Protocol, the United Nations Environment Protection Programme has the duty to car-
ry out through the Regional Coordinating Unit, and in close cooperation with the IMO, the following functions:

- Assist Contracting Parties on the preparation, periodic review and updating of the Contingency plans.
- Promote the compatibility of such plans.
- Establish and maintain liaison with organizations and private entities concerned.
- Encourage research on environmental impacts and oil spill, control materials and techniques; etc., etc.

International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties (1969) & Protocols.

The Convention applies to sea going vessels, with the exception of warships or other vessels owned or operated by a State and used on non-commercial service.

It stipulates the right of Parties to "take such measures on High Seas to prevent, mitigate or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution of the sea by oil."11/

In its general provisions it is expressed that the obligation of the Party taking such measures, shall consult with the Flag State and other Coastal States affected or that may become affected by the maritime casualty, and also seek advise from IMO's experts, who are listed at IMO.

It is obvious, that such intervention should not be undertaken on loose grounds, there must and there is a LIMITATION. The "Measures "shall be PROPORTIONATE to the actual damage or threatened to it."12/. They shall not go beyond WHAT IS REASONABLY NECESSARY to achieve the end, and shall cease as soon as that end has been achiev-
ved. Also, measures "SHALL NOT UNNECESSARILY INTERFERE with the rights and interests of the Flag States, Third States and of any persons, physical or corporated concerned." (article 5).

It also stipulates that if the measures taken are in contravention of the Convention, causing damage, the party shall pay compensation to the extent of the damage, and also mention the Conciliation and Arbitration Procedures.

The United Nations Law of the Sea Convention (1982) and the Coastal State Right of Intervention Against Ship Accidents.

The possible impact or effect of the LOS Convention provisions on existing international rules concerning oil spill preventing and combating, will depend not only on its entry into force, but also on its acceptance by a large majority of the international community. In the meantime, State practice in particular on the EXCLUSIVE ECONOMIC ZONE (EEZ) jurisdiction, might develop sufficiently so as to reflect customary law.

The development and classification provided by the LOS Convention have perhaps been rather modest in the area of coastal State powers to intervene beyond the territorial sea to protect its interests from harm deriving from shipping accidents such as groundings, collisions and floundering.

Article 221 of the LOS Convention on measures relating to maritime casualties in order to avoid pollution applies "beyond the territorial sea" rather than "in the high seas", thus taking into account the emergence of the EEZ which is neither territorial sea nor high seas, brings some kind of disparity between different laws.

The limitation that the danger has to be "grave and imminent" has dissapeared, thus allowing for action to be taken befo-
Article 221 paragraph 7 reflects the need for prompt notification to the Coastal State by ships when its coastline or related interests may be affected by incidents, including casualties, which involve discharges or probability of discharges.

In that respect, in article 8 of Marpol 73/78 it is stipulated a MANDATORY REPORTING SYSTEM by ships to the coastal state or states likely to be affected and to their Flag State of actual or probability of discharge of harmful substances in contravention with the convention standards; also for the purpose to save the ship or life at sea, when combating pollution incidents or for purposes of legitimate research on pollution control.

There has been concern about a more precise definition of probability of discharge. This still is not clear but certain guidance stipulates that a master should make reports in cases of:

- Damage, failure or breakdown, or any other problem that affects the safety of the ship.
- Failure or breakdown of machinery or equipment which may result in a safety of navigation problem.

The system applies to all ships, irrespectively of the distance from the coast. The report must be made by the "fastest channels available" (article II (1) of Protocol) and to the "appropriate officer or agency" designated by each contracting party (article VIII (2) a, who must inform the Flag State and the neighbouring Coastal States likely to be affected. The Protocol I to the Convention gives the detailed provisions on such reports. This was amended at the 21st session of MEPC from which a new format of reports was adopted. The new report formats are presented in following pages.
As a conclusion I can say that a Coastal State is entitled to prompt notification before discharges occur, without prior request, from a ship and/or if necessary from the Flag State itself.
**FORMATS FOR A MANDATORY REPORTING SYSTEM**

**UNDER ANNEX I OF MARPOL 73/78**

1. **ANNUAL SUMMARY REPORT BY THE ADMINISTRATION TO IMO OF INCIDENTS INVOLVING SPILLAGES OF OIL OF 100 TONNES OR MORE**

**PURPOSE:** To provide IMO with a summary of the MAJOR spills that have been reported to the Administration during the last year and any information concerning spill response of interest to other parties.

<table>
<thead>
<tr>
<th>Date of incident</th>
<th>Ship Name</th>
<th>Flag State</th>
<th>Location of incident</th>
<th>Type of oil spilled</th>
<th>Quantity spilled</th>
<th>Comprehensive report on file at IMO (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
PURPOSE: To summarize the violation cases referred to other Administrations for prosecution, to report to IMO and to parties referring violation cases the action taken upon the case submissions, to summarize the alleged inadequacy of reception facilities and to summarize the results of investigations into alleged inadequacy of reception facilities.

Section 1

Summary Report by the coastal State to IMO of Alleged Violations of the Discharge Provisions Referred to the flag State

<table>
<thead>
<tr>
<th>Date of incident</th>
<th>Ship Name</th>
<th>Call Sign</th>
<th>Flag State to whom violation case was referred</th>
<th>Location of incident Lat-Long</th>
<th>Summary of alleged offence and evidence</th>
</tr>
</thead>
</table>

Section 2

Summary Report by the flag State to IMO of Actions Taken on Alleged Violation of the Discharge Provisions Referred to that State

<table>
<thead>
<tr>
<th>Date of incident</th>
<th>Ship Name</th>
<th>Call Sign</th>
<th>Party referring alleged discharge violation</th>
<th>Location of incident Lat-Long</th>
<th>Investigation Results/Action taken</th>
</tr>
</thead>
</table>

Section 3

Summary Report by the flag State to IMO of Alleged Inadequacy of Reception Facilities Referred to the port State

<table>
<thead>
<tr>
<th>Name of Port or Terminal/Country</th>
<th>Date of occurrence</th>
<th>Ship Name</th>
<th>Call Sign</th>
<th>Alleged nature of inadequacy</th>
</tr>
</thead>
</table>

Section 4

Summary Report by the port State to IMO of Actions Taken on Alleged Inadequacy of Reception Facilities Referred to that State

<table>
<thead>
<tr>
<th>Name of Port or Terminal</th>
<th>Date of occurrence</th>
<th>Ship Name</th>
<th>Call Sign</th>
<th>Ship Flag</th>
<th>Investigation Results/Action taken</th>
</tr>
</thead>
</table>

ANNUAL ASSESSMENT REPORT

PURPOSE: To provide IMO and the individual parties with the necessary data to assess the overall effectiveness of MARPOL 73/78.

Section 1

Statistical Report by the port State to IMO of MARPOL 73/78 Effectiveness of Port State Control

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NUMBER OF SHIPS BOARDED DURING REPORT PERIOD</td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>IOPP CERTIFICATION DISCREPANCIES</td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. No Certificate or Equivalency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Certificate or Equivalency discrepancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Compliance rate</td>
<td></td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>OIL RECORD BOOK DISCREPANCIES</td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. No Oil Record Book or Equivalency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Oil Record Book or Equivalency discrepancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Compliance rate</td>
<td></td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MARPOL 73/78 EQUIPMENT DISCREPANCIES</td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Required equipment not on board</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Required equipment not functioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Compliance rate</td>
<td></td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NUMBER OF SHIPS DETAINED IN PORT OR DENIED ENTRY</td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.3. International Law related with Operational Pollution from Ships:

It has been calculated that at least 2 million tons, and probably a good deal more of oil enters the sea each year. The sources taken in consideration for such calculations come from undersea, atmosphere, land (other than oil refining), oil refining, and from ocean transportation.

The estimates are given in Figure 4. In it can be appreciated that the oil source from ocean transportation coming from ships and terminals has been calculated, by Jeffery (1970), to 50% of the total amount of oil entering the sea; and 45% by Chart et al. (1973). Estimates made by J.W-Smith (1975) and E.B.Cowell (1977) went more far away. The former estimated that the oil coming from operational procedures of ships was around 79%, while Cowell estimated it to 82% of the total oil coming from ocean transportation.

In other studies carried out by the United States National Academy of Science (NAS), in 1973 and 1980, it was estimated that the total amount of oil entering the sea due to ocean transportation was 2.1 and 1.5 million metric tons/annum respectively, (this means that in less than a decade, the amount was reduced to 30 per cent) from which only 9.5 and 26% respectively proceed from tanker accidents. This means that although the total amount of oil entering the sea due to transportation has been reduced greatly, the amount of oil coming from accidents has increase considerably. Figure 5, summarizes the outcomes of such studies. Although, accidental pollution is spectacular and may cause serious damage to marine life and great concern in the public, it should be realized that it
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>From Undersea Sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Seeps</td>
<td>0.6</td>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>Offshore Production</td>
<td></td>
<td>0.15</td>
<td>0.6</td>
</tr>
<tr>
<td>From Atmosphere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atmospheric Fallout</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Land Sources (other than Oil Refining)</td>
<td></td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Municipal Wastes</td>
<td>0.5</td>
<td>1.97</td>
<td>1.3</td>
</tr>
<tr>
<td>Industrial Wastes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Run-off</td>
<td>0.15</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>River Run-off</td>
<td>0.06</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>From Oil Refining</td>
<td>0.3</td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Effluent from Coastal Refineries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Ocean Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load on Top Tankers</td>
<td>0.1</td>
<td>1.07</td>
<td>1.0</td>
</tr>
<tr>
<td>Non Load on Top Tankers</td>
<td>0.6</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Tanker Accidents</td>
<td>0.2</td>
<td>45%</td>
<td>79%</td>
</tr>
<tr>
<td>Terminal Operations</td>
<td>0.05</td>
<td>45%</td>
<td>79%</td>
</tr>
<tr>
<td>Bilges and Bunkering</td>
<td>0.3</td>
<td>0.35</td>
<td>0.3</td>
</tr>
<tr>
<td>Dry Docking</td>
<td></td>
<td>0.3</td>
<td>0.25</td>
</tr>
<tr>
<td>Non Tanker Accidents</td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>1.90</td>
<td>3.81</td>
<td>3.60</td>
</tr>
<tr>
<td>Total (Accidental Discharges)</td>
<td>3.81</td>
<td>3.60</td>
<td>5.331</td>
</tr>
</tbody>
</table>

*All land based discharges

Accidental discharges

/J. W. Smith (1983) page 19 from P. G. Jeffery (Laboratory of the Government Chemist)
### Figure 5

**INPUTS OF PETROLEUM HYDROCARBON INTO THE MARINE ENVIRONMENT**

(million metric tonnes per annum)

<table>
<thead>
<tr>
<th>Source</th>
<th>1973 Estimate</th>
<th>1981 Estimate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine transportation</td>
<td>2.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Tanker operation</td>
<td>1.08</td>
<td>0.71</td>
</tr>
<tr>
<td>Drydocking</td>
<td>0.25</td>
<td>0.03</td>
</tr>
<tr>
<td>Marine terminals</td>
<td>0.003</td>
<td>0.02</td>
</tr>
<tr>
<td>Bilge and fuel oil</td>
<td>0.5</td>
<td>0.28</td>
</tr>
<tr>
<td>Tanker accidents</td>
<td>0.2</td>
<td>0.39</td>
</tr>
<tr>
<td>Non-tanker accidents</td>
<td>0.1</td>
<td>0.02</td>
</tr>
<tr>
<td>Off-shore oil production</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Refineries</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Non-refinery waste</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Municipal waste</td>
<td>0.3</td>
<td>0.7</td>
</tr>
<tr>
<td>Urban runoff</td>
<td>0.3</td>
<td>0.03</td>
</tr>
<tr>
<td>River runoff</td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Natural sources</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>0.6</td>
<td>0.05-0.5**</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>6.1</strong></td>
<td><strong>3.2</strong></td>
</tr>
</tbody>
</table>

* 1981 figures are taken from the draft report of the NAS Workshop which is not yet published.

** A figure of 0.3 has been used for the calculation.

/Y. Sasamura (1983) page 40
only constitutes about 20% of the total pollution caused by ships.

Operational pollution, caused by the "intentional" (operational) discharges of wastes resulting from the normal operation of ships is by far the malefactor. As a remedy against operational pollution, two Conventions were adopted by IMO: the OILPOL 54 and the more comprehensive MARPOL 73/78.

The International Convention for the Protection from Pollution of the Sea by Oil (OILPOL), 1954, deals only with persistent oils. It applies to ships registered in contracting States, except tankers of under 150 gross tons and other vessels of under 500 grt. (article II).

The International Convention for the Prevention of Pollution from Ships (MARPOL), 1973/78, came into force in October 1983. This covers all types of oil and also pollution from substances other than oil:

- Annex I: Pollution by Oil.
- Annex II: Pollution by Noxious Liquid Substances in Bulk.
- Annex III: Pollution by Harmful Substances in Packaged Forms or in Freight Containers, Portable Tanks, or Road and Rail Tank Wagons.
- Annex IV: Pollution by Sewage from Ships.
- Annex V: Pollution by Garbage from Ships.

This Convention applies (article III) to ships entitled to fly the flag of a Contracting Party of the Convention. In Annex I, it is stated that the provisions applies to ships of all sizes, and that tankers of 150 grt and above, and every other ship of 400 grt and above shall be subject to the surveys specified in Regulation 4 of this Annex.

In OILPOL 54 oil is defined as crude oil, fuel oil,
heavy diesel oil and lubricating oil; but in MARPOL 73/78 the meaning expanded to crude oil, fuel oil, sludge, oil refuse, and refined products. (All types of oil). 18/

The principal objective of OILPOL 54 was the protection of the seas from oil pollution, which was merely achieved by prescribing certain "PROHIBITED ZONES", extending to at least 50 miles from the nearest land, within which the discharge of persistent oil or oily mixtures (containing 100 parts of oil per million parts of mixture or more), was prohibited. It also states, in article III, that oil or oily mixture from ships other than tankers shall be prohibited except when:

a. The ship is proceeding in route,
b. The instantaneous rate of discharge of oil content does not exceed 60 liters per mile,
c. The oil content of the discharges is less than 100 ppm of the mixture, and,
d. The discharge is made as far as practicable from land.

In 1969, the IMO Assembly adopted extensive amendments, which include the prohibition of oil discharge through the normal operation of a tanker, except under the following conditions:

a. The total quantity of oil which a tanker may discharge in any ballast voyage does not exceed \( \frac{1}{15000} \) of the total cargo carrying capacity of the vessel,
b. The instantaneous rate of discharge does not exceed 60 liters per mile, and
c. No discharge is made within 50 miles from the nearest land.
MARPOL 73/78 has introduced more stringent requirements such as:

- The designation of "SPECIAL AREAS". These are considered of particularly vulnerability to any kind of pollution and specially by oil. Therefore, the discharge of oil or oily mixtures has been in principle completely prohibited. (As the Mediterranean Sea).

- Any discharge, "as far as practicable from land" in OILPOL 54, has been defined and limited to not less than 12 miles from the nearest land.

- The oil content of the discharge is not more than 100 ppm in certain zones however reduced to 15 ppm.

- The ship must have an oil monitoring and control system fitted with a recording device for a continuous record of oil content in ppm at the time of a discharge, and will ensure that any discharge is automatically stopped when oil content exceeds the limit.

- The ship must have in operation oil-water separator equipment or filtering system in operation, ensuring that any oil discharged into the sea shall have an oil content of less than 100 ppm, and also that the oil content in the effluent produced does not exceed 15 ppm.

Discharge criteria under MARPOL 73/78:19/

A. IN SPECIAL AREA

A.1. OIL TANKERS OF ALL SIZES AND OTHER SHIPS OF AT LEAST 400 GRT

Discharge prohibited except in the case of:

- clean or segregate ballast;
processed bilge water from machinery spaces when all the following conditions are satisfied:

i. the bilge water does not originate from cargo pump room bilges,

ii. the bilge water is not mixed with oil cargo residues,

iii. the ship is proceeding in route,

iv. the oil content of the effluent without dilution does not exceed 15 parts per million,

v. the ship has in operation the oil filtering equipment complying with regulation 16(7) of Annex I, and

vi. the filtering system is equipped with a stopping device which will ensure that the discharge is automatically stopped when the oil content of the effluent exceeds 15 parts per million.

A.2.Ships of less than 400 grt other than oil tankers

Discharge prohibited except when:

-the oil content of the effluent without dilution does not exceed 15 ppm; or

-all the following conditions are satisfied:

i. the ship is proceeding in route,

ii. the oil content of the effluent is less than 100 ppm, and

iii. the discharge is made as far as practicable from land, but in no case less than 12 nautical miles from the nearest land.
B.OUTSIDE SPECIAL AREAS

B.1. DISCHARGES FROM OIL TANKERS EXCEPT FROM MACHINERY SPACE BILGES

Discharge prohibited except:
-when all the following conditions are satisfied:
  i. the tanker is not within a special area,
  ii. is more than 50 nautical miles from the nearest land,
  iii. is proceeding in route,
  iv. the instantaneous rate of discharge of oil content does not exceed 60 liters per nautical mile,
  v. the total quantity of oil discharged into the sea does not exceed for existing tankers 1/15,000 of the total quantity of the particular cargo of which the residue formed a part, and for new tankers 1/30,000; and
  vi. the tanker has in operation an oil discharge monitoring and control system and a slop tank arrangement as required by regulation 15 of annex I.

- and, the discharge of clean or segregate ballast or unprocessed oily mixtures which without dilution have an oil content not exceeding 15 ppm and which do not originate from cargo pump room bilges and are not mixed with oil cargo residues.
B.2. DISCHARGES FROM SHIPS OF AT LEAST 400 GRT OTHER THAN OIL TANKERS AND FROM MACHINERY SPACE BILGES OF OIL TANKERS

Discharge prohibited except:
-when all the following conditions are satisfied:
  i. the ship is not within a special area,
  ii. is more than 12 nm from the nearest land,
  iii. is proceeding in route,
  iv. the oil content of effluent is less than 100 parts per million, and
  v. the ship has in operation an oil discharge monitoring and control system, oily water separating equipment, oil filtering equipment or other installation as required by regulation 16 of annex I.

-or, in the case of processed oily mixture when all the following conditions are satisfied:
  a. the oily mixture does not originate from cargo pump, room bilges;
  b. the oily mixture is not mixed with oil cargo residues;
  c. the oil content of the effluent without dilution does not exceed 15 ppm; and
  d. the ship has in operation oil filtering equipment.

B.3. SHIPS OF LESS THAN 400 GRT OTHER THAN OIL TANKERS

In this case, the Administration shall ensure that it is equipped as far as practicable and reasonable with installations to ensure the storage of oil residues on board and their discharge.
to reception facilities or into the sea in compliance with the requirements of paragraph (1)(b) of regulation X.

In both conventions, the parties are obliged to ensure the availability of RECEPTION FACILITIES for residues and oily mixtures. In Marpol 73/78 provisions are added for noxious chemical substances, sewage and garbage, at loading terminals, repair ports, and in other ports where ships usually have such residues to discharge. They must be so arranged so the operation does not cause delay to the ship.

With a view to assist Governments in meeting this obligation, the Maritime Environment Protection Committee (MEPC) has prepared Guidelines on Ensuring the Provision and Maintenance of Adequate Reception Facilities in Ports. It consists of four Parts; Part I - Oil - (1977), Part II - Noxious liquid substances - (1980), Part III - Sewage and Part IV - Garbage - (1978).

However, in order to comply with the above requirements, the IMO Guidelines for the provision of adequate reception facilities in ports, assure that oil tankers operate in accordance with the method of "RETENTION ON BOARD" (ROB) in association with the "LOAD ON TOP" (LOT) system previously stipulated in OILPOL 54/69.

The procedure is as follows:

1- After discharging the oil, the tanker leaves with ballast water in approximately 1/3 of the cargo tanks. "Dirty Departure".

2- During the voyage, the dirty ballast is decanted. (3 days, depending on weather conditions).

3- At the same time, 1/3 of the cargo tanks are washed with sea water, which is transferred to the Slop Tanks for retention.

4- "Clean Ballast Water" is put into these tanks.
5- Departure ballast is discharged into the sea, except the oily mixture on the top layer that is transferred to the Slop Tanks for retention.

6- After separation of the oil from the water in the slop tanks, the water is discharged into the sea, while the oil and oily mixture are retained on-board. The discharge of Dirty Ballast and the effluent from slop tanks are only allowed beyond 50 miles from land.

7- Arrival ballast is discharged at the port of loading.

In addition, MARPOL 73/78 introduced certain requirements for the construction and equipment of ships with respect to the prevention of operational discharges of oil, and the mitigation of uncontrolled release of oil that should occur due to tanker accidents. The following is a summary of such requirements:

1- Oil tankers must be fitted with oil discharge and monitoring equipment, with a recording device to provide a continuous record of discharge operations.

2- Any ship of 400 grt and above, must be fitted with a tank or tanks of adequate capacity to receive the oily residue, such as that resulting from the purification of fuel and lubricating oils and oil leakages in the machinery space.

3- Oil tankers must be provided with suitable slop tank arrangements with a capacity necessary to retain the slop generated by tank washings, oil residues and dirty ballast residues.

4- New piping arrangement for oil tankers, for the discharge to the sea of ballast water or oil contaminated from cargo tanks area. It shall be set on the open deck or to the ship side above the water line in the deepest ballast condition.

5- New crude oil tankers of 20,000 dwt and above and new product carriers of 30,000 dwt and above must be provided with SBT
which must be protectively located (PL), against rupture in the event of grounding or collision, and limit the outflow of oil.

6-In addition, new oil crude tankers must be fitted with crude oil washing system (COW), instead of water, for the cleaning of residues left clinging to the tank walls after the discharge of oil. It is more efficient than water washing and eliminates the accumulation of sludge.

7-Existing crude oil tankers of 40,000 dwt and above must be provided with SBT or dedicated clean ballast tanks (CBT), which are tanks using the same pumping and piping arrangements for both cargo oil and ballast water (however, CBT is recognised as an interim measure for existing ships of 70,000 dwt and above for two years after the entry into force of the protocol and 4 years for those between 40,000 and 70,000 dwt) or COW system.

8-Existing product carriers of 40,000 dwt and above must be provided with SBT or CBT.

9-New oil tankers must comply with the subdivision and damage stability requirements to ensure that they can survive assumed side or bottom damage.

10-Further, the 1978 SOLAS protocol states that the inert gas system (IGS) is mandatory requirement and must always be fitted on ships with COW. IGS reduce the oxygen content of the atmosphere in cargo tanks during and after the discharge of cargo oil in order to eliminate the risk of explosion. The inert gas which is normally produced as boiler flue gas containing less than 5% of oxygen, is pumped into cargo spaces in which oxygen content should not exceed 8%.
11-The MARPOL protocol 78 defines a new oil tanker for the purposes of the implementation of CBT, SBT, COW and IGS, as an oil tanker to which any of the following days apply:

- Contract of building placed after 1 June 1979.
- Keel laid after 1 January 1980.
- Delivery after 1 June 1982.

12-In MARPOL 73/78 regulation 11 (Exceptions) has been expanded, and provision 11(c) states that the discharge criteria shall not apply to the discharge into the sea of substances containing oil when this substance is being used for the purpose of combating an oil pollution incident in order to minimize the damage from pollution.

13-Furthermore, the MARPOL 73/78 Convention has efficiently facilitated the practice regarding contraventions for violation of the requirements with respect to unlawful discharges, within or not the territorial seas of a party. Under OILPOL 54/69, discharge in contravention to the convention is punishable under the law of the Coastal State if it occurs within the territorial sea of that State or under the law of the Flag State if it occurs elsewhere. MARPOL 73/78 extends the right of the Coastal State to cover waters under its JURISDICTION as defined by the new Law of the Sea Convention 82, "in the light of international law in force at the time of application (See page 42). If an illegal discharge, outside its territorial waters is detected by a Coastal State, that State should report to the Flag State, investigate the matter and institute proceedings against the owner or master of the ship for the illegal discharge. Such reports should also be submitted to IMO. It has been reported that in many cases, information submitted by Coastal States to Flag States on alleged
violations of OILPOL 54/69 was not sufficient to enable those Flag States to institute legal proceedings successfully. In order to overcome such difficulties, MEPC has developed guidelines on the contents of Coastal States reports. These practices have been a difficult question throughout several years under OILPOL 54/69, and penalties have been so small and weak to really discourage all these unlawful acts.

Both Conventions require that every ship must carry on-board an OIL RECORD BOOK, and to record such operations as ballasting, deballasting and cleaning of cargo and fuel oil tanks, the discharge of oily mixtures, etc. They also stipulate the obligation and right of officials of Port States to check this book.

Finally MARPOL 73/78 has considerably tightened the requirements for inspections, certification and control of Port States, with the so-called PORT STATE CONTROL.

Broadly speaking, the enforcement provisions of MARPOL 73/78 are therefore divided in two categories:

- Enforcement by Flag States, which includes surveys and certification of ships, in respect to design, construction and equipment; and
- Enforcement by Port and Coastal States, which includes the Port State Control of ships and certificates, and the surveillance and detection of discharges in contravention to the Convention.

In doing the Port State Control, a number of factors may cause a ship to be considered a pollution threat:

a. No compliance with construction or equipment requirements,

b. Inoperative or malfunctioning of equipment,

c. No compliance with the operational requirements.
When inspecting a foreign ship, officials must carry out the following procedure:

i- Verify that the ship has a valid International Oil Pollution Prevention Certificate (IOPP) on-board,

ii- If clear grounds for believing that the ship is not in compliance with particulars on the certificate or,

iii- If there is not a valid certificate on-board, the ship should not sail until it represents no harm to the marine environment, or the ship may be permitted to leave to the nearest repair yard, if such facilities necessary to resolve the problem are not found in the port of detention.

Also, Port States may carry out inspections to ensure that crude oil washings are performed by all crude carriers required to do so.

The guidelines given by MARPOL 73/78 for the control procedures by Port States are:

- Examine the IOPP Certificate,
  the record of construction,
  the oil record book.
- Check days of survey and inspections.
- Check if cargo is in conformity with the certificate.
- Establish how the ship is equipped for the prevention of marine pollution.
- If certificate is valid and maintenance is good, the inspector should confine to report deficiencies.
- If grounds for believing that a ship does not comply with certificate, the inspector must proceed to a more detailed inspection of the engine room, the ship's equipment, and the cargo tank area and the pump room on oil tankers. The new
formats were already presented after page 26, which were adopted and recommended by IMO and MEPC for cases of reports on deficiencies and on alleged contravention of the discharge provisions.

Implementation of MARPOL73/78:

As may have been noted from the foregoing, MARPOL 73/78 is a comprehensive and far reaching instrument COVERING ALL ASPECTS OF MARINE POLLUTION FROM SHIPS and its implementation will require joined efforts by Governments, Classification Societies, industries and institutions.

Governments and industry:

- To understand the technical and administrative implications of the provisions.
- To develop and manufacture equipment in compliance with the MARPOL requirements and related guidelines and specifications developed by IMO.
- To arrange for construction or conversion of ships and installation of equipment to comply with the MARPOL requirements.
- To develop procedures for the operation of ships to meet the MARPOL requirements.
- To train personnel on-board.
- To take necessary legislative procedures to ratify and implement the Convention.
- To establish a system for surveys and certifications.
- To develop systems and procedures for the inspection of ships in ports, detection due to unlawful discharges, penalties, investigation of casualties, and for the preparation and submission of reports to IMO.
When acceding or ratifying Marpol 73/78, annexes I and II are mandatory (oil and noxious liquid substances carried in bulk), while III, IV and V are optional and can be ratified separately when the country concerned felt that all legal and material conditions have been fulfilled by the Administration. However, annex II has a period of grace of 3 years after the submission of the instruments of accession to IMO, so that the country can comply within this period with the stipulated conditions.

The United Nations Law of the Sea Convention, and the Coastal and Port State rights and powers against operational discharges:

OILPOL 54/69 states that only the Flag State is authorized to investigate and PROSECUTE alleged offences. The Coastal State and Port States powers are limited to check the oil record book and transmit the evidence available of any contravention to the respective Flag State. In that respect, the Convention had been criticized for relying exclusively on Flag State enforcement which did not provide satisfactory results. Due to this fact, considerable emphasis was given in the Marpol 73 Convention for more adequate means of enforcement by the other States, such as the establishment of penalties, reporting, inspection, investigation, proceedings, and prohibition of entry to and/or departure from a port; and also for supporting measures such as communications, certificates, records and equipment.

However, the Delegations were unable to agree on a more precise and define Coastal State enforcement powers; on Coastal State powers to apply and enforce discharge, construction and design standards differing from international standards, and on the que-
Question of Port State powers.

In UNCLOS Convention, the basic lines of the enforcement system were formulated. Article 221 paragraph 4, article 21, has clearly recognized the right of the Coastal State to adopt National Laws for the control of pollution from foreign vessels in its TERRITORIAL SEA, without prejudicing the innocent passage right of the ship. According to this article, paragraph 5, the Coastal State has a certain competence to establish laws and regulations for the EXCLUSIVE ECONOMIC ZONE (EEZ), but in conformity with GENERAL ACCEPTED international rules and standards. In a separate provision in paragraph 6, the Coastal State is authorized to define "SPECIAL AREAS" in ecologically sensitive parts, under certain conditions as the IMO HAS TO RECOGNISE THE NEED to do so, and the Coastal State MAY NOT implement any different standards for design, construction, equipment and manning.

In article 220 it is said that when a foreign vessel is voluntarily within a port or off-shore terminal, the Coastal State may always cause proceedings to be taken for violations of both National Laws and International Rules occurring in the territorial sea or EEZ; while navigating, the ship may only be subject to such proceedings if there are "CLEAR GROUNDS" of a violation in the territorial sea, and/or "CLEAR OBJECTIVE EVIDENCE" of such violation resulting in a "MAJOR DAMAGE TO THE COASTLINE" in the EEZ. If nothing of this occur, the Coastal State is limited to require information (identification, route, etc.), without prejudicing its right of innocent passage. Article 218, sets out the conditions under which, the Port State can take actions to investigate and prosecute violations of the International discharge criteria having occurred outside its territorial sea and EEZ, irrespective of where the violation occurred, but only if the Port State was requested to carry
out investigations by other States or unless the enforcing State was also damaged or threatened by the violation. Furthermore, they must suspend any action and transfer any evidence at the request of the Coastal State in whose waters the violation has occurred.

Finally, Port States may prohibit unseaworthy ships from leaving their ports, except to proceed to the nearest appropriate repair shipyard.

In order to satisfy the MARPOL provision that the Coastal State Jurisdiction will depend on the INTERNATIONAL LAW IN FORCE AT THE TIME of the incident, it would be required that the UNCLOS enter into force and amend MARPOL in line with the relevant provisions of the Law of the Sea Convention.
2.4 Enforcement in Marine Pollution Law.

As it can be appreciated, enforcement of International Conventions related to the prevention and control of marine pollution "has unquestionably been the most difficult problem in promoting the protection of the maritime environment." 22/

Enforcement is "the process by which a regulation is made effective or the process designated to compel obedience to a legal rule." 23/

The principal rules in marine pollution are BASIC PROHIBITIONS as the ones referred in the Marpol 73/78 discharges, criteria, and STANDARDS for the design, construction, equipment and manning of ships stipulated in Solas 74 (IGS), in Marpol 73/78 (SBT, PL, CBT, etc.), and in STCW 78 (manning, watchkeeping, standards of training, etc.).

There are two types of enforcement, Stricto Sensu and Lato Sensu. Stricto Sensu refers to the punishment of violations of the principal rules of a Convention or National legislation. While enforcement Lato Sensu refers to the measures and methods for the effective application of these principal rules, and may include the adoption of secondary rules providing for penalties, the punishment of violations, intervention in the high seas in case of accidents, cleaning up operations, and even the establishment of some material conditions for the effective application of principal rules such as the installment of reception facilities for oil and oily mixtures.

Gr. J. Timagenis (1980) suggested four stages of the punishment process: 24/

a) Reporting or discovery of the violation. This is an aspect of International Cooperation in the field of marine pollution. 25/

b) The investigation. This stage not only inclu-
de inspection, but also examination of witnesses, chemical analysis of samples and collection of evidence of any nature.26/

c) The judgement, on basis of the evaluation of the evidence, and the determination of sanctions. Such proceedings must be taken by the Administration of the ship (Flag State) wherever the violation occurs, and by any party for a violation occurring within its jurisdictional waters. (Coastal State).

d) Enforcement of the judgement. This is to give effect to the determined sanction, and is usually done by an advance security process, that facilitates this enforcement. The security could be obtained by the arrest of the ship (by a Port State), or its release upon depositing an adequate bond (by its agent, owner, etc.).

M'Gonigle and M. Zacher (1979) divide the process into three functions where the diverse international accepted provisions are grouped:

1- Reporting of compliance. This include implementation, reception facilities, oil record book, discharges on contraventions.

2- Inspection and surveillance (genuine link). Includes inspection of documents, equipment, construction, regular surveys, coastal watchings, etc.

3- Actions against violations. Such as report to Flag States, investigate accusations, impose penalties, detention, etc.
2.5 The Costa Rican Status related to International Conventions

As it will be appreciated from the following lists of countries, Costa Rica has not accepted any International Convention related to safety and marine environment protection. We will never suggest to our Maritime Administration to start ratifying and implementing them without a previous good study of the possible effects this can bring to our economy. This has not always been the case in many developing countries, with the subsequent problem of non-compliance with the standards and an inadequacy of effective enforcement of the provisions and rules. This can lead to bad international reputation, an over-load of work in the Administration and confusion in National and foreign shipowners, and in the long run it may affect our maritime transportation and trade.

Due to our clear position as an imminent Coastal State, the Costa Rican Administration must look forward those conventions that can strengthen our rights and powers on our jurisdictional and adjacent waters, but also keep informed on the latest developments and provisions with which foreign ships calling at our ports must comply. The Costa Rican Administration has worked wise and prudently by delegating responsibilities on surveys and the issue of certificates or letters of compliance for our ships, to Classification Societies such as the Norske Veritas for Solas 74, Load Lines 66 and Tonnage 69 Conventions, but now is the time for an up-dating of our National Maritime Legislation parallel to provisions set up in International Conventions, in order to formulate the more suitable structure for our still small maritime activity, and for a better protection of human lives and of important economic
and ecological sites, for the benefit and welfare of our future generations.
LIST OF STATES WHICH HAVE ACCEPTED CONVENTIONS RELATED TO MARITIME SAFETY IN RESPECT OF WHICH IMO PERFORMS DEPOSITARY FUNCTIONS

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Parties to the 1978 MARPOL Protocol undertake to give effect also to the provisions of the 1973 MARPOL Convention subject to the modifications and additions set out in the Protocol.
### STATUS OF MARPOL 73/78  
(as at 5 July 1985)

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Total Number: 37  | 23  | 22
NOTES:


4- Smith, pp.16-18.

5- Personal suggestion of Mr. Per Eriksson, assisting at the World Maritime University, 16 Sept. 1985.

6- Smith, pp.17-18.


9- Nagendra Singh, *International Maritime Law Convention*


12-Idem, 3:2459

13-Ibid.


15-Smith, p.15.

16-Idem, p.19.


18-See chapter 1 section 1.3, page 8.

19-Prepared by and received from Mr. Per Eriksson at the World Maritime University, Malmo, Sweden, 16 Sept. 1985.

20-See chapter 2 section 2.2 page 26.
21—See chapter 2 section 2.4 page 44 et passim.


25—See chapter 2 section 2.2 pages 20 to 23.

26—See chapters 4 and 5, sections 4.5 and 5.1, pages 87 et passim and 129 respectively.
3. Strategic Plan

3.1. The First Steps for the Formulation of a Contingency Plan.

3.1.1. Identify the routes with the heaviest volume of shipping

Due to the limited bibliography available, it was impossible to deal deeply in the subject.

The traffic of tankers through our waters is not significant. The main concern for the set up of such a plan is the laden tankers that bring our crude and petroleum products to the oil terminal in the Caribbean Coast at Moin, Limon, and these products are a potential risk of pollution in the case of an accident or grounding. The passage of tankers in the Pacific Ocean is far away from our continental coasts but they pass quite near our island territory, the Coco Island (348 miles from our coast), when coming from or going to the Panama Canal. The routes are shown in Figure 6.

Although, the transit of loaded tankers represent a potential risk of a spectacular pollution incident, tankers in ballast, passenger ships, cargo vessels and also small fishing and pleasure boats greatly increase the risk of accidental pollution and represent the major contributors of operational pollution due to their frequency of transits through our waters and because of the weak surveillance and control by the various States on their navigational conduct at sea.

This control is specially difficult in the Caribbean Sea were so many ships are in transit every day due to the great number of island States and territories to and from which they
navigate, so that the limitation of responsibilities and rights make the area one of the most diverse and conflictive of the so-called regional seas. This is why, joint efforts towards a common cause by regional agreements have been developed and will be formulated in the future.

Special concern and preoccupation must be felt by our government for an immediate study on the possible changes in our coastal waters and on our negative (until today) pollution incidents record, when installing and operating the pipe line across Costa Rica due to the increase in the transit of bigger tankers through our waters.
Figure 6
Sea lanes of tankers in the Caribbean Sea and Pacific Ocean

3.1.2 Identify the most significant points for an oil pollution incident.

The most significant points for an oil pollution incident are those areas or locations where crude oil and related substances are handled and transported with major frequency.

Right now in Costa Rica the only oil terminal in operation is Puerto Moin, which is located in the Caribbean Sea, 10 Km north-west from the National Port of Puerto Limon. (See Figures 7 and 8).

This area and its surroundings are the points with a major probability of occurrence of an oil spill.

I believe that Puerto Moin is the more adequate place to install the Caribbean Local Control Team’s Headquarters, because of:

- Its risky situation.
- The already availability of equipment and material necessary to deal with an oil spill.
- The availability of manpower that knows how to deal with oil and the safety measures that must be taken when an emergency arises.
- Its easy accessibility and warehouse capacity.

On the Pacific Coast we do not have, for the time being, an oil terminal, but still we must be prepare to deal with an oil spill, a fire on-board or the rescue of people due to the collision or grounding of a vessel.

For that purpose, I think that the installment of the Pacific Local Control Team’s Headquarters must be in the surroun-
Figure 8
Recommended location of the local control teams
/Mario A. Boza (1984) pages 8 and 9
dings of Jaco Beach (See Figure 8), because of its strategic situation in the middle of the Costarican Pacific Coast, its easy accessibility, and also, because from there important coastal cities, industrial areas, and tourist and research installations will be easily protected.

3.1.3. Identify types, quantities and frequency of oil handling

Also in this section, the limited bibliography obtained and the lack of well-documented data available, made an extensive discussion on the subject impossible, however I will present the little information gathered.

By 1982, the Costarican importation of crude oil and petroleum processed products account for 20% of the total imports. The amount of crude oil imported was 402,500 metric tons, petroleum products 238,000 metric tons, motor spirits or gasoline 40,716 m.tons., distillate fuels 172,779 m.tons. and lubricant oils and greases 16,112 m.tons.3/

The frequency of arrivals is of one tanker of approximately 35,000 dwt per month.

3.1.4- Identify the areas and activities of particular sensibility

As it could be appreciated in Figure 9, both Costarican coast lines have very different configuration. In the Pacific we have a very irregular coast line with numerous bays, gulfs, and capes, while in the Caribbean it is straighter, with few irregularities. This characteristic of the Caribbean Coast makes any oil
Figure 9
Coastal major towns and industrial sites
spill incident more serious, because the oil will be spread easily in a wider area of the coast due to the absence of natural barriers.

Although, both coasts have certain characteristics in common:

- Numerous and extensive coastal National Parks. (See Figure 10)
- Their flora and fauna is rich and, because of their tropical nature, also very delicate and easily damaged or destroyed by a small change in environmental conditions (specially coral and related sedentary organisms).
- Usually with calm waters and moderate winds.
- Most of the inhabitants of the coast depend to some extent on the food they take from the sea, also the great number of fishing industries along the coast give employment to people in the region, and their products represent an important share of Costa Rican exports.

For all this features mentioned, I have the reason to think that THERE ARE FEW SENSIBLE PRIORITY OR IMPORTANT AREAS OR LOCATIONS (see list in following page) along any of both Costa Rican coastlines to be more carefully protected than others, because both are sensible, and economically and socially important. In fact, the National Contingency Plan of Costa Rica must prevent and diminish the damage that may occur from an oil spill incident in any place within the Costa Rican jurisdictional waters. Some of the priority areas which must be protected immediately after the verification of an incident are (See Figure 10):

In the Pacific Coast:
- National Parks Santa Elena and Santa Rosa.
- The Nicoya Gulf, Islands and rivers.
- Coastal sector of Quepos and Parrita.
- Deltas of the Rivers Terraba and Sierpe.
- The Dulce Gulf.
- National Park Corcovado.

In the Caribbean Coast:
- Coastal Sector of Cahuita (Coral Reefs).
- Coastal Sector of Tortuguero (Green Turtle unique site of her spawning).
- Tortuguero Delta and Canals.
- Colorado River Delta.
Figure 10
Coastal National parks and amenity sites
3.2 Designation of a National Response Organization and its Local Sector and National schemes and Regional Cooperation

3.2.1 Functions and organization. Coordination with other available and interested elements in case of an emergency.

It is known that it is impossible to prepare a plan that would cover all potential situations of an oil spill, specially if the capital available is scarce as is the case of Costa Rica. Although, the Government should identify a certain responsible agency or response organization, taking into account the existing administrative subdivisions' (see page 66 et passim.) functions and responsibilities, which experts appointed by the administrative subdivisions, should establish the procedures whereby all those organizations, industries, etc capable of making a contribution, can marshal their resources in an organized way.

In that respect, the Costarican Government should:

a) Account relative sensitive areas.4/

b) Consult with interested organizations such as: -Fishing Shipowners Associations.
   -Fishing Industry.
   -National Wildlife Parks Foundation.
   -Costarican Tourist Institute.
   -Educational Institutions (Costa Rica University, National University, UNED, etc).
   -Etc-

c) Ensure adequate communication with relevant sections of the industry such as:
Shipowners Associations.

The National Insurance Institute.

The Costarican Petroleum Refinery (RECOPE).

And various material and equipment suppliers for the acquisition of resources.

d) Conclude arrangements with ship's masters and aircraft's pilots operating in the area of scope, for the reporting of an oil spill caused and sighted.

e) Cooperate with other national organizations dealing with emergencies such as:

- Costarican Fire Brigade.
- Costarican Red Cross.
- National Aviation, etc.

f) Delegate a Press Officer who must deal with the adequate dissemination of news to the public and National Administration Ministries.

g) Ensure the training of personnel, specially those who have experience or certain skills needed in an emergency, such as:

- Oil & pipe line terminal personnel.
- Municipal Fire Brigade personnel.
- Red Cross personnel.
- National aircraft pilots.
- Tugs officers and pilots.
- University staff, etc.

(I will deal with this in more detail in Part D Section 2 and 4).

h) Provide adequate financial and organizational arrangements for exercises, in order to find
the weak points or to assess the need for the updating of new developments and techniques.

i) Analyse all exercises and incident reports for any further change or development of the plan.

In Section II of the IMO Manual on Oil Pollution, it is recommended that the spheres of responsibility within and between the organizations must be clearly defined and understood, in order to provide and arrange for the essential resources and manpower, conduct the training and liaison, prepare the contingency plan and put such plan into operation, when the occasion arises.

The Costa Rican Response Organization (CRO) has the following basic responsibilities and functions:

- a) Carry out the general direction.
- b) Prepare and approve the application of the National Plan, and give guidance and advice in the elaboration of national and local plans.
- c) Give the order for the carrying-out of Contingency Plans.
- d) Take decisions regarding the negotiations and participation on Bilateral Plans.
- e) Broadcast the objective of the organization and its rules or recommendations at a National level.
- f) Keep being informed about the new techniques, equipment and methods which deal with an oil spill.
- g) Carry out the training of personnel on the
h) Acquisition and allocation of manpower and other resources.

i) Promote programmes of investigation and development for the systems and equipment by the national industry and educational institutions.

j) Establish the minimum requirements for prevention and control of oil pollution with which the government and private entities must comply.

k) Division and definition of responsibilities for action.

l) Liaison with Ministries and Industry.

m) Public relations.

n) Post incident recovery of expenditure by the different parties involved.

o) Analyse incident reports.

National Response Organization Members.

-MTD=Maritime Transport Directorate.
-MOPT=Ministry of Public Works & Transport.
-MIDEPLAN=Ministry of Planification & Economic Policy.
-RECOPE=Costarican Petroleum Refinery.
-MAG=Ministry of Agriculture and Livestock.
-MEP=Ministry of Public Education.
-INS=National Institute of Insurance.
-MSP=Ministry of Public Security.
The Costarican Response Organization must define and delegate such spheres of responsibility to the agencies which cover the sea, the coast, ports and harbours, and inland water traffic; and also designate a coordinating authority that in my opinion must be the Director of the Maritime Transport Directorate.

These agencies involved in shipping matters, to which the Costarican Response Organization gives the responsibility to deal with any oil spill, are called the Sector Control Agencies (SCA). In my opinion they should be: The Board of Port Administration and Economic Development of the Atlantic Seabord (JAPDEVA) for the Caribbean Coast and The Costarican Pacific Ports Institute (INCOP) for the Pacific Coast (see pages 65 and 66). They must designate a Sector Commander (SC), who must have a certain degree of authority and who is responsible for the work planning and control of operations. He must be a person with great knowledge of the region, and with experience in all the different matters of maritime transport; specially in the transport and handling of oil. He needs good and direct communication with the resource centers of the region and the nation, and with those who are or may become concerned with diverse aspects of such an incident.
These two agencies have certain characteristics that make them the best suited to deploy these tasks:

i-Close association with shipping matters and marine affairs in general, including authority to control shipping.

ii-Bases along the coasts and navigable waterways.

iii-Possession of, and/or access to ships, tugs, boats, aircrafts and helicopters.

iv-Enjoy the cooperation of all other government agencies, and appropriate industries, that can provide support to the extent of their capabilities.

The SCAs are formed by the different interested parties concerned with an oil spill, and directed by their SCs. The commanders must:

a) Elaborate the sector and local plans.

b) Direct the carrying-out of the plans of response in the case of an oil spill in their area of responsibility, or any other of the areas that have asked for assistance, with the resources available.

c) Designate a Local Controller, for the control and coordination of operations, and to support the on-site team with manning, other resources and any assistance requested by the on-site supervisor.

d) Coordinate the maintenance and control of the resources available.

e) To look out for, and control the contamination
of the waters within their jurisdiction.

f) Broadcast all the pertinent information about the incident to the public in the case of contamination of our waters.

The Local Controller (LC) has the following functions:

a) Keeping informed about the development of the incident.
b) Evaluating the scope of the incident and taking the adequate measures; asking for advice and deciding about the strategy that must be followed in order to overcome the incident.
c) Procuring the timely supply of resources.
d) Supervising the operation, so that it is being carried out according to the patterns preestablished by the plan.
e) Integrating the different means of contamination control available.
f) Keeping informed about the development of the operations and when the case arises asking for new resources.

In the CONCAWE’s Guide Book (1981) it is mentioned that the local control teams must carry out the following tasks:

- Spill containment.
- Oil spill recovery.
- Application of treatment chemicals.
- Shore clean-up.
- Storage of equipment and material.
- On-site disposal.

This team needs the aid of various support teams provided by the SCA, such as:

- Equipment, material and manpower supply.
- Finance.
- Accommodation.
- Transport.
- Office facilities.
- Maintenance.

And also, the assistance or advice from certain key experts, such as:

- Logkeeping (of resources and operation's expenses),
- Ecology (animals and ecosystems rehabilitation)
- Disposal of recovered oil.
- Meteorology and hydrology.

Depending on the extent, location and possible risk of a greater incident, the following contingency plan's response must be followed:

1- When the action and means of the LCT are not enough for the efficient combat of the oil spill; the Sector Control Plan (SCP) must be put into operation.
II-When the action and means or resources of the SCAs. are not enough for the efficient combat of the oil spill; the National Contingency Plan (NCP), must enter into operation.

III-When the action and resources of the NCP are not enough for the efficient combat of the oil spill, the Regional Contingency Plan (RCP) (Regional cooperation) must enter into operation.

NATIONAL CONTINGENCY PLAN PARTICIPANTS AND ABBREVIATIONS

-NCP=National Contingency Plan.
-CRO=Costarican Response Organization.
-NC=National Coordinator.
=Director of the Maritime Transport Directorate.
-SCA=Sector Control Agencies.
-PSA=Pacific Sector Agency.
=INCOP=Costarican Pacific Ports Institute.
-CSA=Caribbean Sector Agency.
=JAPDEVA=Board of Port Administration and Economic Development of the Atlantic Sea-bord.
-SC=Sector Commander.
-LCT=Local Control Teams.
-OSS=On Scene Supervisors.
-BU=Boat Units.
-SU=Shore Units.
NATIONAL CONTINGENCY PLAN STRUCTURE

Costarican Response Organization (CRO)

National Coordinator (NC)

(MTD Director)

Sector Control Agencies

Pacific Sector Agency (INCOP) —— Caribbean Sector Agency (JAPDEVA)

Pacific Commander —— Caribbean Commander

- Fire Brigade.
- Red Cross.
- National & Civil Aviation.
- National Guard Force.
- Coast patrols and tugs.
- Pilots.
- Surveyors & Inspectors.
- Oil & Pipe line Terminal Personnel.
- Meteorological and Hydrographycal Service.

Local Control Teams (LCTs)

Local Controller (LC)

On-scene-supervisor

Boat Units —— Shore Units
TASKS AND RESPONSIBILITIES OF THE MAIN GOVERNMENT BODIES

M.O.P.T.:
- Ensure that the Road Patrols take control of the roads to and from the incident site, allowing the smooth transit of the supply and operational vehicles.
- Ensure that the National Air Traffic Service maintain the easy and safe access of the aircraft and helicopters operating on oil recovery, or salvage, or supply of resources, etc, to and from the oil spill base site; and deviate any other commercial or private aircraft from the area.
- Provide manpower, vehicles such as trucks, jeeps, bulldozers, etc, for the transport of material, persons, equipment etc, or cistern tank trucks for the transport, storage or disposal of the oil recovered.
- Deal with the construction of any infrastructure or access roads needed in an oil spill.

M.I.D.E.P.L.A.N.:
- To plan the equipment purchase and its distribution between the local agencies.
- Control the use of such equipment and material. (Keep records).
- Fullfill the immediate requirements and the medium and long term needs of the National Contingency Plan.
- Coordinate the training and liaison of the Local Agencies’ personnel.
- To divulge the NCP, and encourage cooperation from the public and private sectors.

Promote and finance the research on such matter.
M.I.E.N.:  
- Give advice on technical matters about petroleum.  
- Promote cooperation and research from the industry.  
- Keep informed the CRO about the new technological advances in the field and assist in the training of personnel.

R.E.C.O.P.E.:  
- Provide equipment and personnel.  
- Provide the training for oil terminal's personnel, and make them aware of the importance of avoid any type and size of oil spill, and encourage them to notify immediately any defect found on a ship, pipe line or hose, that can lead to an oil spill.  
- Provide cistern trucks for the transport, storage or disposal of the recovered oil.  
- Make the public aware of the role they are playing on the prevention of contamination by oil and the need of their cooperation.  
- Give experts access to their laboratories for purposes of research or oil spill source identification.  
- Control the ships calling at the terminals.  
- Keep a logbook of any incident.

M.A.G.: Provide equipment for the clean-up operations such as trucks, shovels, etc. Determine and organize those farmers who have aircraft used for the spreading of fertilizers, etc., because those are the most recommended devices for the spraying of dispersants, and for the oil spill surveillance (9/), because of their manuevrability and cargo capacity.
M.S.P.:

- Provide an easy movement of vehicles to and from the place of the incident, or from where the operations are being organized.
- Avoid crowds of curious people coming to the area.
- Cooperate in the transfer of injured people or bodies.
- Provide manpower for the watchkeeping of the equipment and materials.
- Cooperate with the supply of materials and the sample taking.
- Cooperate with the installation and good function of the communication network.

M.E.P.:

- Organize educational institutions and research centers for carrying out research on the subject, give training to the personnel of the agencies, the industry, etc.; for carrying the analysis of the samples.
- Broadcast in the educational institutions, the importance of avoiding any kind of contamination in our sea and inland waters.

I.N.S.:

- Provide advice to the government on the best scheme of cost recovery in the case of the occurrence of an oil spill in our waters. Recommend which international instruments and conventions are important to be ratified and implemented by Costa Rica for the easy recovery of such expenses. Also, about the conventions with which the transporters of the oil and other
harmful substances must comply for the coverage of costs in case they get involved in an incident.

- Promote the safety standards on national ships, ports and terminals.
- Provide training to the Fire Brigade on how to deal with fire or explosions on-board ships or in oil terminals. Also, cooperate in the training of the Red Cross in the transfer and taking care of injured people, or in the search of bodies.
- In the case of an incident, provide the Red Cross with the extra requirements on accommodation and medical supplies they may need.
- Help these entities in searching the necessary financing for the purchasing of equipment and material they may need in the event of an oil spill.

I.C.E.:

- Provide the adequate communications network between the different teams, agencies and control commanders with all the important long, medium and short distance destinations. Such channels must be direct and reserved for an easy flow of communications to and from the site of the incident.

I.C.M. & H.D.:

- Provide all expertise and information required on meteorological and oceanographic parameters, the possibility of changes on weather, wind, currents, etc; this information is essential for the spill surveillance and for the planned and organized transfer and location of resources, to deal efficiently with an oil spill incident.
3.2.2 Regional Cooperation

Pollution is the subproduct of industrial progress and commercial development, which keeps growing because of ocean transportation, and specially due to the transport of oil and oil products, which represent the energy that moves the world progress machinery. Because of the fact that the transport of oil by sea cannot be substituted and is an International Industry that produces contamination, it has been concluded that Regional Cooperation on the prevention and combating of marine pollution is also necessary.

Right now any single country, and specially the developing countries, cannot cope by themselves with the tremendous expenses incurred when trying to combat pollution from an incident that involves the largest tankers of today. Accordingly, it makes sense to provide for the sharing of equipment and expertise between countries, organisations and industries.

This Regional Cooperation agreements should be established with the assistance from IMO. First of all, a country must provide every one of the immediate neighboring countries, willing to be involve in such arrangement, all the information regarding the type and quantity of resources and expertise available, and other means of its National Response capability.

As Mr. I.N. Archer said, "regional agreements should therefore be considered as a supplement rather than a substitute for a national response capability."10/.

Second, the countries involved must identify the points of contact which should be maintained by reliable means of communication. This is specially important for the pollution reporting obligation, which has been underlined in International Conven-
tions such as the Intervention in the High Seas in case of accidents, the Law of the Sea and the Marpol, by which a master of a ship must, without delay, report incidents in which his ship is involved but also the pollution reporting system for the exchange of information between contracting parties of regional agreements, such as the POLREP system (See report format in next page). This exchange of information is also important for the identification of the competent authority responsible for operational aspects, the exchange of information on technological developments, operational procedures, laws, regulations, etc.

Third, form a regional center or coordination unit, which must support the regional anti-pollution arrangements or protocols by its operational tasks such as: - Collecting and disseminating information,

- Maintain current inventories on equipment, materials and expertise available,
- Assist in the establishing of contingency plans,
- Encourage technological cooperation and training programmes.

The regional arrangements could be of two types:

I-A JOINT PLAN; in which parties must decide on the division of responsibilities, harmonize their national plans to facilitate the response, define how the plan is to be activated, which party is in the control of the operation (lead government) and resources, provide an easy movement of resources by fast customs clearance, and establish good and reliable means of communication. The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region is of this type of arrangement.
POLREP FORMAT

From: (State requesting the alert)

To: Commander, Greater Antilles Section, US Coast Guard, San Juan, Puerto Rico

CARIBPOLREP number (sequential number of report)
(Brief title of the incident including source or potential source, location and time of incident)

1 Situation (provide full details of the incident as known)

2 Action Taken (describe the action taken initially, or since last report, in response to the discharge or threat)

3 Future Plan (describe the action contemplated in response to the discharge or threat)

4 Assistance Requested (identify assistance desired by particular State)

5 Alert (a) identify State to whom the alert is to be re-addressed, (b) advise flag State following message "quote - unquote"

6 Status of situation (case pending or case closed)
II-A MUTUAL ASSISTANCE ARRANGEMENT; in which every party is able to seek the loan of resources from any other, but deciding beforehand which country has the tactical control over these resources.

Despite the type of arrangement chosen by the Costarican, Nicaraguan, Panamenian and Colombian Governments (which are our immediate neighbors), the progress in its implementation is usually slow because of the frequent shortage of expertise and funds, and due to the many other fields which seems in the short-run, and because of the actual economic and political situation, more important and necessary for the development and defense of those countries.
3.3 RESOURCES REQUIRED

As it was already mentioned, one of the duties of the National Response Organization is to order the carry-out of an inventory of all equipment, material, manpower and other resources available that can be used in the combating with an oil spill. This inventory must be carried-out by each Sector and Local Agencies in their area; and by those government agencies and private industries that are or can be involved in the combating of an oil spill; and also all those resources available in neighboring countries.

After this has being done, the CRO, based on the quantities and type of oil transported through our waters, must assess the kind and quantity of resources and expertise still required, in order to have an effective action. This resources depend on:

- Type of pollutant,
- The possible maximum size of the spill,
- The meteorological and oceanographic conditions usually prevailing, and,
- The location that can be affected by the spill.

3.3.1 Equipment and Material:

The NRO must determine the type and quantity required, WHERE to buy, hire or borrowed them; WHERE to store them (the location of equipment adjacent to high risky areas ensure a rapid and effective response); WHICH is the maintenance required; WHERE to repair them and assess and organize the possibility of assistance from outsiders.

A table containing the description of every item
available must be kept; where details such as type, dimensions, capacity, transport requirements and the contact point for its release are listed against location. In some cases, equipment and services will be owned or provided by contractors, industry or others, which makes it desirable to define beforehand, the contractual terms acceptable in principle by the parties concerned.

All this information about the equipment and material should be kept by a designated SUPPLIES OFFICER, who may well be a purchasing officer in the oil company (RECOPE) or in the Local Agency (Main Oil Terminal). He will be in the best position to check the stock and avoid that such equipment and material run out of stock or lost when dealing with an oil spill.

Some equipment and material that may be required are:

- Protective clothing.
- Cleaning material, as rags, soap, detergents, brushes, etc.
- Equipment to clean machinery.
- Plastic bags (heavy duty), for collecting oily debris.
- Spades, shovels, scrapers, buckets, rakes.
- Anchors and buoys.
- Lamps and portable generators.
- Whistles.
- First aid material.
- Portable pumps.
- Workboats or tugs.
- Trucks/cars (four-wheel drive).
- Radio transmitter/receiver.
- Workshop/repair facilities.
- Bulldozers, mechanical scrapers, rotovate and similar earth moving equipment.
- Tank trailers.
- Life vests.
- Twin wing aircraft.
- Helicopters.
- Cameras and video equipment.
- Skimmers.
- Booms.
- Various lengths of rope and cable.
- Chains.
- Dispersants and other chemicals.
- Containers for the application of chemicals.
- Herding or gelling agents.
- Tankers and coastal barges.
- Fenders.
- Spraying equipment.
- A device to measure and record wind speed and direction (anemometer).
- Explosimeters.
- Sampling containers.
- "No Smoking" notices, etc, etc.

3.3.2 Manpower (training):

The classification of the manpower required goes as follows:

- Control staff.
- On-scene commanders.
- Afloat commanders.
- Communication operators.
- Crew.
- General labour force.
- Specialists and advisors.
- Support staff.
- Relief teams.
- Doctors.
- Drivers of cars, trucks and other machinery.
- Maintenance teams.
- Press officer, etc., etc.

Manpower requirements may vary considerably due to factors such as:

- Availability of equipment.
- Weather conditions.
- Temperature.
- Length of the emergency.
- Type of emergency (fire, blow-out, injured or dead people).
- Size of the spill.
- Location of the spill.
- Coastal configuration.
- Beach type affected.
- Duration and extent of oiling.
- Availability of food, shelter, transportation, accommodation, etc.

Experience has shown, that small groups, at the orders of a supervisor, form the most effective working units. It is generally accepted that about 10 persons should work with a foreman, and that 10 of such teams should be managed by the supervisor, who is in direct contact with the local spill response team leader. 11/

A contingency plan must take very much into account the relief teams, because the men cannot be expected to work for more than 12 hours straight-off, or for more than 6 days continuous-
The establishment of a Manpower Office or the designation of a responsible person from the Personnel Department of the oil company, could ensure the availability of reliefs. A personnel directory of persons who have extensive manpower resources available must be elaborated in order to have a direct and fast contact.

Chapter IV of the IMO Manual on Oil Pollution, Section II "Contingency Planning" (1978), deals with the subject of training of oil spill response personnel, and suggest the following:

- The elaboration of short intensive courses by the government and industry (by national entities or by those capable in the region).
- Crew members of boat units (BU), must be trained on the carrying out of their duties, and on the handling and practical limitations and maintenance requirements of oil combating equipment and material.
- There must be simulated practical experiences and an assessment afterwards (This will be particularly valuable in assessing the capabilities of all the communication systems, equipment and operators.)
- Paper exercises which are less costly, help the personnel to be better decision makers, and to make sure that everybody knows what he is supposed to do and when.
- Give training in joint operations with other associated emergency services.

When an oil spill arises, all the various activities must be fully coordinated; for this, a skilled, well practised and experienced team is essential, because time and efficiency are the most important points to take into consideration.
3.3.3 Communication Network:

Good and reliable communications are vital. All the facets of a large and complicated operation is impossible without a comprehensive multi-channel communication system, which gives direct speech links between all those engaged in directing any facet of the operation.

The establishment of a communications center is essential, with telephone, telex and radio communication services (as radio VHF and UHF, and portable sets). The center serves as the ideal focal point throughout the response operation, since all information on clean-ups, oil recovery, and logistic support operations (food, clothing, shelter, medical) will be channelled through it. As operations are being carried out at the same time, it is necessary to allocate separate frequencies for each operation, and repeater stations may be required so that communications can be maintained over long distances.

On the CONCAWE Report number 9, *A field guide to coastal oil spill control and clean-up techniques*, it is setting up the telecommunication requirements for long, medium and short distance destinations. These for the case of our National Response Organisation will be:

Long distance destinations:

- The National Response Organization Office.
- Petroleum exploration and exploitation organizations.
- International Bodies such as IMO and UNEP.
-Multinational spill combating contractors and advisors.

This is preferably done by telex and telephones can be used in emergencies.

Medium Distance Destinations:
- The Local Authorities.
- National and civil aviation.
- Truck rental firms.
- Air traffic service.
- National Guard Forces.

The use of telephone is the most suited.

Short Distance Destinations:
- Work teams.
- Surveillance aircraft.
- Salvage and fire fighting teams.
- Spraying aircraft and vessels.
- Containment vessels.
- Oil recovery vessels.

For these, the use of VHF or UHF radios are essential, but a careful determination and subdivision of the frequencies to be used by the different operational activities must be set-up in advance by the strategic plan, in order to avoid time spending and confusion.

The operational plan should provide for:
1) Installment of telecommunication cables as near to the site
as possible.

2) Necessary radio equipment to the personnel and make sure (by training) that they know how to use it.

In this respect, the Costa Rican Institute of Electricity must cooperate in the planning and installation of the communication lines and equipment, and must render advice to the NRO when they are setting-up the basic requirements for telecommunications to deal with an oil spill, and also help in the training of equipment operators.
NOTES:

1-This problem was also experienced by the IMO's Regional Consultant on Marine Pollution Mr. James D. Spitzer when preparing a review of tanker traffic in the Caribbean Sea for the IMO/OAS/UNEP Government experts meeting on Sub-Regional Oil Spill Contingency Planning for the Island States and Territories of the Wider Caribbean Region in Saint Lucia on May 1984.

2-See chapter 3 section 3.1 part 3.1.2. page 53.


4-See chapter 3 section 3.1 part 3.1.4. page 56.


8-The Oil Companies' International Study Group for the


4. Operational aspect of the contingency plan.

4.1. Identify the possible source, type and location of the oil spill.

After an alert of the possible contamination of our waters by oil has been given by a particular person, a national or commercial aircraft, or a national or foreign vessel; the Sector Control Agency must verify such information, and send immediately for verification of the positive or negative confirmation of such notice to the Costarican Response Organization through the respective channels of communication. Such confirmation must give an accurate location of the incident, the possible quantity of oil spilled and the possible source, if there is one suspected.

After the receiving of accurate information on the situation, the Costarican Response Organization must give the order to the Sector Agencies to put the plan into operation through their Local Control Teams, and alert all national institutions and industries that will get involve into the combat of the incident; and also alert the neighbouring countries that can become affected (See part 3.2.2.). The sampling taking and analysis are important in this first stage of the incident for the search of the possible polluter and to identify the type of oil with which one is going to deal.

It is recommended to use twin wings aircraft with good visibility for the search and surveillance of oil spills in the open seas (see page 86), and the use of helicopters for areas near the shore because of its maneuverability and easy landing. It is
Figure 11
Across-wind ladder search

Movement of oil from last known position (A) to predicted position 3 days later (B). Wind speeds of 25 knots and current speeds of 0.5 knots prevail in the directions indicated. Arrow lengths represent distances applicable to movement during 24 hours. A cross-wind ladder search pattern over B is shown with a flight path separation of 5 miles, chosen with regard to visibility.
also recommended to prepare a flight plan with the use of updated charts, in order to reduce the area of search and economice time and fuel. This is called a SYSTEMATIC AERIAL SEARCH or LADDER SEARCH, which is done across the direction of the wind. (See Figure 11). 2/

4.2 Identify the possible quantity of oil spilled.

An oil spill changes with the passage of time because of the so called weathering effects.

EVAPORATION, can produce appreciated property changes within minutes. Hours, weeks and months respectively are required before OXIDATION, DISSOLUTION and BIOLOGICAL ATTACK cause changes in an oil spill. The unevaporated oil spreads on the water and will emulsify to form a stable water-in-oil emulsion which can contain up to 80 percent of water. Thus, the amount of pollutant can be appreciably greater than the amount of oil spilled, and it is difficult to assess the thickness and coverage of floating oil at sea. The best form to calculate is by a vertical down on the oil aerial observation and the use of an instant picture. Also, by the time expended in overflying the length and width of the affected area at a constant speed. Example:

65 seconds x 150 knots / 3600 sec. per hour = 2.7 n.m. length.

53 seconds x 150 knots / 3600 sec. per hour = 1.5 n.m. width.

This gives a total area affected of 4 square n.miles or 14 square kilometers. Then, with the help of the table before mentioned an knowing the state of the oil, it is really easy to determine the amount of oil spilled.
4.3 Identify the situation.

The first aerial information is important in assessing the situation on-board the vessel or vessels in the case of a collision. If there is fire on-board, or if there are injured people; it is necessary first to control the fire and to rescue all the persons before start trying to control the oil slick and spill, by dispersants or physical removal. Here, the Fire Brigade and the Red Cross play the most important role. These bodies need the cooperation from other bodies such as the National Guard Force, Coastal Patrols, tugs, and private vessels and boats (see page 65).

After assessing the right location of the spill, and by the use of past records and observations in situ on sea state, wind and current direction and speed, and other hydrologic and oceanographic parameters, experts can make a forecast of the possible changes in the area of the spill and of the possible movement of the oil spill.

If past records are not available, the experts must try to predict the possible changes on the basis of their experience and the action must be carried-out accordingly. At this stage, the CMI and the HD work and advice play the most decisive role; but their information and advice will be valuable for the length of the operation.

Although, it is desirable that research should be carried-out in the following years in matters of hydrographic and oceanographic parameters determination along our coast and jurisdictional waters, in order to have enough back-up information when dealing with an oil spill.
4.4 Spill surveillance and forecasting.

The spill surveillance on the open seas is recommended with the use of a twin-wing aircraft and near the shore with an helicopter.\(^5\). The collection of data on wind and current, and also in the possibility of future changes, is very important and essential for the spill surveillance, because wind can move oil at 3\% of its speed, while currents on the same proportion.

In the CONCAWE Field Guide the use of computer models is recommended for the prediction of the movement of oil spills. On Figure 12 the schematic spreading of an oil spill on the sea surface at a specific rate of speed and direction is shown.

Aerial surveillance of the spill should be attempted as soon after dawn, in order to gain as clear a picture as possible on how the overall situation has developed during the night. Surveillance flights should then be repeated as often as necessary, particularly if the conditions of the source of the spill and the weather change constantly.

A final surveillance flight should be made shortly before dusk. The use of video or film cameras is recommended.\(^6\).

4.5 Samples collection, transportation and analysis.

Most of this section is elaborated based on the recommendations given by the IP Oil Pollution Analysis Committee in its book *Marine Pollution by Oil*, chapters 4 and 5.
Figure 12
Spreading of oil spilled on sea surface

/Concawe's report 9(1981) page 17
SAMPLE COLLECTION

The best procedure is to take a large and representative sample of the oil spilled; or to take small samples (100gr or ml) at intervals along the beach or oil spot at sea, because in this form it will be easily found if one or more types of oil are involved in the incident.

Each sample must be taken with detailed information, which must be kept in a logbook:

1- Ownership.
2- Description.
3- Position.
4- Code number of sample.
5- Location.
6- Date and time.
7- Method of sampling.
8- Photograph taken.
9- Name of person collecting the sample.
10- Other relevant information:
   a- If dispersant or other chemicals were used.
   b- Indication of suspected source.

The immediate responsible person(s) to whom the incident was notified must be trained to take, label, store, preserve and transport the samples; because, the fast and effective sample taking positively influences the laboratory analysis. Also, at a National and Local level, a record of the samples taken must be kept.

The total size of the sample must be at least one liter when taken from the beach, and 5 liters when taken from the
Glass jars should be used as containers, with security caps. They must be put into a wooden box with polyurethane foam material for the safe transit. The jars must be labelled and numbered for an easy cross-reference with the notebook.

The sampling in the surface of the water is usually difficult because of the rapid formation of a very thin layer of oil.

Glass or polythene buckets can be used with good success. Also, the use of clean polyurethane foam sheets which act as absorbers of the oil leaving the water to drain. The oil can be recovered by squeezing the sheet or by washing it with an organic solvent such as chloroform.

On the beach, the viscous oil can be scraped off from wood, rocks, concrete or other surfaces and placed directly into the containers.

Lumps can be picked up by hand and placed into the containers.

The fresh light crude oil tend to sink into a sandy beach. This tendency is enhanced where dispersants have been used in attempts to remove the oil. In these instances it may be necessary to take a sample consisting largely of sand with only small amounts of oil and water.

As it was said before, each container must be labelled with the following information:

1. Collector's name.
2. Description.
3. Location.
5. Date and time.
6-Reference to any written or photographic record taken.

In storage or during transport, the samples should be adequately protected, if possible air should be excluded from the filled sample container by displacement with an inert gas such as carbon dioxide. They should preferably be kept at low temperature (≤5°C), and in the dark.

SEPARATION

The separation of the pollutant into the three components, oil, water and debris, is the first stage of any recovery process of the oil from the sample to be used in further analysis.

Three common techniques are used for its separation:

a) Filtration:

Essentially, the sample is diluted with an organic solvent (toluene); then this is filtered and finally the solvent is destilled.

b) Centrifugation:

It is a useful treatment for water-in-oil emulsions, but the detritus present makes a clean separation difficult to achieve. Nevertheless, it usually allows sufficient clean oil for examination to be recovered by aspiration, only when the separation phase is completed.

For samples with little oil, it is practicable to
dilute them with a solvent such as chloroform. When the separation is complete, the water layer is aspirated and the chloroform solution is decanted.

o) Extraction:

It is used to circumvent the difficulties arising from the presence of waxy material or finely divided solids, however it should not be used for pollutants that are liquid at 110°C or for "CHOCOLATE MOUSSE" (water-in-oil emulsions) type of pollutants.

ANALYSIS

The scheme of analysis that is going to be presented, was taken and modified from the book published by IP Pollution Analysis Committee "Marine Pollution by Oil", chapter 6.

The scheme of analysis has being arranged so that important information concerning the type of pollutant involved in the incident can be obtained at the early stages of the examination.

High resolution gas chromatography is a technique that can be of considerable assistance in the characterization of pollution samples, particularly if weathering has not been too severe. (This is why the fast sampling collection is important).

The analytical methods suggested in this scheme are standard IP methods, published by the Institute of Petroleum Standards for petroleum and its products, part I.
SCHEME OF ANALYSIS

Homogeneity of the sample
Pollutant sample

- Add toluene.
- Reflux to remove and determine water content.
- Filtration, extraction or centrifugation.

\[ \text{Preliminary identification:} \]

\[ \text{GC IP296T} \]
- Petroleum distillate
- Crude oil
- Tank residue
- Fuel oil
- Unidentified

\[ \text{TLC/UV IP314T} \]
- Lubricating oils
- Prolatums - Diesel fuels - Crude and fuel oils - Unidentified

\[ \text{TLC/UV IP314T} \]

Destillation

\[ \text{Toluene, water & debris free sample.} \]

\[ \text{GC IP296T or TLC/UV IP314T} \]

Residues \[ \text{destillate} \]

\[ \text{GC IP296T} \]
\[ \text{TLC/UV IP314T} \]
\[ \text{Hr} \]
\[ \text{Nickel IP285T} \]
\[ \text{Vanadium IP285T IP2862T} \]
\[ \text{Sulphur ASTM0129 IP61} \]

\[ \text{Possible identification. Match with possible source samples.} \]

\[ \text{Petroleum distillate} \]

\[ \text{Viscosity ASTM0445 IP71} \]

\[ \text{Identity of petroleum distillate.} \]
The backbone of the characterization scheme, as it can be appreciated, consists of gas and thin layer chromatographic methods.

The interpretation of the results must be made by experts in petroleum chemistry, or other related subjects, maybe by those working in the laboratories of RECOPE or in our national universities.
4.6 Physical removal, dispersion, and other treatments for oil spill

4.6.1 In open seas

Physical Removal in Open Seas:

SKIMMERS

Skimmers are any device to recover oil or oily-water mixtures from the surface of the water, particularly where it has concentrated in thicker layers against artificial barriers (booms) or other obstacles. They are composed of an OIL RECOVERY element, a flotation or SUPPORT ARRANGEMENT and a PUMP. (See Figure 14).

There are different types of skimmers:

I-Skimmers that rely on the adhesion of oil to a solid surface.

II-Skimmers that rely on adhesion to a continuous flexible belt, drawn through the oil/water interface. (See Figure 13).

III-Centrifugal devices that rely upon increasing the effect of gravity by creating a vortex to increase the thickness of the oil.

IV-Devices in which the oil is separated from the water by passage over a weir. (See Figure 14).

All of them work on different principles, but all try to serve the same purpose: "to recover the oil spill from the sea water".

Its performance depends greatly on its PUMPING CAPACITY. They also require power for the function of the recovery ele-
Figure 13
Continuous flexible belt type of skimmer

Figure 14
Weir type of skimmer showing its main elements

/J. Wardley Smith (1983) page 142 from Warren Spring Laboratory
ment and for transferring the collected oil to a storage tank. This is why many of them have been designed with an integral power pack.7/.

Experience has shown that their practical performance is disappointing and that tank testing results are quoted as "obtainable performance".8/ At sea, under realistic conditions, the results are not the same because of certain factors. The skimming system takes time to be organised and settled in the right position; during this time the oil moves, spread and absorb water. This may proceed rapidly (specially in open seas), and in some instances the character of the discharged oil will change markedly within hours. The optimum performance depends on the properties of the oil being collected, and specially the viscosity, which changes easily.

All skimmers work more efficiently on a relative thick layer of oil, but as they operate, they deplete this layer in their immediate vicinity. Arrangements must therefore be made either to keep new oil coming or to move the skimmer into an undepleted area.

Other factors affecting their performance include the extent of the formation of a water-in-oil emulsion, and the extent to which this oil is contaminated with dispersants and debris.

Maybe, in open seas, the most limiting parameter is wave height. Some types work better than others, but the important matter is that the skimmer remain operating in the oil-water interface.

To concentrate floating oil at sea, booms can be towed in V, U or J configurations using two vessels. The skimmer is either deployed from one vessel (Figure 15), or towed as part of the boom array (Figure 16).
Figure 15
Boom deployment by one vessel

Figure 16
Boom deployment by two vessels and skimmer as part of the boom array

/J.Wardley Smith (1983) page 149 from Warren Spring Laboratory

Weather and wind are limiting factors for the deployment of such kind of arrangements, but every effort should be made to collect oil as close as possible to the source of the spill. Even when oil is spreading on the water surface, "collection is preferable to beach clean-up". 

Also, currents must be taken into account, because currents exceeding 0.7 knots affect the effectiveness of the skimmer due to the tendency for floating oil to escape confinement by booms. 

The recovery of oil from the surface of the water and specially from the high seas, requires the work of a well trained team and the provision for relief arrangements for men and vessels. The team must know the equipment available, its limitations and requirements, and how to perform a skilful handling of them for the continuous adjustments as conditions change.

Equipment is preferable to be air transportable, cheap and sufficiently light for an easy and fast deployment. Reliable communications are essential for the coordination of boats, crews and logistic support services.

**BOOMS**

Boom is an artificial floating barrier used to contain or enclose oil or other noxious substances. It could be described as a floating fence supported by one or more buoyancy units and used to prevent the spreading of oil, and sometimes to thicken its layer by reducing the area into which it has spread.

There are many variations in design, but most of them have the following components:

- Free board,
-Sub-surface skirt,
-Flotation section,
-Longitudinal tension member.

There are two types; the Fence and the Curtain types. (See Figures 17 and 18). The fence type consists of a screen of resistant fabric or of rigid material held in a vertical position by floats on each side of the screen. The curtain type consists of an air- or plastic-filled tubular buoyancy compartment, which supports a flexible skirt. Any boom selected to deal with operations in the high seas must have certain requirements:

- Must be formed by unit lengths, which can be coupled together prior to or during deployment.
- Should be flexible to conform to wave motion.
- Should be rigid to retain as much oil as possible.
- Should be strong enough to carry the loads generated, when it is towed, or when wind, waves and current conditions generate a water velocity in excess of the escape velocity of 0.35 m/sec. For this purpose, booms should have tension points called connectors, designed to carry the load throughout the full width of the material.
- It has to be cheap and easily available.

Experience has shown, that using the curtain booms, bulk storage is saved, but some sort of inflation device has to be carried as additional equipment. However, it has been easier to inflate than to assemble the many parts of which the fence type is composed. Also, the great windage of most vertical fence booms makes them very instable to remain vertical, specially if conditions are severe. It has been found from research experiences that the performance of vertical rigid screens is far below that of the heavier curtain type booms.11/.
Figure 17
Curtain type of boom

Figure 18
Fence type of boom

Despite the type of boom used, all have certain limitations. Their performance depends on:

- Wind and current effects on the barrier,
- Type of sea bed and its effect on mooring patterns,
- The angle at which the flow hits the boom. The adequate angle for positioning the boom can be determined by the following formula: \( \sin \theta = 0.3 / \text{max. current velocity (m/s)} \)

When installing the booms, the use of clump anchors consisting of pieces of cast iron or concrete of adequate proportions have the best performance. This mooring technique is specially recommended when the information on the type of sea bed is not available. Some researchers suggest that the minimum weight of such "anchors" should be 15% higher than the predicted load on the boom \(^{22}\), while others suggest a weight three times higher than the expected load.\(^{12}\)

The expected load depends on the wind and current strength and direction, and most of the time it can only be determined in-situ or, if available, from past hydrological and oceanographic data on the area. This is usually difficult in our developing countries.

Another parameter that must be taken into account when mooring booms are the length of the mooring lines. This depends on the water depth, and the swell and tidal range, but they are recommended to be long so that the boom has freedom to rise and fall due to the wave action.\(^{13}\)
Operational Considerations:

The use of commercial booms in open seas have not been very successful because they cannot stand the prevailing conditions. The best results were obtained by the U.S. Navy boom (See Figure 19), but it has the disadvantage of daily maintenance and high manpower requirements.

In open seas an ACTIVE ACTION is more suitable to overcome an oil spill incident. This involves to take the boom to the oil, usually by two vessels, and probably operate as neap as safely possible from the source, in order to concentrate more oil and to save in boom length.

The type of vessel recommended for these operations has to be as large as possible, because of the heavy loads they are going to deal with, such as the big booms for open seas that can weight as much as 20 Kgr per meter, and the usually severe conditions prevailing in that area. To handle these heavy booms a vessel with a lifting gear is required to load, unload or move the boom easily, specially when changes in winds, currents and tides make the necessity for frequent re-adjustments. Also, a wide deck work area is desirable, specially when it is preferable to assemble the boom on-board, on the way to the spill and when the distance from the shore to the incident site is too long, as it is not recommended to do the trip towing the boom, that have been assembled ashore. This allows the response equipment to travel faster and to economize in fuel.

As it was already mentioned, booms can be towed in V, U or J configurations using two vessels (Figure 20). The use of skimmers in such arrangements is necessary for the recovery of the oil contained by the boom, and to release the boom from the excessive loads created by the towing of a greater amount of oil than for
Figure 19
The Navy boom

Figure 20
Towed boom U, V and J configurations

(a) J configuration
towed by two vessels, one of which deploys the recovery device.

(b) V configuration
towed by two vessels – collection device towed with boom array and oil transferred to third vessel.

(c) Single ship system extended with additional vessel towing boom to increase the encounter rate.

(d) U configuration
towed by two vessels at 1–2 knots. Oil escaping behind boom is intercepted by a single ship system.
which it was built.

The towing speed of the tug or work boat must be in accordance with the strength of forces acting against the boom such as currents, wind and waves, in order to obtain the best performance of the operation and recover as much oil as possible.

It has been found that the relative velocity between the work boats and the opposing current should not exceed 0.5 knots (15/), and that the tensile strength needs of such booms must be in the region of 10 tons (16/).

An helicopter or aircraft can provide valuable help in directing the operation and for the aerial surveillance of the spill in order to locate the thicker slicks of oil. In that respect, radio communication between vessels, aircraft and the local controllers ashore is essential for a better response planning and organization. The training of the personnel is also important, because they must know the practical limitations and the necessary maintenance, storage and cleaning procedures of such equipment.

When using booms, the Sector Agencies must have certain precautions such as, the notification of marines about the position of such moored equipment or, of the area in which the towing operation is taking place, and also to display warning lights or flag demarcation.

Sinking of Oil in the Open Seas

The compounds used to sink oil are chemicals in the form of a powder or granular solid. The principle is to make the oil heavier than the water by spraying the solid over it so that the combination forms a compound of a greater density than the water,
making the oil sink.

This powder has certain requirements:

- Has to be oleophilic to get firmly attach to the oil,
- Has to be of high density, so that a minimum amount could be needed,
- Has to be of an adequate particular size in accordance with the oil viscosity.

Number of experiments have been carried out about this method to deal with an oil spill (17/). In laboratory and practical experiences it was found that the use of certain fine dry material distributed from the air was not successful because it was easily carried away by the wind. The best solution proposed is to use a fine sand treated with an oleophilic agent and discharge it mixed with water as a slurry from a vessel through suitable nozzles.

In sea trails carried-out by the Dutch and British governments the results were positive, but with some subsequent difficulties. It was found that after few days some of the sunken oil was rising back to the surface, and that trawling over the area resulted in damage to the fishing equipment and the catch. For this and other reasons, certain recommendations in the use of this method were suggested:

1- Oil should not be sunk where there are strong currents that can move this sunken oil to shore,
2- It should not be applied in areas of trawling purposes,
3- Neither in shellfish beds or fishspawning grounds. 18/
Dispersants are liquids with organic solvents and surface-active products, or SURFACTANTS. These products consist of oleophylic and hydrophylic molecules (amphiphatic nature) that act reducing the oil/water interfacial tension (reducing viscosity), and promoting the formation of finely dispersed oil droplets.

The sea motion distributes the droplets over a large volume of water and the dispersant still acting prevent the COALES-CENCE of these droplets.

Because of various advantages in its application, dispersion is still the most widely method employed in combating oil spills. Some of these advantages are:

- An immediate effective method,
- Produce a larger surface area exposed to the sea, given a higher rate of BIODEGRADATION or DECOMPOSITION of the oil. However, the United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) in its report *Impact of Oil on the Marine Environment* said that, "certain chemical dispersants will inhibit microbial activity."\[19\]
- Tends to inhibit photo-oxidation of oil to toxic peroxides and acids,
- Reduces fire hazard when volatile hydrocarbons are present,
- Reduces the formation of "Chocolate-Mousse",
- Reduces shore pollution,
- Less expensive than shore recovery of oil.

There are two types of dispersants:
A-Hydrocarbon Nature; with 15 to 25% of surfactant agent, not prediluted and with a rate of dilution of 1:3 with sea
water prior to application,
B-Concentrate, Alcohol or Glycol Solvent Nature; with a higher percentage of surfactant and are prediluted with sea water in a proportion of 1:5 to 1:30. This last ones are of low toxicity and can be used concentrated but at the same absolute rate per unit area.

The application of dispersants have certain limitations. If the spilled oil is very viscous or even solid at sea temperature, dispersants are not effective; and, if the oil is light or of low viscosity, they become difficult to disperse. J.W-Smith (1983) indicates that "the limit of effectiveness is between \( 7,000 \) and \( 10,000 \) centistokes", while I.T.O.F. (1982) suggest its application "for oils with viscosities of less than 2,000 cS". As it is appreciated, there is still too much ground to be investigated on the application of dispersants on oil spilled.

The application of dispersants in the open seas depends on:

- Type of dispersant available.
- Type of oil and its viscosity.
- Size and location of the spill.
- Availability of spraying equipment (boats and aircraft).

When using ships, the application will always have serious limitations particularly due to the low treatment rate, the difficulties of locating the thicker slicks, the inevitable spraying of some dispersant on the clean sea, and the insufficient mixing energy provided. The use of an aircraft to control the operation, can ensure that the vessels are located in the heaviest concentration of oil.

The usual method of applying dispersants is by means
of spray pipe lines with nozzles, fitted to the ship sides. The nozzles openings should be of adequate size so that the dispersant droplet size resembles moderate rainfall therefore the pattern is only slightly affected by windy conditions, and the rate of application is varied by altering the speed of the work-boat. See Figure 21.

Ships fitted with the major spraying equipment can, when correctly operated, disperse only about 10 tons of oil per hour per unit, while the use of spraying aircraft ensure a faster application of dispersants needed before the spilled oil changes or come ashore; and also ensure the optimum and best cost-effective use of dispersants. See Figure 22.

Today, the most widely used aircraft is the small single engined crop-spraying aircraft, usually used in farms. Some of its main capabilities for this task are:
- Capable of operating at low altitude,
- Speed between 50 to 150 knots,
- Good manoeuvrability,
- Good capacity, specially necessary for operations in the open seas.

There are two types of devices to control the droplet size; pressure nozzles or rotary devices commercially available. Despite what system is employed, the optimum droplet size is between 600 to 800 micrometers in order to minimize wind drift and possible evaporative losses. The spraying equipment must be resistant to the dispersant damage and prove to dispersant GEL BLOCKAGE.

The rate of application depends on the state, type and thickness of the oil being treated; but some important parameters must be taken into account before their application:

- Distance between the application site and sensitive areas,
Figure 21
Nozzles installation on a ship for the spreading of dispersants

Figure 22
Costs Comparison in the use of ships and aircraft for the spraying of dispersants

<table>
<thead>
<tr>
<th>Spill size (kiloliters)</th>
<th>Cost of dispersant (£'000)</th>
<th>Operating time (radius 100 miles / hours)</th>
<th>Total cost (£'000)</th>
<th>Cost/ton of oil dispersed (£)</th>
<th>Cost/ton with no retainer (£/ton / days)</th>
<th>Total cost (£'000)</th>
<th>Cost/ton of oil dispersed (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>75</td>
<td>10</td>
<td>180</td>
<td>90</td>
<td>40</td>
<td>20</td>
<td>115</td>
</tr>
<tr>
<td>6</td>
<td>225</td>
<td>30</td>
<td>340</td>
<td>64</td>
<td>40</td>
<td>60</td>
<td>345</td>
</tr>
<tr>
<td>10</td>
<td>375</td>
<td>50</td>
<td>500</td>
<td>50</td>
<td>40</td>
<td>100</td>
<td>575</td>
</tr>
</tbody>
</table>

/J.Wardley Smith(1983)page 190 from Warren Spring Laboratory
- Currents direction and strength, and,
- Mixing depths of surface waters.

From an aircraft, the rate of application is calculated from the following formula:

\[ Q = D \times N \times S_w \times E \times R \text{ (liters/second)} \]

\( D \) = distance run-over by the aircraft in one second.
\( N \) = speed in miles per hour.
\( S_w \) = sewath width on the water surface in meters.
\( E \) = average thickness of the oil in millimeters.
\( R \) = ratio of dispersant to oil (manufacturer's instructions).

Ecological Factors:

Both I.T.O.F. (1982) and J.W-Smith (1983) agree that there are "few ecological problems associated with the use of dispersants on high seas", because the high concentrations do not persist for more than few hours. Also it is said, that the potential benefits gained by using them outweigh the possible disadvantages such as the temporary tainting. Furthermore, the GESAMP Group in its report on *The Impact of Oil on the Marine Environment*, conclude that the major effect of the chemical dispersion is the introduction of small dispersed oil droplets in the water column, because, although it is more susceptible to microbial degradation in this form, also "oil become available to other smaller types of marine life in addition to the hydrocarbon-oxidizing bacteria", as nekton and other filter feeders, particularly in the ten-micron range, and in this way get into the Food Chain. We must remember that
although this type of organisms are present in the water in the high seas, their density is not as great and significant as it is near shore areas. Maybe, the only relevant problem of dispersing oil in the open seas is that the finely dispersed droplets become a more widespread contaminant and may cause long-term effects.
4.6.2 ON SHORE LINE.

**Physical Removal on Shore Line**

**SKIMMERS**

For an operation in shallower and more sheltered waters, skimmers must have certain characteristics: they must be a device with light weight so as to be handled by few persons, to operate efficiently in low drawghts and stand the oily debris and trash of all kinds. Trash can enter into the recovery device causing damage, and it can accumulate at the water surface near the unit and prevent oil to pass through the skimmer's oil recovery element, given a low oil recovery rate.

Self propeller skimmers (see Figure 23), although more expensive, can work better in confined areas, particularly where access from the shore is impractical.

The oil can become accumulated due to the influence of wind and sea motion, particularly in places along the coastline, or can be further concentrated with the aid of booms. In such places the skimmers must therefore be deployed. Although skimmers operate unmanned, they need frequent supervision to ensure that enough oil is reaching the collection element; that debris is not obstructing, and that they are positioned in the thicker oil layers.

At marine oil terminals suitable skimmer devices must be available to specifically deal with the type of oil which is usually handled. However, in order to save money and availability of resources, any country, and specially the developing countries must be more interested in purchasing or building versatile types of
skimmers and other equipment.

To give frequent maintenance, inspections and practical tests of the equipment prior and after an incident is essential.

BOOMS

In operations of oil recovery on shorelines is where booms efficient deployment is more necessary. This is due to the fact that booms are not only used in arrangements for the containment and collection of oil, but also for its deflection to recovery points, and for the protection of sensible natural amenities and economically important places and industries; such as National Parks, industrial water intakes, aquaculture water intakes, bird sanctuaries, estuaries, harbours, etc, etc. In that respect, it is important to mention the duty of States not to transfer pollution from one area to another when taking measures to prevent, reduce or control pollution of the marine environment, in a manner that may cause damage to Third Parties.25/

Due care must be given to the mooring arrangements. If currents do not exceed 1.2 m/sec, and if the estuary or delta is not of an exposed type, booms can easily be installed in both sides of the estuary's mouth or in any suitable location upstream and deflect the oil to the sides. Here, currents tend to diminish due to the reduction of the depth of the water and the effect of the friction of the bed on the water passing over it. Suitable skimmers must be deployed in the ends of such booms, in order to ensure an adequate oil recovery rate, which has to be, if not higher, equal to the oil containment rate in order to avoid high tensile strength (more than
Figure 23
Self propeller skimmer

Figure 24
Deployment of booms in both sides of a estuary or river showing the collection areas

5 tons) on the booms arrangements. (See Figure 24). Curtain type
booms with a minimum freeboard of 30 to 45 centimeters and a
draught of 50 cm are recommended. 26/

Assessment of tidal cycle is necessary for the re-adjustments of booms and mooring arrangements.

For protection against oil coming into water intakes
of industries or fish farming, the deployment of a simple permanent
boom system can work satisfactorily. The only parameter to take into
account when installing such a system is wave action. The mooring
lines should be of adequate length to allow booms to rise and fall
due to wave and tidal changes. (See Figure 25). Good results were
also obtained with the use of a double-floating boom system to pro-
tect industrial water intake. See Figure 26. 27/

Good maintenance, adequate storage and cleaning of the
booms after or during an incident is essential.

Application of Dispersants on Shore Line

Experience has shown that the use of dispersants in
shore areas is not very much recommended, because there is normally
a slow dilution rate of the dispersed oil and also because the eco-
systems in those areas are richer in density and variety of organ-
isms. Also, most of these organisms are very delicate to any change
on the environment, and any damage on them may result in greater
ecological imbalance. Maybe the most vulnerable ecosystems are mar-
shes and mangrove swamps which are breeding grounds for crabs,
shrimps and many kind of fishes (28/); and the living ground of many
sedentary species such as clams, oysters and gastropods which are
not able to migrate and whose filtration feeding (29/) make them
Figure 25
Boom fixed installation for the protection of a water intake

/J.Wardley Smith(1983)page 120 from D.E.Newman

Figure 26
Double boom configuration at the entrance of the water intake channel

weak and easily affected organisms by the tiny droplets of dispersed oil.

One important fact to consider is that the use of dispersants should not be more toxic than the oil itself, however, the use of dispersants may affect molluscs and other slow moving species, fish, aquaculture, spawning grounds, nursery grounds, estuaries, etc more than the oil itself. Furthermore, dispersion on a sandy beaches increases penetration of oil into the sand, affecting on a long term the holiday industry on that area. In article 196 of the UN Law of the Sea Convention is implicit the duty of States "not to transform one type of pollution into another". An increasing number of national and international organisations are more aware of the need for further clarification on the pros and cons of dispersant application. In 1979, at the suggestion of the International Petroleum Industry Environmental Conservation Association (IPIECA), which is the petroleum industry organisation in consultative status with UNEP, a Symposium in Brest, France to discuss the use of oil dispersants was held. The conclusions and recommendations approved were published in 1981 as the IMO/UNEP Guidelines on Oil Spill Dispersant Application and Environmental Considerations. 30/

However, since then, progress on the subject has gone far, and the need for a collation of all the new developments is felt. IPIECA and The International Tankers Owners Pollution Federation (ITOPF) proposed to convene a follow-up symposium some time in 1986, for a revision on such guidelines.

4.6.3 AT THE BEACH

Shore contamination is the easiest noticed form of
the marine environment pollutions because it can be seen, smelt, and felt by the general public when spending holidays at the beach. In this sense, shore clean-ups seem to be necessary, whatever the costs and the possible negative effects of such actions. However, ecologists and biologists concern about the probability that those procedures may cause an even greater damage to the shore life, makes this a conflictive and difficult stage of the oil pollution combating.

The extent of the clean-up operations, the use of inappropriate techniques, the inadequate organization of resources and the lack of consultation with experts before a decision is made on the method and extent of the operation, can aggravate the damage caused by the oil itself.

Here is when an ENVIRONMENTAL IMPACT ASSESSMENT of the effect of such operations on the shore life and the ecological equilibrium is necessary. However, a fast and reliable assessment cannot be done immediately, if previously there was not a study of the types of shores, and of the organisms living on or using them for breeding or spawning on both Costa Rican coasts. This is what J.W.-Smith (1983) called "MAPS OF SHORE CLASSIFICATION". See Figure 27.

This can be done by taking advice from specialists and people concerned with tourist and wildlife conservation and research on the diverse areas along the coasts. From the advice, suggestions and recommendations given, a map marked with all important economical, amenity and ecological places, and also the position of the means from access to them should be provided. From this map, a clean-up operation can be organised and developed.

The correct clean-up treatment involves the asking of
many questions:

- What are the short- and long-term effects of a particular type of oil, and how long will it remain on the shore if not treated?
- Which is the ability of a beach to self-clean? This depends greatly on the wave energy impact on different beaches.
- How efficient are different methods and what damage will they do to the shore life?

There are different ways by which the National Response Organisation of a country can find the basis for environmental decision-making:

- Surveys carried-out after an oil spill.
- Long-term monitoring schemes to find the long-term effects of usually small and frequent oil spills. (As may be the case at an oil terminal)
- Field experiments, either by the National Educational Institutions or by the National Oil Company (RECOPE), on oil and cleaning treatments damages on different types of shore.
- Laboratory tests to compare toxicity of different types of oil and dispersants, the sensibility of different organisms to a particular treatment or pollutant, etc.

In practical experiences it has been found that there is no a single and universal method to deal with oil on the shore; this depends on the volume and type of oil spilled and on the different types of shore line which can be affected by it. (32/). However, on occasions the environment will suffer more if an attempt is made to remove the oil rather than if it is left to weather and
natural degradation. There are certain strategy considerations to be taken into account:

- Prevent the oil from moving to uncontaminated parts of the coast by booms.
- If the oil is moving to an environmental sensitive shore, this must be forced to migrate to less sensitive areas.
- Wait until all the oil spilled from a particular incident has come ashore, in order to avoid cleaning the same area more than once.
- Define at which stage the clean-up operations should be concluded. (SHORE CLEAN-UP IMPROVEMENT versus COST)

Physical Removal of Oil from the Beach

SAND BEACHES

Some sand beaches are unable to stand vehicle movement because they sink causing a greater pollution problem as the oil gets deeper mixed into the sand. Then it is better to collect the oily sand with the use of shovels and carry it in heavy duty plastic bags.

When the beach is firm enough, oily sand can be removed by bulldozers or other front-end loaders, and then loaded into lorries. It has been found that this kind of machinery can remove as much as 100 to 200 cubic meters of oily sand per day while a man collects between 1 to 2 cubic meters per day when helped by front-end loaders only in transporting the collected material. The quantity of sand removed must be kept to a minimum, because it can lead to beach erosion.
Big lumps of oil and oily debris can be collected by groups of men (10 men per group) by using horticultural rakes and putting it inside heavy duty-plastic bags. On dry sand beaches, the remaining small modules of oily sand (tarry lumps) can be collected by using beach cleaning machines used on amenity beaches. They consist of a series of vibrating or rotating screens, which retain the lumps and allow the clean sand to drop back to the beach.

ROCKY BEACHES

The cleaning of this kind of shore can only be done manually using buckets, scoops, etc., because usually there is not access for heavy machinery or vehicles, and because it is very difficult and not safely desirable to move heavy equipment and material over rocky terrain. The use of water under high pressure is recommended. 34/

PEBBLE OR SHINGLE BEACHES

These are very difficult to clean, because the oil penetrate into the stones contaminating the deeper layers. One usual way to remove the oil and clean the beach is to push the top layer of the stones into the sea where the abrasive action of the waves rapidly cleans them. This type of beach has been categorized as RELATIVE SELF-CLEANING. 35/

MUDDY SHORES

Salt marshes, mangroves and estuaries, which are some of the most important ecological and sensitive types of shore are classified in this category.

Most researchers strongly recommend that no action should be taken in these places. They only suggest to give protec-
tion to them by the deployment of booms and, when approved, the use of light mechanical equipment (spades and shovels) for manual cleaning. However, especially in estuaries and mangroves, it is important to avoid over-booming too far downstream because the normal tidal cycle will change and the ecosystems affected and damaged.

The short-term effects found on this shores are; trapping of oil, high mortality of invertebrates, defoliation, death of seedlings, and death and injury of birds, but in the long-run, the weathering of oil, and the recolonisation by plants, trees and invertebrates of those grounds, are comparatively quick. 36/

CORALS

Live corals are unlikely to become coated by oil because of their natural defenses and also because they are rarely exposed to the air. However, if it occurs, the best is to leave them undisturbed and allow natural recovery to work as quickly as possible. The only priority is to keep oil away from them by booming because they are affected if the light cycle and the oxygen air/water interchange is altered.

Application of Dispersants on the Beach

SAND BEACHES

Dispersants application in shore environments should only be done after considerable precautions have been taken. First, the oily sand must be treated with the right amount of the dispersant chemical; second, an appropriate time (30 minutes) must be allowed to pass for the dispersant to get mixed with the oil; and last, the treated oily sand must be vigorously mixed with as much sea water as possible from the incoming tide, so as to produce a
diluted dispersion and to reduce the dispersant's toxicity.

Dispersants should not be used if there are commercial fisheries, nature reserves, fresh or sea water intakes, rivers or canals near the site of the operation. These places should be accurately located and marked on the shore classification maps.

Dispersants can be applied from back packs or other agricultural spraying vehicles, but the use of spraying aircraft is not recommended because of the tremendous waste of chemicals on clean sand, and the possible movement of them by the wind to areas which could be damaged. 37/

ROCKY BEACHES

The use of dispersants is not very much recommended because if the surface has a slope, the dispersant will run off before it penetrates into the oil. Nowadays there are dispersants available in a gel state so that it can work on vertical surfaces. Its application can be done from back packs, and then the treated surface must be washed with sea water by a high pressure fire pump.

The method is only recommended if the area has a strong water movement for a rapid dilution, and for rocky shores that form a part of an amenity beach or man made structures subject to constant use. 38/

PEBBLE OR SHINGLE BEACHES

Except in the case of dealing with low viscosity oils, the use of dispersants is not advisable because it tends to carry the oil further into the substrates which will bring unknown long-term effects. It is only recommended for lightly oiled beaches and for final surface cleaning. 39/
* For muddy shores and corals the dispersants are not recommended.40/

**Burning**

As it will be appreciated in section 4.7, the burning of material on the beach is not recommended because it brings air contamination, it is expensive and when wet, oil tar balls and oily debris are difficult to ignited.

Only in certain muddy shores, such as salt marshes, it has been recommended that during summer time the oily dry vegetation can be cut off and burnt in order to avoid further oiling of birds. 41/
4.7. Oil recovered, storage, treatment, and disposal.

In most of the cases, the oil collected will be contaminated and viscous due to the effects of weathering.

Oil collected from the sea will probably be relatively free of solid debris but is likely to contain large amounts of water present as a water-in-oil emulsion ("Chocolate mousse").

In order to make economical use of the temporary storage capacity available, it is desirable to keep the quantity of entrained water to a minimum. This could be achieved by a separation process previous to storage, and then pump out the water.

Oil stranded on the shore may be collected in three main types of waste, and each may require a different method of treatment and disposal:

1- Oil mixed with sand.
   - Recovered liquid oil can be use as fuel or refinery feedstock.
   - Direct disposal.
   - Degradation through land farming or composting.
   - Burning.

2- Oil mixed with wood, plastic or seaweed.
   - Direct disposal.
   - Burning.
   - Degradation through land farming or composting for oil mixed with natural solvents.
3-As solid tar balls.

- Direct disposal.
- Burning.

Temporary storage must be:

- Resistant to puncturing.
- Strong to contain hose connections for filling and for emptying.
- Preferable transported by road, as skid-mounted tanks, road tankers or containers; and either self-powered or towed at sea such as dump bars, floating flexible containers or bags, coastal tankers, etc.

Other means of temporary storage are collapsible tanks made from metal, or plastic panels assembled on situ (as swimming pools). Also pillow tanks capable of holding up to 1 ton of oil made from heavy gauge polyethylene. (See Figure 28). As far as possible, bulk oil should be stored separately from debris so that different methods of treatment and disposal can be followed. Under some circumstances, it may be possible to recover the oil from eventual processing or blending with fuel oil. This should always be the first option to consider. Every country (specially developing ones) must accurately consider the cost involved in the transportation of the contaminated oil as well for the processing or blending in a refinery, also the costs involved in such processes and the possible damage to the equipment used in that recovery, due to the high salt concentration and debris in the recovered oil. The oil should be pumpable, low in solids and have a salt content of less than 0.1% for being processed through a refinery or less than 0.5% for blending into fuel. 42/.
Figure 28
Pillow tank of heavy gauge polyethylene

-Institute of Petroleum (1975) page 69
DISPOSAL PROCESSES.

Direct disposal:

Perhaps the most common disposal route adopted, when recovery of oil is impractical, is dumping it in designated land-filled sites, without porous strata, to avoid the risk of contamination of ground water. For example, when oil and oily debris were deposited in an abandoned gravel pit, it was found that the oil percolated through the strata and threatened a salmon river some distance away. 43/

Co-disposal of oil and domestic waste is often an acceptable method even though degradation of oil is likely to be slow due to the lack of oxygen. 44/. Nevertheless, in the United Kingdom it has been found that, if the oily beach material is uniformly spread over the heaps of garbage covered with a layer of soil every few feet in the refuse tips, it will degrade fairly rapidly. The effectiveness of the system depends on the material being properly spread out and that an adequate amount of soil has been provided.

If such dumps are not available, then sites will have to be found as near to the site of clean-ups as possible.

In the case of shorelines lightly contaminated with oily debris or tar balls, it may be possible to bury the collected material at the back of the beach where vegetation can cover it.

Stabilisation:

This process is specially applicable to oily sand. It binds the material with an inorganic substance such as quicklime (calcium oxide). This forms an inert product which does not allow the oil to leak out. Other materials might also be applicable such
as cement.

The water in the oily material reacts with the quick lime and heats the mixture, thus aiding the mixing process.

J.W-Smith (1983) says that the basic treatment is to mix 7 to 10% of quick lime with the oily beach material while The International Tanker Owners Pollution Federation Ltd. in its Technical Paper #8 (1984) suggest an amount between 5 to 20%.

The mixing can be done by spreading layers on suitable flat ground and mixing mechanically using agricultural machinery (e.g., rotovator). This technique is probably the most cost effective. The stabilised material can be disposed of under less stringent conditions than unstabilised oily sand, and can also be used for land reclamation, road construction and embankments, where there is no requirement for high load-bearing properties.

This method was the most successful in the treatment of such material in Brittany, whose shores have suffered from the Torrey Canyon, Amoco Cadiz and Tanio incidents.

Burning or incineration:

In Brittany this treatment was also used in the disposal of the oily material recovered in the clean-ups but was judged too costly and too slow.

The method usually causes atmospheric pollution. Also, when oil is burnt in the open, it tends to spread and be absorbed into the ground. In addition, a tarry residue may remain since it is rarely possible to achieve complete combustion. These problems can be overcome by using an incinerator. Those used for domestic waste are not suitable since sea water may cause corrosion, and industrial waste incinerators may not have enough capacity to deal with
a large quantity of oily waste. As it could be appreciated, the method is not suitable for the disposal of oily waste because of its slow rate of disposal, the need of incinerators near the clean up site which can stand the sea water corrosion, the negative implications of atmospheric pollution, a tarry residue, and its high cost of operation. An important part of any contingency plan is that temporary storage and disposal routes and sites for oily wastes must be agreed and determined in advance. Locations close to areas of greater risk suitable for temporary storage of oil and oily waste have to be identified. The disposal options should be decided, taking into account environmental considerations of each method and the probable costs of transport and disposal. This places have to be showned in the shore classification maps already mentio-
4.8. Post incident reports & Documentation of clean-up costs.

During the duration of the response operation, the carry out of an accurate and complete recording of all expenses incurred in overcoming the pollution incident is essential. Purchase and use of equipment and material, the employment of manpower, the assessment of damages or lost to the shores, commercial activities and equipment, and all related actions and expenses must be well-documented if a State wants to have a complete compensation coverage.

The preparation of the record forms must be made by the National Response Organisation. The form must be as simple, but comprehensive as possible and must be annexed to the operational plan and distributed to the Sector and Local Agencies, and specifically to the Purchase Officer nominated.

After the termination of the operation, the preparation of a detailed report on the operational experience is important in order to determine the weak points, misunderstandings and confusions, to review the Contingency Plan and make the required adjustments. Furthermore, it is one of the ways by which a National Response Organisation can find the basis for environmental decisions-making.
NOTES:


2- ITOPF, Tech. Inf. Pap. # 1, p.5.

3- Idem, p.6.

4- See chapter 4 section 4.6 part 4.6.1 pages 102 and 109

5- ITOPF, Tech, Inf. Pap. # 1, P.1.

6- CONCAWE, p.16.


9- CONCAWE, p.20.

11-Smith, p. 93.


15-Smith, p. 122.

16-Institute of Petroleum, p. 39.

17-Smith, pp. 173-174.


20-Smith, p. 177.

21-ITOPF, "Use of Oil Spill Dispersants"; in Tech. Inf.-

23-Ibid.

24-Idem, p. 6.

- Smith, pp. 192-193.

- GESAMP, p. 27.


26-ITOPF, Tech. Inf. Pap. # 2, p. 36.

- Smith, pp. 117-118.


29-GESAMP, p. 27.

31-Smith, p. 59.

32-Smith, p. 126.


34-Smith, p. 204.
   -ITOPF, Tech. Inf. Pap. # 7, p. 3.

35-Idem, pp. 5-7.
   -Smith, pp. 214-215.
   -CONCAWE, p. 34.

36-CONCAWE, pp. 42-47.
   -Smith, pp. 70-72, 214, 216.

37-Smith, pp. 210-214.
   -CONCAWE, p. 30.

38-Smith, pp. 215-216.
   -ITOPF, Tech. Inf. Pap. # 7, p. 3.

39-CONCAWE, p. 34.
   -ITOPF, Tech. Inf. Pap. # 7, p. 5.

40-Smith, pp. 214, 216.
41-Smith, p. 214.


43-Idem, p. 6.

44-Smith, p. 225.

45-Ibidem.


-Smith, p. 225.

47-Smith, p. 224.

48-Ibidem.

49-See chapter 5 section 5.3 pages 132 and 133.

50-See chapter 4 section 4.6 part 4.6.3 page 112.
5-RECOVERY OF EXPENDITURES.

5.1-Pollerter Identification:

In the case of an accidental pollution of the seas due to the grounding or collision of a tanker it is very easy to identify the source from which the oil is being or was spilled. However, when a spill has been identified from an aircraft or a vessel, or when oil traces are found ashore and there are no ships, or there are plenty of them in the surrounding from which you can suspect the oil is coming, the situation changes and a more sophisticated procedure is needed to find the real polluter. This is significantly difficult in developing countries, where there is a lack of equipment to carry out an adequate surveillance by air and by sea of their jurisdictional waters. Most of the oil transporting companies are aware of such deficiencies, and they know that it is difficult for a Coastal State to start proceedings against them, "on clear grounds," if one of their tankers has a discharge in contravention with the international acceptable criteria. The interpretation of the results from the laboratory analysis of the samples from the oil spilled, and its match with those obtained from the analysis of the samples from the expected source or sources, is one of the pieces of evidence and sometimes the only one a Government has to claim compensation for the damages and expenses incurred when dealing with such oil spills.1/

5.2-Polluter's Liability

The owner of a tanker is liable for pollution damage caused by an oil spill as a result of an incident. There are few cases where an owner is exempted:
- Act of War: war, hostilities.
- Intentional Act or Omission by Third Party.
- Negligence of a Government: failure to maintain navigational aid.

5.3-Existing Schemes for Cost Recovery

During the mid-sixties, the frequent and increasing oil spill incidents were giving the oil industry a bad reputation among the general public and governments. Maritime Administrations were pressing for tighter legislations in order to improve the situation.

In order to recover the face, the tanker owners decided to establish arrangements for the payment of costs and damages resulting from an oil spill incident, and formed the Tanker Owners Voluntary Agreement Concerning Liability of Oil Spill (TOVALOP), which has been in operation since 1969 and was amended in 1978.

Also, the oil companies have set-up a fund known as CRISTAL Contract Regarding and Interim Supplement to Tanker Liability for Oil Pollution. It has been in effect since 1971 and was amended in 1978; this scheme covers incidents which exceed the limits of TOVALOP, but only if the cargo owner is a member of the FUND Convention.

The Torrey Canyon incident in 1967 made the world aware of the need to set uniform international rules and procedures concerning liability, and an adequate compensation for persons suffering from oil pollution incidents. In 1969, the IMO convened a conference in which the International Convention on Civil Liability for Oil Pollution Damage (CLC) was adopted. The convention lays down
the principle of strict liability, that an owner of a tanker is liable for pollution damage caused from the oil spilled from the tanker. It also provides for a system of compulsory insurance, which obliged an owner of a tanker carrying more than 2,000 tons of cargo oil to ensure his liability under CLC convention through a P&I CLUB whose certificate must be carried on-board.

Furthermore, the conference noted the inadequacy of the CLC scheme to provide full compensation to victims of oil pollution damage, and suggested to IMO to elaborate a draft text of a Convention to offer supplementary compensation. In 1971, a conference held in Brussels adopted the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND).

As it can be appreciated, compensation for oil pollution damage caused by tankers is based in two separate regimes; one relies on International Conventions and the other through voluntary industrial agreements established by the tanker and oil industries. Both consist of two sources of compensation; one is provided by the shipowner through their third party liability insurance through a P&I Club, and the other is provided by the tanker and cargo owners' funds to which they contribute.

In diagrams 29 and 30 these different schemes for cost recovery are simplified; their purpose, scope of application, liability limits, claims procedures, etc.

In respect to the CLC and FUND Conventions it was experienced that they were not adequate for full compensation because their low liability limits, and also the arising of certain problems related to liability of small vessels and the indemnification of shipowners. IMO decided for a revision of these two conventions and convened a Conference in London in 1984, which resulted
<table>
<thead>
<tr>
<th>Civil Liability Convention (CLC)</th>
<th>TOVALOP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PURPOSE</strong></td>
<td>Establishes a uniform international regime under which owners of ships carrying oil in bulk as cargo have strict liability for pollution damage resulting from the escape or discharge of oil including liability for the cost of preventive measures to mitigate such damage. Provides that tanker owners (including bareboat charterers) will compensate persons (including governments) who sustain pollution damage resulting from the escape or discharge of oil (including taking preventive measures to mitigate such damage). Also provides for payment of compensation for costs incurred by any person in taking measures to remove the threat of a discharge of oil, even if no discharge occurs. Basis of liability is strict, as under CLC.</td>
</tr>
<tr>
<td><strong>STATUS</strong></td>
<td>Agreement among tanker owners, in operation since 1969, as amended June 1, 1976.</td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td>Seagoing vessels of any type carrying oil in bulk as cargo. Applies to pollution damage which occurs on the territory or in the territorial sea of a contracting state, regardless of where the spill occurs.</td>
</tr>
<tr>
<td><strong>OILS</strong></td>
<td>Persistent oil, including whale oil (cargo or bunkers) if cargo being carried at time of spill (does not cover vessels in ballast)</td>
</tr>
<tr>
<td><strong>DAMAGES</strong></td>
<td>Loss or damage by oil contamination, including costs of preventive measures and further loss caused by preventive measures.</td>
</tr>
<tr>
<td><strong>LIABILITY LIMITS</strong></td>
<td>$160 per convention ton, not to exceed $16.8 million per incident absent actual fault or privity of owner.</td>
</tr>
<tr>
<td><strong>DEFENSES</strong></td>
<td>War, hostilities. Exceptional natural phenomenon (Act of God). Intentional act or omission by third party. Negligence or wrongdoing by any government (mismaintenance of lights/navigational aids).</td>
</tr>
<tr>
<td><strong>ADMINISTRATION</strong></td>
<td>Government agencies of contracting states.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Civil Liability Convention (CLC)</th>
<th>TOVALOP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FINANCIAL RESPONSIBILITY</strong></td>
<td>Vessels must be certified by a contracting state as having sufficient financial coverage for convention liability. Must be established and maintained to the satisfaction of the Federation.</td>
</tr>
<tr>
<td><strong>CLAIMS PROCEDURE</strong></td>
<td>Actions brought in courts of contracting states. Court determines apportionment and distribution of award. Claim registered with tank vessel owner within one year. If claim disputed, International Chamber of Commerce arbitration.</td>
</tr>
</tbody>
</table>

---

Figure 29  Resume of CLC and TOVALOP schemes of recovery

/Skuld P&I club(1983)pages 26 and 27
<table>
<thead>
<tr>
<th><strong>Fund Convention</strong></th>
<th><strong>CRISTAL</strong>*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PURPOSE</strong></td>
<td>Supplements CLC to assure adequate compensation to parties suffering pollution damage. Also indemnifies tanker owners for part of their liability under CLC.</td>
</tr>
<tr>
<td><strong>PURPOSE</strong></td>
<td>Supplements CLC, TOVALOP or other sources of compensation to assure adequate compensation to parties suffering pollution damage. Also applies in the case of threat removal. Also indemnifies tanker owners for part of their liability under CLC, TOVALOP, or national or local law.</td>
</tr>
<tr>
<td><strong>STATUS</strong></td>
<td>International treaty in force since October 16, 1978.</td>
</tr>
<tr>
<td><strong>STATUS</strong></td>
<td>Agreement among cargo owners in effect since 1971, as amended June 1, 1978.</td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td>Contracting states' territory and territorial seas, although discharge may have occurred elsewhere. * *</td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td>Territory or territorial seas of any state, although discharge may have occurred elsewhere. Tanker must be owned (or bareboat chartered) to a party to TOVALOP.</td>
</tr>
<tr>
<td><strong>OILS</strong></td>
<td>Persistent hydrocarbon mineral oils whether carried as cargo or bunkers, provided ship is carrying oil in bulk as cargo.</td>
</tr>
<tr>
<td><strong>OILS</strong></td>
<td>Same as the Fund Convention.</td>
</tr>
<tr>
<td><strong>CONDITIONS</strong></td>
<td>A party to the Fund Convention must also be a party to CLC. Flag state must be a party to the Fund Convention in order for shipowner to be paid indemnity.</td>
</tr>
<tr>
<td><strong>CONDITIONS</strong></td>
<td>Oil must be owned or «deemed» owned by a party to CRISTAL. Tanker involved in incident must be enrolled in TOVALOP. Circumstances such that CLC imposes liability on tanker or would have done so if it had been applicable.</td>
</tr>
<tr>
<td><strong>DAMAGES</strong></td>
<td>Pollution damage not adequately compensated under CLC because of: — no CLC liability; — financial incapacity of the vessel owner; — damages exceed CLC limits.</td>
</tr>
<tr>
<td><strong>DAMAGES</strong></td>
<td>Pollution damage not otherwise recoverable from tanker owner or any other source.</td>
</tr>
<tr>
<td><strong>METHOD OF FUNDING</strong></td>
<td>Contributions by crude and fuel oil cargo receivers in contracting states. Individual contributions assessed pro rata on amount of crude and fuel oil received in contracting states which has been transported by sea.</td>
</tr>
<tr>
<td><strong>METHOD OF FUNDING</strong></td>
<td>Contributions by parties to CRISTAL. Individual contributions assessed pro rata based on amount of crude and fuel oil received by parties to CRISTAP, which has been transported by sea.</td>
</tr>
</tbody>
</table>

| **FUND LIABILITY** | Maximum $54 million aggregate with CLC compensation, if any. Can be increased up to $72 million by the Assembly of the Fund. Indemnifies owner for CLC liability over $120 per convention ton or $10 million, whichever is less, but not in excess of $150 per convention ton or $16.8 million, whichever is less. |
| **FUND LIABILITY** | Maximum $36 million aggregate with all other sources of compensation, if any. Can be increased up to $72 million by the Institute. Indemnifies owner for liability under any other legal regime than CLC in excess of $160 per convention ton or $16.8 million, whichever is less. |
| **DEFENSES OF FUND** | War, hostilities. No proof of ship-source spillage. Intentional or negligent act of claimant. |
| **DEFENSES OF FUND** | War, hostilities. Exceptional natural phenomenon. Intentional act or omission by third party. Negligence of governments. Intentional or negligent act of claimant. |
| **ADMINISTRATION** | Fund Convention Secretariat, Executive Committee and Assembly (latter comprising representatives of all contracting states). |
| **ADMINISTRATION** | Oil Companies Institute for Marine Pollution Compensation LimitedDirectors. |
| **CLAIMS PROCEDURE** | Brought against the Fund Convention in court of contracting states in which damage occurred. |
| **CLAIMS PROCEDURE** | Direct application to the Institute. |

* The Information contained in the column under «CRISTAL» was provided by Oil Companies Institute for Marine Pollution Compensation (OCIMF.) ** The limits in the Convention are specified in gold Poincaré francs (pending the entry into force of the 1976 Protocol to the Convention, which replaces gold Poincaré francs by Special Drawing Rights as defined by the International Monetary Fund), but are, for convenience, expressed above in roughly equivalent figures in U.S. dollars. The limits in the TOVALOP agreement are specified in U.S. dollars. *** Corrected from original IMCO document. 

Figure 30 Resume of FUND and CRISTAL schemes of recovery

/Skuld P&I club(1983)pages 28 and 29
in the approval of two Protocols whose main amendments are:

-The geographical scope of the application was extended to the EEZ, due primarily to the new UNCLOS provisions (1982).

-A new concept of minimum liability for owners of small vessels under CLC was introduced. For a ship below 5,000 tons, a fixed liability of 3 million of Special Drawing Rights (SDR).

-For ships between 5,000 and 14,000 units of tonnage, the limit is 3 million SDR plus US$438 for each additional unit of tonnage over 5,000.

-For ships above 14,000 tons, the limit of liability is set at 59.7 million SDR.

-The maximum compensation payable by the IOPC Fund is raised from 45 million SDR to 135, and an automatic increase to 200 million SDR if total quantity of oil received by contributors in member states exceeds 600 million tons.

-Abolition of the shipowners indemnification payable under Fund. This was done because of the new balance of liability between shipping and oil interests under this protocol.

-Simplified procedures for the amendment of limits under both conventions.

-Both conventions now cover spills from unladen tankers. Pure threat removal measures will be covered to the extent that they are taken to prevent pollution damage. (The removal of a wreck for safety of navigation).

In a hypothetical study made by Edgar Gold, involving a major marine pollution incident in the Malacca/Singapore Strait (2/), the realistic problem of most developing Coastal States for an "effective and satisfactory damage quantification" after an oil
spill incident was pointed out. The problem is specially found in matters such as quantification of costs of manual clean-up of shores, the value of activities such as general coastal fisheries, shrimp fishery, sea weed, aquaculture and shellfish; also the assessment of long-term damage to regional fisheries, the losses of the tourism activity and the subsequent social problems.

Any Coastal State must provide realistic data of the losses, damage and expenses incurred in any incident, well backed-up by statistical and scientific criteria to the compensation schemes and insurers concerned, when claiming compensation; because, damage which is not quantifiable on clear grounds will not be compensated.

The oil and tanker industries had also established various other organisations, each dealing with a particular interest. They usually set parameters for inter-governmental activity by their own initiatives, to improve safety, minimise pollution and develop efficient clean-up and compensation procedures.

Some are mentioned and briefly described below:

(IADC) = International Association of Drilling Contractors
- Concerned with interests of onshore and offshore drilling contractors.
- Members are oil and gas producing companies.
- Promote the protection of environment and safety standards.

(INTERTANKO) = International Association of Independent Tanker Owners
- Members are only independent tanker owners.
- Involved in market research.
- Involved in tanker, port and charter information.
- Promote marine safety and clean seas.
- Look after members' interests.

(IPIECA)=International Petroleum Industry Environmental Conservation Association
- Members are oil companies and related organisations.
- Act as focal point of communication and consultation between the petroleum industry and the UNEP and other governmental bodies on the impact of petroleum operations on the environment.

(ITOPF)=Tanker Owners Pollution Federation Limited
- Administer TOVALOP.
- Provide technical advise on cases of oil spills.
- Conduct post-spill surveys.
- Provide consultancy services on Contingency Planning

(OCIMF)=Oil Companies International Marine Forum
- Members are oil companies transporting, loading and discharging crude oil and oil products.
- Concerned with the safe conduct of operations and protection of the marine environment.
- Represents its members in various organisations.
- Conduct research programmes on oil transport and oil terminals.

(E&P FORUM)=Oil Industry International Exploration and Production Forum
- Association of oil companies interested in offshore oil exploration and exploitation.
Concerned with safety standards and protection of environment.

Represents its members on matters related to exploration and drilling for crude oil and natural gas, their production, treatment, storage and pipeline transport.

In the following chart the main areas of activity and the role of the already mentioned organisations related to such activities are summarised.

5.4 Polluter Insurance

When a vessel is insured by one of the recognised P&I Clubs, has cover its liabilities, expenses, including fines, for oil pollution damage up to a limit of US $ 300 million per incident. However, owners and insurers shall obviously always seek to limit the liability in accordance with the applicable law at the time of the incident. This is why every government must be aware of the developments on international law related to compensation, and establish contact with the appropriate representatives of the P&I clubs before and during an incident.
Figure 3:1
Resume of main areas of activity of inter-governmental and industrial organisations

Main areas of activity

<table>
<thead>
<tr>
<th>Function</th>
<th>What is involved</th>
<th>Who is involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution Prevention</td>
<td>☐ Identification of causes of accidents  ☐ Design and equipment of oil tanker and offshore rigs/installations  ☐ Development of techniques to prevent operational pollution  ☐ Training of personnel</td>
<td>Governmental ☐ IMO  ☐ UNEP  ☐ Individual Governments Industry ☐ IADC  ☐ INTERTANKO  ☐ ICS -  ☐ IPIECA  ☐ OCIMF  ☐ E &amp; P Forum  ☐ Individual Companies</td>
</tr>
<tr>
<td>Contingency Planning</td>
<td>☐ Evaluation of risk of spill  ☐ Decision on priorities of protection  ☐ Development of response capability  ☐ Establishment of structure for immediate action</td>
<td>Governmental ☐ IMO  ☐ UNEP  ☐ Individual Governments Industry ☐ IPIECA  ☐ ITOPF  ☐ OCIMF  ☐ E &amp; P Forum  ☐ Regional Industry Co-operatives  ☐ Individual Companies</td>
</tr>
<tr>
<td>Response to Spills</td>
<td>☐ Stopping pollution at source  ☐ Implementation of contingency plan  ☐ Clean-up  ☐ Disposal of oil and debris</td>
<td>Governmental ☐ Individual Governments Industry ☐ ITOPF  ☐ P &amp; I Clubs  ☐ Regional Industry Co-operatives  ☐ Individual Companies and Contractors</td>
</tr>
<tr>
<td>Compensation</td>
<td>☐ Compensation for clean-up costs and pollution damage</td>
<td>Governmental ☐ IMO  ☐ IOPC Fund  ☐ Individual Governments Industry ☐ ITOPF (TOVALOP)  ☐ OPOL  ☐ CRISTAL  ☐ P &amp; I Clubs</td>
</tr>
</tbody>
</table>
NOTES:

1- See chapter 4 section 4.5 page 92.


Almost always in a family, there are between its members certain patterns of behaviour that are repeated since the early times of humanity from one family to another, such as the conduct of the small and weak members trying to imitate the good and bad acts that are being done or that have been done by those big and experienced ones, without first analysing the today's possible negative results these acts can bring, not only to themselves or their relatives, but also to their neighborhood. This may be due to their lack of experience, ignorance of behaviour norms or due to the fact that the big and experienced members do not teach or advice them on what things must and must not be done, and which is the best way to do them.

These patterns of conduct are also experimented in the World Community in which some regional families of countries are composed by new and inexperienced members, who have never tried to learn their lesson from the old and developed members, who have grown up making mistakes, correcting them and once again trying to find new and suitable ways of resolving their immediate and long-term challenges and problems.

This has been the case of the POLLUTION problem, not only the pollution of the oceans which is a subject of relatively new international concern, but we are also talking about pollution of many other environments which are still today unresolved.

Today countries such as the United States, Mexico, England, etc, are feeling the effects of its past, mad, industrial and agricultural progress. They are now spending great amounts of money and hours of investigation in order to clean rivers and seas, to re-
duce smog and noise in cities and towns, and they are trying to change the anti-conservation mentality of their people, which is in my belief the most difficult task. This concern has grown with the passage of the years, through which they have faced the problems of the past instability, damage or loss of those, once considered vulnerable or useless, natural ecosystems.

We, as developing countries, must learn from these facts and try to make efforts so that they will never happen in our territories and regions, but, until today this is by far the case. We can blame our inexperience or our weak economic and political situation, but the real malefactors are more complicated. We may find the cause in the actual world industrialisation trend from north to south. Most of our small countries are now being crazily, but economically recommended, industrialized. As the Director General of the Organization of Eastern Caribbean States, Dr. Vaughan Lewis said,

"ON THE BASIS OF THE RESOURCES AND OBJECTIVES OF FOREIGN INVESTORS" 1/

Although with the knowledge that the "OBJECTIVES" of foreign investors are not towards a wise and prudent progress of our Nations, we are "hands tied", because not only our consciousness of the needs of our people for jobs, positions and self achievement of their educational and economic goals, but also due to the lack of wise, futurist and conservationist thinking and decision making of our politicians and governors.

There must be a balance on this ambivalence and a variety of interests, and it is our task to try to find it by pressing, helping and researching towards the minimization of pollution.
without interfering or impeding the industrial development.

We, as humans will never ever predict or avoid natural disasters such as hurricanes, volcanic eruptions and earthquakes. Maybe neither the failure of equipment or the mistakes made by the men on-board a ship, which can lead to undesirable operational or catastrophic accidental pollution incidents on our waters. However, we can prevent or diminish the operational pollution incidents, which are, as it has already been explained and proved, the real malefactor of the shipping pollution source, by tightening the laws and rules of our Maritime Legislation, without affecting the normal trade and economic balance. This readjustment of our legislation might be done by acceding and implementing the provisions of those IMO, ILO and UNEP International Conventions, after an exhaustive study and discussion from our government and industry on the possible economical, financial, social and political effects of such action in our trade, industry and development.

Such decision, if taken, must be accompanied and backed-up by adequate enforcement procedures, which are the only way to make the aims of such Conventions for safer and cleaner seas evident and functional. Here, I am talking about the duty of Flag States to conduct severe and frequent surveys on the design, construction, equipment and manning of their ships, and provide better and modern training of seafarers. Beside this, seafarers must enjoy safer, juster and better working and living standards and conditions, and to inculcate on them the importance of an early and without request, warning to the immediate Coastal State or States, of the occurrence of a spill of a harmful substance into the sea. Also, I am talking about the duties of Coastal and Port States for better demarcation of sea lanes in the immediate approaches of ports or in congested straits, of a more severe and organised con-
control and inspection of ships when navigating or when voluntarily at port and of a better and amplified surveillance and detection of unlawful discharges.

All these enforcement provisions are necessary and essential for the prevention of marine pollution, but they also involve complexity and expenses for any Maritime Administration, and specially for a country with a new historical and small maritime activity such as Costa Rica.

However, despite all these PRECAUTIONS and MEASURES taken, spectacular accidental pollution incidents still occur, and are, as natural disasters, unpredictable. We have known or heard about incidents such as the Amoco Cadiz and Torrey Canyon oil pollution disaster cases, experienced by old traditional and developed maritime nations such as England and France, with high safety and pollution prevention standards.

From these and other undesirable cases has grown the world wide need in every country and region to prepare and established an Oil Contingency Planning. The preparation of such a plan and the subsequent gathering of human and material resources is difficult to achieve, but it must be done as efficiently and quickly as possible, because oil spill incidents do not wait for plans.

In that sense, developing countries such as ours, must seek the expertise and financial help for the preparation and development of our Contingency Plan, from International Governamental and Industrial Organizations such as IMO, UNEP, ITOPF, etc, through their programmes on technical assistance and training. However, due to our economic situation and the actual priority areas for government and industry investment, we will never be able to cope by ourselves with a major oil spill occurrence in our waters. This is why
we have felt and see the logical need, and the economical and func­tional advantages of a neighborhood unification against such inci­dents, through regional cooperation arrangements such as the one settled for the Caribbean Region, which in our believe, must be extended to the Pacific as well, using the same aims and statements for a joint plan that furthermore will enhance our National Respon­se capability and those of our neighbors.

In my belief this is the most suitable and the best cost-effective way to deal with oil pollution incidents and any kind of pollution incident, but I also know that it is a difficult and delicate situation because our disunion and the actual politi­cal instable situation of the Central American and Caribbean Region.

I know that any Contingency Plan is infallible and that there may be errors in its appraisal or development, but it is more important to start with the resources available due to the imminent risk of an oil pollution incident. I have learned that there is no a universal method or system and equipment to deal with an oil spill with a hundred per cent of success because the best approach to the problem depends on the specific situation, location, type of pollutant and the prevailing weather and sea conditions. I also know that most of the equipment and materials which deal with the recovery and containment of oil have been designed, built and tested in other areas of the world where conditions are completely different from those prevailing in our territories, and that it may be a waste of money and time to try to apply them to a local or regional situation. What we must do is to learn and research on the basis of the findings, investigations and mistakes of the advanced developed countries, and start developing our own means and techni­ques to deal with pollution by oil or other harmful substances, not
only at a scientific level but also in a legal and socio-economic approach, by pressing on an ecological, wise and prudent process of industrial development of our Nations for safer and cleaner working and living environments.

As it has been proved in the research paper, the main concern on oil pollution damage is the damage to amenity sites along the coasts, the immediate direct damage to fisheries and aquaculture sites and other important maritime commercial and socio-economic activities of a country. However, I think it could be interesting to point out here the findings of a series of experiments on the subsequent effects on the marine environment of an oil spill incident:

a- Organisms truly accumulate, but rapidly lose petroleum hydrocarbons,
b- Non-existent interference in the food chain,
c- That if affected, organisms have the capacity to regenerate and repopulate quickly the affected sites, and,
d- That rarely the damage has persisted for more than a year. 2/

I am in complete disaccordance with the last statement, because I have found that oil persist in sensible areas as estuaries and affect certain economic activities as fisheries and aquaculture sites for longer periods of time. In Figure 32 it is summarised the effects and the approximated time of persistance of oil on different types of shore. It could be appreciated that oil can persist as long as 10 years on certain kinds of shore such as marshes and estuaries. 3/

From these and before mentioned facts, I may suggest that, although accidental pollution incidents affect greatly any
# Figure 32

**Index of Vulnerability of different types of shore and the period of persistency of oil.**

<table>
<thead>
<tr>
<th>Index</th>
<th>Morphosedimentary types</th>
<th>Accumulation of oil</th>
<th>Duration/Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rocky coasts &amp; platforms of abrasion</td>
<td>Upper part of the strand</td>
<td>Some months</td>
</tr>
<tr>
<td>2</td>
<td>Beaches of coarse sand at medium</td>
<td>Interstratification in sediment, Slow migration in deep</td>
<td>1-2 years</td>
</tr>
<tr>
<td>3</td>
<td>Beaches of coarse sand at gravel</td>
<td>Interstratification in sediment, Quick migration in deep</td>
<td>1-3 years</td>
</tr>
<tr>
<td>4</td>
<td>Beaches of pebbles, stones and field of blocks</td>
<td>Quick migration of oil in deep, less or any deposit on surface</td>
<td>3-5 years</td>
</tr>
<tr>
<td>5</td>
<td>Rocky coasts</td>
<td>Accumulation of oil in the crevices of rocks, Recovered rocks of a thin film</td>
<td>3-5 years</td>
</tr>
<tr>
<td>6</td>
<td>Beaches of thin sand at medium</td>
<td>Percolation in deep, Pollution of the subtidal zone by tides (mixture of oil and thin sediments), Formation in surface of a hard stratum after 1 year</td>
<td>5 years</td>
</tr>
<tr>
<td>7</td>
<td>Beaches of course sand at gravel</td>
<td>Quick percolation in deep, Formation of hard stratum after one year</td>
<td>5 years</td>
</tr>
<tr>
<td>8</td>
<td>Beaches of pebbles</td>
<td>Quick percolation in deep till substratum, Formation of crust of pebbles &amp; oil after one year</td>
<td>5 years</td>
</tr>
<tr>
<td>9</td>
<td>Estuaries &amp; &quot;tidal flat&quot; at muddy</td>
<td>Percolation in deep due to burrowing organisms &amp; water movement</td>
<td>10 years</td>
</tr>
<tr>
<td>10</td>
<td>Maritime marshes</td>
<td>Encrusted in surface, Migration in sediment</td>
<td>10 years</td>
</tr>
</tbody>
</table>

Coastal State and that there must be a prepared plan of action against them; the permanent and localized pollution by small quantities of maybe stronger substances than oil, coming from the effluents of factories, plants and industries in inland or coastal areas, truly affect considerably more the marine environment than one isolated oil spill incident; and due care must be given to that fact by any Administration.

In that sense and on the basis of my research, I strongly recommend our Government, industry and research institutions to:

- Start an ecological and conservationist education in our Educational Institutions, and on our industry,
- Reinforce National Laws concerning the dumping of wastes from land based industries and plants,
- Implement and enforce the International Accepted Provisions that can strengthen our imminent Coastal State position, and that may guarantee the complete compensation coverage for damages and expenses incurred due to an oil spill incident,
- Foment the environmental impact assessment of major coastal projects,
- Set up the procedures for an action in the high seas,
- Foment the cleaning of cities, rivers and beaches,
- Identify the sea lanes of loaded tankers, tankers in ballast, passenger and cargo ships. Make the pertinent changes and re-adjustments of them and provide adequate safety demarcation precautions, especially in the approaches of ports and in heavy traffic areas,
- Identify and record the types, quantities and frequency of oil and other harmful substances transported and handled
through our waters,

- Carry out an extensive study on our coasts. Localize their risky, sensible and economic priority areas, and make up-dated coastal charts where those areas must be clearly and accurately marked, the means of access to them, and the public and private resources and disposal sites in their immediate vicinity.

- Make an inventory of the resources available,

- Purchase all suitable and required equipment and material, within our financial possibilities; and when possible, purchase equipment that could be employed in other tasks if not used in a pollution cleaning operation,

- Determine the key areas along our coasts for the strategic and protective location and storage of this equipment and materials,

- Promote and finance practical use and deployment of the equipment,

- Provide training to personal in other countries in the region with greater experience in oil pollution aspects, such as Venezuela and Brazil,

- Arrange contracts beforehand with immediate suppliers of equipment and material, and with clean-up Multinational Contractors,

- Create a fund to deal with accidental disasters involving harmful substances,

- Provide an accurate and permanent communication network between risky, ecological and important economic sites with the responsible agencies, suppliers of resources, and with the National Response Organization. The network will not only serve oil pollution incidents but also other accidental or
natural disasters that may occur within our territory,
- Put aside political differences and work together against pollution as a unified family,
- Provide for the necessary points of contact with other National Response Agencies of neighbor countries and with Inter-Governamental Organizations and Industrial Agreements, in order to seek for technical advice and resources aids,
- Set up the customs clearance procedure beforehand, for people and resources that are going to be employed in the combat of an oil spill. The procedure must provide a smooth transit of those resources,
- Provide ports with better communication and surveillance equipment for an efficient control of ships navigating through our waters, and decide on more severe port state procedures for inspection of foreign ships when calling at our ports,

I know that there are still many things that must be clarified and studied on the subject which have escaped my appraisal. In closing I hope that this research paper may be of benefit and interest for somebody as it was for me. Also, I want to mentioned now some phrases said by various persons, which resume the aim of the today efforts against marine environment pollution:

"ONE MAN'S WASTE CAN BE ANOTHER MAN'S POISON" 4/

"WE HAVE NOT INHERITED THE EARTH FROM OUR FATHERS, WE ARE BORROWING IT FROM OUR CHILDREN" 5/

"TODAY WE ARE ALMOST TWO AND A HALF MILLION COSTARI-CANS, BUT THERE ARE SO MANY MORE TO COME."
NOTES:

1- Vaughan Lewis, in his opening remarks as Director of the Organization of Eastern Caribbean States, in the IMO/OAS/UNEP Government Experts Meeting on Sub-Regional Oil Spill Contingency Planning for the Island States and Territories of the Wider Caribbean Region, Saint Lucia, 7-11 May 1984, p. 2, annex 2.


4- Idem, p. 256.

5- Words said by Lester Brown, cited by David L. Black in his statements as the OAS representative in the IMO/OAS/UNEP Government Experts Meeting on Sub-Regional Oil Spill Contingency Planning for the Island States and Territories of the Wider Caribbean Region, Saint Lucia, 7-11 May 1984, p. 2, Annex 4.
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7-Department of International Economic and Social Affairs. 1982


