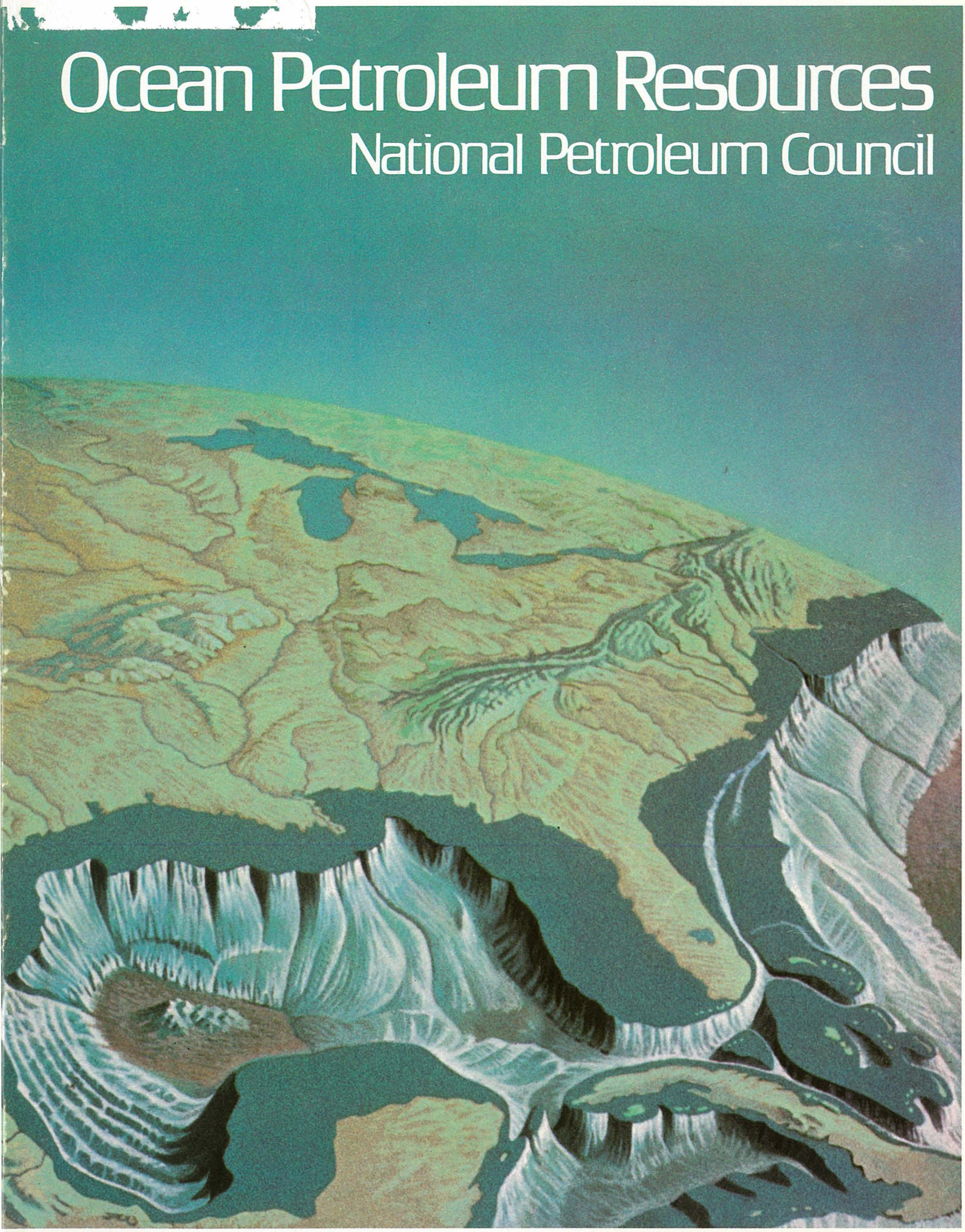
Ocean Petroleum Resources

National Petroleum Council



OCEAN PETROLEUM RESOURCES

Report of the
National Petroleum Council

March 1975

Prepared by the
National Petroleum Council's
Committee on Ocean Petroleum Resources, Wilton E. Scott--Chairman
Coordinating Subcommittee, Cecil J. Olmstead--Chairman

NATIONAL PETROLEUM COUNCIL

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Industry Advisory Council
to the

U.S. DEPARTMENT OF THE INTERIOR

Rogers C. B. Morton, *Secretary*
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PREFACE

In May of 1946, the President stated in a letter to the Secretary of the Interior that he had been impressed by the contribution made through government-industry cooperation to the success of the World War II petroleum program. He felt that it would be a good idea if this close relationship were to be continued and suggested that the Secretary of the Interior establish an industry organization to advise the Secretary on oil and gas matters.

Pursuant to this request, the National Petroleum Council was established on June 18, 1946, by Secretary of the Interior J. A. Krug.

The purpose of the National Petroleum Council is solely to advise, inform, and make recommendations to the Secretary of the Interior on any matter relating to petroleum or the petroleum industry.

Matters which the Secretary of the Interior would like to see considered by the Council are submitted as a request in the form of a letter outlining the nature and scope of the study. The Council reserves the right to decide whether or not it will consider any matter referred to it.

The Council is subject to the provisions of the Federal Advisory Committee Act of 1972. It does not concern itself with trade practices, nor engage in any of the usual trade association activities.

Members of the National Petroleum Council are appointed for one-year terms each fiscal year by the Secretary of the Interior. Membership is drawn from all segments of the petroleum and natural gas industries and from other segments of the Nation which are vitally interested in oil and gas matters. The Council is supported entirely by the voluntary contributions received from its members.

The Council is headed by a Chairman and Vice Chairman, who are members of the Council. The Secretary of the Interior serves as Government Cochairman with the Assistant Secretary of the Interior for Energy and Minerals designated to serve in his absence. The Council staff is administrated by an Executive Director appointed by the Chairman of the Council.

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INTRODUCTION

THE STUDY ASSIGNMENT

By letter dated January 9, 1974, addressed to Mr. H. A. True, Jr., Chairman of the National Petroleum Council, Assistant Secretary of the Department of the Interior, Stephen A. Wakefield, requested the Council to undertake a further study and report on matters relating to the Law of the Sea (see Request Letter, Appendix A). This is the fourth in a series of study requests from the Department of the Interior regarding ocean petroleum resources and related matters.* In his January 9, 1974 letter, Mr. Wakefield wrote:

> In view of the decision of the United Nations General Assembly to convene a Third Law of the Sea Conference and to assist the Department of the Interior in the further preparation for it, the National Petroleum Council is requested to study and report further on several key matters which will constitute important parts of a comprehensive treaty dealing with Law of the Sea.

In the context of the present dependence of the United States on imported petroleum and the need to reduce that dependence, Mr. Wakefield stated:

> Since it clearly appears that accelerated petroleum exploration and producing activities on the seabed will be essential to meeting requirements for energy, it would be particularly helpful for the NPC to concentrate on the state of technology and the potential for offshore oil discovery and operations in the seabed under deep water around the globe. At the same time, the Department would appreciate receiving the views of the NPC regarding international minimum standards to govern safety and pollution control of such offshore operations.

In addition, the Council was asked in preparing the study to consider:

- Design and construction and operating standards for petroleum carrier vessels to ensure safety of operation and minimization of pollution hazards.

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* Earlier NPC reports dealing with this subject are: *Petroleum Resources Under the Ocean Floor*, March 1969; *Petroleum Resources Under the Ocean Floor--A Supplemental Report*, March 1971; *Law of the Sea*, May 1973; and, *Ocean Petroleum Resources--An Interim Report*, July 1974.

- Methods and institutional arrangements for formulating and bringing into effect international standards for seabed petroleum production and vessel transport of petroleum.

- The Inter-Governmental Maritime Consultative Organization (IMCO) treaties as to their adequacy in eliminating pollutants from the sea and the interrelationship of IMCO competence and its potential future role in a broader Law of the Sea organization.

- Other views on any matters which may be found relevant.

In conclusion, Mr. Wakefield asked for an early response to his request letter in view of the fact that the first substantive session of the Third Law of the Sea Conference was scheduled to begin on June 20, 1974 in Caracas, Venezuela.

THE STUDY GROUP

Mr. True, then the Council's Chairman, referred this new study request to the Council's Committee on Ocean Petroleum Resources under the chairmanship of Mr. Wilton E. Scott, President, Tenneco, Inc. The Secretary of the Interior, Hon. Rogers C.B. Morton, is the Government Cochairman of the Committee.

A Coordinating Subcommittee and four task groups were organized to assist the Committee in carrying out the assignment (see Committee Rosters, Appendix B). These were:

- Coordinating Subcommittee, Cecil J. Olmstead, Chairman.

- Offshore Exploration and Production Task Group, John E. Sherborne, Chairman (succeeded by Robert I. Levorsen).

- Ocean Tankers and Deepwater Port Facilities Task Group, Capt. Billy E. Smith, Chairman.

- Finance and Economics Task Group, Richard E. Faggioli, Chairman (succeeded by John N. Garrett).

- Legal Task Group, Northcutt Ely, Chairman.

INTERIM REPORT (JULY 1974)

The Coordinating Subcommittee and its task groups commenced a thorough study on a number of priority matters in order that, at least, preliminary views would be available to the Department of the Interior and other government agencies at an early date. On an "urgency" basis an interim report was prepared and published under the title *Ocean Petroleum Resources--An Interim Report of the National Petroleum Council*, July 4, 1974. The report was submitted to the Secretary of the Interior Morton and distributed to

the United States Delegation to the Third Law of the Sea Conference in Caracas, Venezuela, other government agencies and the general public.

RECENT UNITED NATIONS DEVELOPMENT

Background

Since 1967, the United Nations has been dealing with the subject of peaceful uses of the seabed and oceans. It established a Committee on the Peaceful Uses of the Seabed and Ocean Floor Beyond the Limits of National Jurisdiction which was later charged by the General Assembly with the preparation for a Conference on the Law of the Sea to encompass virtually all areas of the oceans and the seabeds and with their uses.

CARACAS CONFERENCE

The first substantive session of that Conference was held in Caracas, Venezuela, from June 20, 1974 until August 29, 1974, and it failed to reach agreement on any of the major issues on the agenda. On the other hand, the positions of groupings of countries respecting some of the major issues were clarified and thus are better understood by participating states. A brief review of where the Caracas session left major issues affecting the petroleum interests may be useful.

Territorial Sea and Straits

Except for a few countries, there was broad agreement supporting a 12 nautical mile territorial sea. Freedom of passage through straits used for international navigation remains a critical issue. Extension of the territorial sea to 12 nautical miles would have the effect of including many straits important to navigation within the territorial seas of straits states and thus under the sovereignty of such states unless otherwise agreed in the Convention. Maritime powers strongly urged that continued unimpeded transit be assured through both international straits and archipelagic waters.

Economic Zone

At Caracas a broad consensus of states emerged in favor of a 200 nautical mile exclusive economic zone offshore the coastal state. The precise nature of this zone has not been seriously considered by the Conference and can be expected to raise fundamental differences among states. Expected differences will range from a few states demanding that this area be considered territorial sea and thus under coastal state sovereignty, to others favoring that the waters of the zone remain high seas with its traditional freedoms.

The United States along with a rather large group of states favor a middle position under which the coastal state would have exclusive rights regarding seabed mineral resources and priority for exploitation of fisheries. The superjacent waters of the area would retain their character as high seas for navigation and overflight and the right to lay submarine cables and pipelines would also be retained. Measures to protect the area from pollution, both from vessels and mineral development, remains a difficult matter for resolution. The United States also favors the applicability of international standards and disputes settlement procedures to investment and contractual relations concerned with mineral resource development in the area. Such a position should accommodate the fundamental interests and needs of all coastal states.

Continental Margin Seaward of Economic Zone

A rather large group of states favors coastal state jurisdiction over seabed mineral resource development to the seaward edge of the submerged continent, i.e., to the margin of the continent extending beyond the proposed 200 nautical mile economic zone. The United States has stated support for such a position if other elements of its position on the coastal state economic zone were to be accepted. Land-locked and shelf-locked states have, as expected, opposed any extension of coastal state jurisdiction beyond 200 nautical miles. Assuming the acceptance of mineral resource jurisdiction to the continental margin, difficult issues remain as to the method of determining the limit of the margin.

Seabed Seaward of National Jurisdiction

During the Caracas Session of the Conference, the subject of an international regime seaward of national jurisdiction was a major controversial issue. This resulted in a more precise formulation of differing positions between groupings of states than occurred respecting any other subject. The group of developing countries, referred to as the Group of 77 (numbering now some 106), advanced a position which would establish an international seabed resource authority to control exploitation of deep ocean seabed mineral resources, including actual participation by the authority in mining operations. Any role under this view for the private enterprise approach of the industrial countries would be limited to service contracts or production sharing arrangements or possibly joint ventures in which the authority would hold a major interest and exercise control. Generally speaking, the industrially developed countries favor a system under which private enterprise would have equal access to the area and which would promote competition by precluding price-fixing and production control arrangements.

Environmental Protection

Little formal work or progress occurred in the area of environmental protection, although general positions of some types of states

are rather well known. Coastal states continue to be seriously concerned about the danger of pollution from vessels in broad areas off their coasts. Maritime states are equally concerned that if broad coastal state jurisdiction over such pollution were to be provided for in the Convention, freedom of navigation would be seriously impaired with economic harm resulting to all. These maritime states favor internationally agreed standards for vessel design and construction, safety of navigation including traffic separation patterns, and operational discharge. They would also resist convention provisions establishing broad zones offshore coastal states within which such states would be authorized to exercise enforcement jurisdiction respecting pollution.

Disputes Settlement

While the subject of international compulsory settlement of disputes involving ocean uses did not formally occupy the Conference, an informal group of some 35 countries met during the Conference to consider such essential matters as alternative institutions and procedures which might be utilized, types of disputes to be subjected to the procedures as well as parties that would have access thereto.

If a new regime for ocean space and its uses is to be a regime of law and justice, it is fundamental that the regime include procedures and institutions for the settlement of disputes which would be independent of states and the proposed international seabed resource authority for the area beyond national jurisdiction. Private users of ocean space as well as governments and international organizations should have access to the same procedures and institutions.

SCOPE AND PURPOSE OF THIS REPORT

This report is not intended to supersede the National Petroleum Council's earlier reports dealing with ocean petroleum resources. Rather, it treats matters respecting ocean petroleum resources and the Law of the Sea within the context of the Third United Nations Conference on Law of the Sea, the next session of which is scheduled to convene March 17, 1975.

During the seven years in which the National Petroleum Council has been engaged in the study of petroleum resources of the ocean seabed and other uses of the ocean related to petroleum, the world energy outlook has undergone profound change. From a position of apparently adequate and low cost of petroleum supply in the second half of the 1960's, major consuming nations, including the United States, today face serious uncertainties as to the reliability of future supply from foreign sources. At the same time, sudden escalation in the cost of petroleum supplied by the exporting nations has exacerbated both the energy and general economic problems of consumers.

These changes, among others, have stimulated concern and introduced a note of urgency in efforts to discover and develop new unconventional energy sources and also new sources of supply of conventional fuels. New sources of petroleum from the seabed are in the vanguard of those efforts.

The matter of accelerated exploitation of petroleum ocean resources raises questions internationally as to the jurisdiction over areas of the seabed, the technological capacity available for finding and producing oil under deeper waters, the economics of petroleum production from the ocean floor under deeper waters, the need for economical marine transportation, the protection of the marine environment, the stability and integrity of investments, the capability of conducting exploration and production in harmony with other uses of ocean space and settlement of dispute procedures and institutions.

These and other questions are discussed in this report.

Note: Throughout this report, water depths are expressed in meters and well depths are expressed in feet. The accepted conversion rate is 1 meter equals 3.28 feet. Also, 1 kilometer (km) equals 0.62 statute miles and 1 nautical mile equals 6,080 feet or 1.15 statute miles. The term petroleum refers to the following: hydrocarbons, crude oil, natural gas and liquids extracted from natural gas.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The National Petroleum Council, having given careful consideration and study to the letter from the Secretary of the Department of the Interior, dated January 9, 1974 (Appendix A) and to the status of the negotiations respecting the Third United Nations Conference on the Law of the Sea, has reached the following conclusions and recommendations which are drawn from this report, *Ocean Petroleum Resources*:

Offshore Exploration and Production of Petroleum

1. The frontier areas of the continental shelf and slope offshore the United States have the potential for arresting and possibly reversing the current decline in U.S. petroleum production and thus should be subjected to an accelerated leasing and developmental program.

2. While this report is unable to estimate the petroleum potential of specific areas of the offshore continental shelf and continental slope, it is believed that there is good potential for petroleum accumulation in the seabed of the shelf and slope areas.

3. During recent years, great progress has been made in offshore exploration and production technology in a wide variety of operational conditions and industry has demonstrated its ability to extend its operating capabilities at a rapid rate.

4. Costs for exploring, developing and producing petroleum from seabed areas will increase markedly with water depth and climatic severity and to a lesser degree as distance from shore increases.

   --Seabed petroleum resources are likely to be economic under many combinations of reservoir size, water depth and climate.

   --As governmental financial exactions, such as royalties and taxes, are increased, the economics of seabed petroleum production deteriorate rapidly, particularly for smaller reservoirs, deeper water and more severe climatic conditions.

Jurisdiction and Regime Over Ocean Mineral Resources

5. The National Petroleum Council repeats its previous recommendation that:

   A new Law of the Sea Convention should confirm the exclusive jurisdiction of the coastal state

over the exploration and production of seabed mineral resources throughout the natural prolongation of its land areas into and under the sea.

6. The most logical guide to determining the limit of this natural prolongation of the land areas of the coastal state, and thus the boundary between areas of coastal state jurisdiction and international jurisdiction over mineral resources, is the base of the continental (or insular) slope.

7. Because it is often difficult to define the base of the slope precisely enough for it to serve as a boundary itself, it is recommended that the base of the slope be used principally as a guide to the boundary and that the exact jurisdictional boundary be drawn within a boundary zone of an agreed reasonable width extending seaward from the base of the slope.

8. Seaward of the territorial sea, in the area referred to as the coastal state 200 nautical mile resource zone, the exclusive jurisdiction of the coastal state should be limited to economic interests and should entail no territorial interests as such.

9. The superjacent waters of the area referred to in 8, above, should continue to retain their character as high seas for freedom of navigation and the adjacent coastal state should have no jurisdiction over vessels exercising high seas freedoms in such waters except in limited emergency circumstances.

10. It is of the greatest importance that a Law of the Sea Convention provide that an agreement between a coastal state and a foreign investor or operator for exploration and development of ocean petroleum resources in the area referred to in 8, above, be binding upon the parties according to their terms and for the period specified in the agreement.

11. The National Petroleum Council reiterates its view that any lawful uses of ocean space must be conducted compatibly and with due regard for other lawful uses in the area.

12. A dispute between a foreign investor or operator and a coastal state, party to the Convention, regarding mineral resource exploration or production in the area referred to in 8, above, should be resolved under the disputes settlement procedures included in the Convention.

13. Any international seabed resource authority established pursuant to a new Law of the Sea Convention to be concerned with seabed mineral resource development beyond areas under national jurisdiction should be organizationally simple. The provisions governing its establishment and

operations should provide adequately against discriminatory and arbitrary actions.

14. Access to the seabed mineral resources beyond national jurisdiction should be available without discrimination under the Convention to all technically and financially qualified organizations including private companies or groups of such companies as well as to states which ratify the Convention; the authority referred to in 13, above, should not be empowered to enter into exploration and production activities, directly or indirectly.

15. Convention provisions and regulations pursuant thereto governing the development of seabed mineral resources should be designed to encourage development with due concern for the environment. Agreements including those with private parties for exploration and production of such resources should provide the operator with an exclusive right in a defined area for a specified term of years and be binding upon the parties.

16. A private company entering into agreement with the authority for deep ocean mining should be sponsored by a state with which it has substantial connections and that state should provide assurances to the authority that such company is financially and technically competent to perform under the agreement.

Marine Transportation

17. Merchant vessels engaging in mere transit through straits used for international navigation must enjoy a right of unimpeded passage provided such vessels in transit are in compliance with internationally agreed safety standards, including ship design and construction and pollution prevention provisions, and internationally agreed standards designed to accommodate other uses in the area.

18. The right of merchant vessels engaging in mere transit should be generally applicable in territorial waters subject of course to the compliance of those vessels with the same standards as those applicable to such vessels in straits used for international navigation.

19. In waters seaward of the territorial sea including those of the area in which the coastal state exercises limited resource jurisdiction, the present character of the waters as high seas must be preserved with continued freedom of navigation.

20. Coastal and strait states should be authorized by the Convention to take reasonable enforcement action of a civil nature with respect to vessels not in compliance with internationally agreed "Rules of the Road" and traffic

routing schemes in limited areas in the waters adjacent to their coasts. The Law of the Sea Convention should establish the responsibility of coastal and strait states, supplementary of course to the basic jurisdiction of the flag state, to enforce the internationally agreed navigation standards. The interests of all states in freedom of navigation, however, require that prompt procedures be agreed upon so as to permit the immediate release of a vessel upon provision of appropriate guarantees to comply with a properly adjudicated order enforcing such internationally agreed standards. In the view of the National Petroleum Council, such disputes should be settled in accordance with the dispute settlement procedures to be provided for in the Law of the Sea Convention. And in a case in which it is found under those procedures that a coastal or strait state, in exercising this limited enforcement jurisdiction against a vessel, acted arbitrarily or without reasonable cause, the vessel owner or cargo owner would be entitled to damages for any injury resulting from such exercise.

21. Whatever general provisions of a Law of the Sea Convention might be adopted regarding the status of archipelagic waters, the right of navigation as described herein should be applicable to merchant shipping transiting such waters. This transit would only involve movement through the archipelago for the purpose of reaching points beyond.

Protection of the Marine Environment

22. It is estimated that the total amount of oil pollutants introduced into the oceans amounts to only 0.2 of 1 percent of worldwide daily petroleum consumption; over half of this total results from land-based activities, about a third originates from vessels and only 1 percent is caused by offshore producing activities.

23. A new Law of the Sea Convention should include provisions for the protection of the marine environment which would express broad policies and principles rather than detailed technical specification.

24. The marine environment should be protected by provisions of the Convention establishing procedures and an institution for reaching international agreement on standards respecting vessel source pollution; these standards should cover ship design and construction, equipment, navigational safety,operational and accidental pollution, and pollution liability and damage compensation.

25. Coastal states including those bordering straits located where natural conditions may present particular marine environmental problems should proceed according to the procedures and through the established convention institu-

tion to reach international agreement on special international standards to assure environmental protection where such conditions are found to obtain.

26. Because of its competence and broad experience in dealing successfully with vessel source marine pollution matters, a new Law of the Sea Convention should confirm the Inter-Governmental Maritime Consultative Organization (IMCO) as the institution responsible for establishing standards regarding international marine pollution protection.

27. Enforcement of internationally agreed vessel design, construction and equipment standards should remain the primary responsibility of the flag state supplemented by limited port state authority in accordance with the 1973 IMCO Convention for the Prevention of Pollution from Ships.

28. Emergency coastal state action taken to prevent or mitigate pollution of its coastlines in connection with a maritime casualty involving a vessel registered in another state should always be reasonable and nondiscriminatory. Seaward of the territorial sea, in situations involving maritime casualties resulting in imminent danger of major harmful pollution damage to the coastline of a coastal state, authority for such emergency action by that state in accordance with the 1969 IMCO Intervention Convention, as amended, should be confirmed.

29. Internationally agreed operational discharge standards should be enforced by a combination of flag and port state measures, recognizing the right of a coastal state to take reasonable emergency enforcement action of a nonpunitive nature against foreign flag vessels when a risk of substantial damage to its coastline or other economic interests subject to its territorial jurisdiction arises from an operational discharge alleged to be in violation of the internationally agreed standards.

30. Unresolved differences among states or between states and private parties (other than between a vessel and its flag state) arising out of any action taken or not taken by a state to enforce internationally agreed standards should be adjudicated by means of the disputes settlement procedure provided for in the Convention. In this regard, a vessel owner should have a direct right of action for damages against a state other than the flag state of its vessel for arbitrary interference with vessel operations or other abuses of enforcement jurisdiction in violation of the Convention.

31. Minimum internationally agreed operational safety and environmental standards should be formulated for drilling rigs and platforms and for offshore deepwater petroleum terminals in the form of capabilities to perform under given weather and climate conditions.

32. Jurisdiction to enforce all safety and environmental standards applicable to offshore facilities which are fixed and operating should be confirmed in the coastal state or other authorizing body.

Settlement of Disputes

33. The National Petroleum Council strongly urges that the U.S. Government in the Law of the Sea Conference continue to maintain its position that a convention must provide procedures and institutions for peaceful, compulsory and impartial settlement of all disputes arising under the Convention, rules and regulations pursuant to it, and under general principles of international law, including those disputes involving private parties. Such procedures and institutions are fundamental characteristics of an orderly society, whether domestic or international. If disputes involving uses of ocean space are not subject to compulsory, peaceful and impartial settlement with accepted legal standards as a basis for decision, grave threats to international peace may well develop.

34. The Convention should establish a Disputes Settlement Center to deal with disputes involving a private party including those disputes arising out of arrangements between a private party and a state or the international authority for exploitation of seabed minerals and disputes concerning a vessel, its owner or the owner of its cargo and a state or an international organization.

35. In resolving such disputes as those referred to in 34, above, the Disputes Settlement Center should resort progressively to mediation, conciliation and arbitration. In case of disputes resolved by arbitration, the award should be binding upon the parties and not appealable to any other court or body.

Chapter One

OFFSHORE EXPLORATION AND PRODUCTION OF PETROLEUM

OFFSHORE PETROLEUM RESOURCES

U.S. offshore petroleum production provides over one-sixth of all domestic production today and it should be increasingly important in the years ahead. Thus, U.S. offshore oil and natural gas activities are of critical consequence to this country.

Most of the continental shelf and adjacent continental slope off the United States has not yet been leased or drilled. Large sedimentary basins have been identified which may contain significant amounts of petroleum. These offshore, frontier areas have the potential for arresting and possibly reversing the current decline in total U.S. petroleum production. Vigorous programs of leasing, exploration and development will be required to evaluate and realize this potential.

Worldwide offshore exploration and producing activities are now expanding at a faster rate than are such U.S. offshore activities because of the greater availability of frontier acreage and active leasing programs in certain foreign areas.

Production

At the time of the first report by the National Petroleum Council in 1969 entitled, *Petroleum Resources Under the Ocean Floor,* U.S. offshore petroleum production came from only four offshore areas, namely, offshore Louisiana, Texas and California, and the Cook Inlet of Alaska. No new producing areas have been added and crude oil production from these four areas has increased only from 1.4 million barrels per day (MMB/D) in 1969 to 1.6 MMB/D in 1973. During the same period, natural gas production from these offshore areas has increased from 2.8 to 3.9 trillion cubic feet per year (TCF/Yr.). Table 1 indicates that in 1973, petroleum production from these four areas constituted 17 percent of U.S. total production. It is interesting to note that the energy equivalent of natural gas production of the United States during 1973 amounted to 10.7 MMB/D of crude oil and for offshore natural gas production was equivalent to 1.8 MMB/D.* Both these amounts are slightly greater than oil and condensate production.

World crude oil production offshore has expanded from 6.2 MMB/D, or 15 percent of total production of 41.7 MMB/D in 1969 to 10.4 MMB/D, or 18 percent of total production of 56.7 MMB/D in 1973.† New offshore discoveries are being continually announced

* This relationship is based on thermal values of 5.8 million British Thermal Units (BTU's) per barrel of crude oil and 1,000 BTU's per cubic foot of natural gas.

† Offshore, Wideworld Drilling and Production Report, June 20, 1971 and June 20, 1974 (includes production from some nonoceanic areas such as Lake Maracaibo) and U.S. Bureau of Mines data.

TABLE 1

PETROLEUM PRODUCTION – 1973

	Oil and Condensate (MMB/D)	Natural Gas (TCF/Yr.)
U.S. Offshore		
Louisiana	1.2	3.6
Texas	< .1	< .2
California	.2	.1
Alaska	.2	.1
Total Offshore	1.7	4.0
Total U.S.	**9.2**	**22.6**
Offshore to Total Ratio	17.4%	17.3%

Source: U.S. Geological Survey, Outer Continental Shelf Statistics, June 1974, pp. 81-82.

in many areas around the world (such as the North Sea, the Java Sea, off western Africa and off Brazil). It is expected that new offshore petroleum production will more than make up for the natural declines in older offshore fields for many years to come. If these trends keep up, world offshore petroleum production is expected to increase significantly in the future, both in absolute volumes and in percentage of total production as well.

Offshore Discovered Petroleum Resources

The amount of producible offshore petroleum already discovered consists of past production plus remaining proved reserves. Published estimates for the United States and the world are shown in Table 2.

Undiscovered Offshore Petroleum Resources

In recent years, offshore exploration has undergone a very rapid increase around the world wherever the opportunity for acquiring production rights exists and, at last count, there were 78 active marine seismic crews. The quantity of offshore geophysical data obtained in the last five years is staggering as it amounts to many millions of miles of survey.

As a result of this expanded effort, some continental shelves have been sufficiently surveyed by geophysical tools and have had enough drilling carried out so that the extent, thickness and, to some degree, the nature of their sediments are known. For much of the world, however, detailed knowledge of the sediments of the continental shelves and continental slopes still remains very meager and even less is known about the sediments beyond the continental

TABLE 2

OFFSHORE PETROLEUM RESOURCES DISCOVERED AS OF JANUARY 1, 1973

	Petroleum Liquids (Billion Bbls.)		Natural Gas (TCF)	
	United States*	World†	United States*	World‡
Cumulative Production	5.4	36.8	23.1	NA
Proved Reserves	7.6	135.5	48.0	490.8
Discovered Resources	**13.0**	**172.3**	**71.1**	**NA**

*U.S. Geological Survey, Press Release, March 26, 1974.

†U.S. Geological Survey, *The Worldwide Search for Petroleum Offshore – A Status Report for the Quarter Century, 1947-72,* Circular 694, p. 17. (Includes offshore production and reserves from some nonoceanic areas.)

‡"Middle East and Offshore Oil Reserves," *Offshore Magazine,* June 20, 1974, p. 85. (Includes offshore reserves from some nonoceanic areas.) These data are current as of January 1, 1974.

margins. Furthermore, there still is no reliable way of determining that a commercial accumulation exists within a particular sedimentary section without drilling into the accumulation and testing it. Thus, it is impossible to determine the amounts of producible petroleum remaining to be discovered from various portions of the world's subsea, even though it is considered likely that large amounts of undiscovered petroleum exist.

Distribution of Offshore Petroleum Resources

In view of the many unknowns regarding undiscovered petroleum resources, the National Petroleum Council feels that any attempt at this time to estimate the subsea petroleum resources within the various potential seabed jurisdictional boundaries which will be under consideration during sessions of the Third United Nations Conference on the Law of the Sea would provide only speculative estimates of little real value. This is believed to be the case even though many well-informed experts are of the strong opinion that substantial accumulations of petroleum remain to be discovered under the ocean floor in many areas of the world.

The development of a range of estimates showing relative percentages of the total amount ultimately to be found and produced from under various parts of the oceans is much less subject to differing views than is an estimate of actual recoverable resources. Furthermore, the development of such a range of estimates serves continually to remind those concerned that (1) neither the total amount of petroleum present under the oceans nor its location has been established and (2) the amounts which will be found and produced are even less certain.

Percentage distribution estimates are included in Table 3 and Figure 1. These estimates relate to the distribution of ultimate

TABLE 3

ESTIMATED RANGE OF PERCENTAGE DISTRIBUTION OF POTENTIAL, ULTIMATELY RECOVERABLE PETROLEUM WITHIN VARIOUS BOUNDARIES
(Offshore)

	Percent	
	United States	World
Within 12 nautical miles of shore	10 - 25	5 - 20
Shoreward of 200 meters water depth	55 - 70	55 - 70
Shoreward of 200 nautical miles	75 - 94	80 - 95
Seaward of 200 nautical miles to the base of the continental slope*	5 - 11	3 - 10
Shoreward of base of the continental (or insular) slope*	86 - 99	90 - 98
Between the base of the continental slope* and the seaward edge of the rise	1 - 12	2 - 8
Shoreward of the seaward edge of the rise	98 - 100	98 - 100
Seaward of the rise	0 - 2	0 - 2

*See discussion under "Extent of Coastal State Jurisdiction," Chapter Two.

recoverable petroleum, including the already discovered resources, and are only concerned with marine offshore petroleum resources under the oceans and semi-enclosed seas. The assumptions which have gone into these estimates are:

- Technology will continue to be developed, making it possible to produce petroleum resources under increasingly greater water depths and in increasingly hostile environments.

- Exploration and production of petroleum will be authorized and encouraged under all parts of the ocean on an orderly, progressive basis, with respect for contractual obligations and integrity of investment.

- Sufficient economic incentive to justify monetary investment in ocean petroleum resource exploration and production will always exist.

As indicated in Table 3 and Figure 1, 55 to 70 percent, or over half of the United States and world offshore petroleum resources are estimated to lie under water depths of less than 200 meters. Furthermore, most of these resources are expected to lie shoreward of the base of the continental (or insular) slope; between 86 and 99 percent in the case of the United States and 90 to 98 percent for the world as a whole.

As much as 14 percent of the petroleum resources offshore the United States may exist beyond the base of the continental (or insular) slope; as much as 10 percent for the world as a whole. In

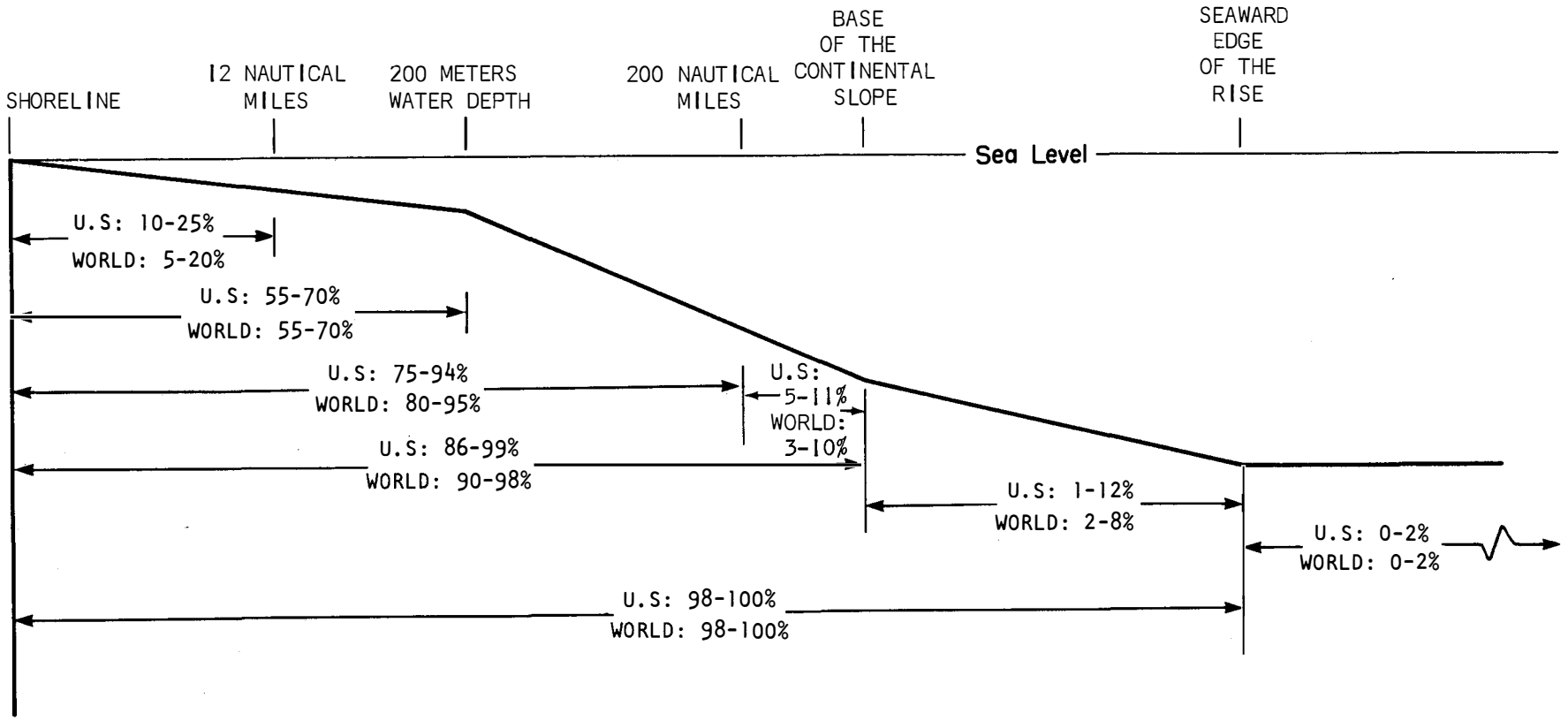

Figure 1. Estimated Range of Percentage Distribution of Potential Ultimately Recoverable Petroleum Within Various Boundaries Offshore. (Boundaries are Described in Table 3.)

both cases, however, the minimum percentage of total producible petroleum to be found is estimated to be very small, i.e., 1 percent and 2 percent, respectively. Beyond the rise, out in the deep ocean, as much as 2 percent of all offshore petroleum resources may ultimately be found.

Differences between United States and world estimates occur in several of the ranges shown. The reasons for these differences are geographic and/or geologic, not economic or political.

OCEAN EXPLORATION AND PRODUCTION TECHNOLOGY

In the six years since the Council's 1969 report entitled, *Petroleum Resources Under the Ocean Floor*, much progress has been made in offshore exploration and production technology. Substantial, active and growing offshore petroleum industries now exist on all continents except Antarctica. Offshore construction, operating and support facilities have been established in many parts of the world. In addition to the larger organizations involved, numerous smaller, specialized and highly technically oriented enterprises have also been established. As a result, there is a very large worldwide base of technical expertise and competence.

This progress in technology has been made over a wide spectrum of operating conditions. More important, industry has demonstrated the ability to continue to extend its operational capabilities at a rapid rate. New developments appear to be imminent in several areas of drilling and production technology.

Petroleum search and recovery operations fall into a number of phases. First, geological and geophysical surveys are conducted to identify areas favorable for accumulation of hydrocarbons in the earth's sedimentary rock strata. Next, in order to determine the actual presence of oil or gas, exploratory wells must be drilled and tested. Offshore drilling equipment used for exploratory wells is moved frequently and hence typically is mounted on a ship or other movable structure. A number of development wells must then be drilled to provide oil and gas from a discovered reservoir; these are typically drilled from fixed platforms which also serve as sites for the installation of production equipment. Production equipment includes devices to control and measure fluids produced, vessels to separate gas from the hydrocarbon liquids and treaters to remove water and impurities. Storage tanks and pumping or compressing facilities must also be provided.

Present and prospective technological capabilities in various phases of offshore operations are briefly discussed in the following sections. For convenient reference, Table 4 presents a summary of present and projected water depth drilling and production capabilities for various U.S. offshore areas.

GEOPHYSICAL EXPLORATION TECHNOLOGY

Since 1969, a great many developments have occurred in offshore geophysical exploration technology. These include continuing

TABLE 4

PRESENT AND FUTURE WATER DEPTH CAPABILITIES AND EARLIEST DATES FOR EXPLORATION DRILLING AND PRODUCTION FOR UNITED STATES OUTER CONTINENTAL SHELF AREAS

Area/Province	Maximum Water Depth Capabilities		Earliest Date	
	Exploration Drilling*	Production	Exploration Drilling	Production†
1. North Atlantic	At present, jack-ups 300 - 350 feet. Drillships and semi-submersibles 1,000 - 1,500 feet. Dynamically positioned drillships 2,500 - 3,000 feet. In the future, forecast capabilities up to 6,000 feet by 1980.	At present, fixed platforms 600 feet. Under water completions (UWC) 1,200 - 1,500 feet. In the future, platform capability 1,000 feet by 1979 - 1980. UWC 3,000 feet by 1978 - 1980.	Now	Fixed 24 well platform in 600 feet ready for production 4 to 5 years after field discovery and delineation. Pipelines or barges required for production.
2. Middle Atlantic	Same as North Atlantic	At present, fixed platforms 800 feet. UWC 1,200 - 1,500 feet. In the future, platform capability 1,000 feet by 1979 - 1980. UWC 3,000 feet by 1979 - 1980.	Now	Same as North Atlantic
3. South Atlantic	Same as North Atlantic	Same as Middle Atlantic	Now	Same as North Atlantic
4. East Gulf 5. Central Gulf 6. West Gulf	Same as North Atlantic	At present, fixed platforms 1,000 feet. UWC 1,200 - 1,500 feet. In the future, UWC 3,000 feet by 1978 - 1980.	Now	At present, fixed 24 well platform in 400 feet ready for production 3 to 4 years after field discovery and delineation. Fixed 40 well platform in 1,000 feet ready for production 6 to 8 years after field discovery and delineation. In the future, production from UWC in 1,000 - 3,000 feet by mid-1980's. Because of special treating facilities required, sour (H_2S) hydrocarbon production in Area 4 may add 1 to 2 years.
7. Southern Cal. Borderland 8. Santa Barbara 9. North & Central Cal. 10. Washington - Oregon	Same as North Atlantic	For Areas 7 and 8, same as Gulf of Mexico. For Areas 9 and 10, same as North Atlantic.	Now	For Areas 7 and 8, same as Gulf of Mexico. For Areas 9 and 10, same as North Atlantic. Earthquake zones require special surveys and engineering considerations.
11. Cook Inlet 12. Southern Aleutian Shelf 13. Gulf of Alaska 14. Bristol Bay S. of 55° Lat.	Jack-ups 300 - 350 feet. Drillships and semi-submersibles 1,200 - 1,500 feet.	Platforms 600 feet for ice-free areas. For seasonal ice areas such as Bristol Bay and Lower Cook Inlet, platforms to 200 feet feasible.	Now	At present, fixed 24 well platform for ice-free areas in 600 feet ready for production 4 ½ to 6 years after field discovery and delineation; in 200 feet ready for production 4 to 5 years. Earthquake zones require special surveys and engineering considerations that could cause delays. Satellite UWC could extend depth 100 - 200 feet in most areas. In the future, production in ice-free areas in 1,500 feet feasible 1980 - 1985. Production in seasonal ice areas beyond 200 feet feasible 1980 - 1985.
15. Bristol Bay N. of 55° Lat. 16. Bering Sea Shelf 17. Beaufort Sea 18. Chukchi Sea	Jack-ups 300 - 350 feet. Drillships and semi-submersibles 1,200 - 1,500 feet during ice-free periods. Gravel islands and island-type structures 50 feet. Land-fast ice (as in Kotzebue Sound) may be drilled. Conventional offshore rigs not useable in areas of heavy moving ice. Anticipate that current R & D projects such as ice-breaking drillships will extend present capabilities.	Gravel islands and island-type structures 50 feet. Concrete or steel cone structures may be feasible to 200 feet. Drillship capability may permit UWC if latter can be designed for potential bottom ice conditions.	Now, selectively, with some modifications to existing equipment for specific areas	At present, production from gravel islands and island-type structures 4 to 5 years after field discovery and delineation, provided development drilling from same island as exploration drilling. In the future, development cycle periods for deeper water dependent on current R & D. Additional overland pipelines required for moving petroleum to southern ports, since the pipeline presently under construction will be fully used by projected North Slope production forecasted from current discoveries. Earthquake zones require special surveys and engineering considerations.

* All jack-up rigs derated from indicated maximum water depth capability during severe weather seasons.

† "Ready for production" assumes all development wells drilled before initial production; one rig per platform. Development period related to number of wells, drilling depth, drilling conditions. Number of wells not limited to examples given.

refinements in nondynamite energy sources used in seismic surveying, equipment used in picking up and recording reflected energy, and equipment and procedures used in processing the recorded energy by computers. These refinements have improved the quality of data available for determining possible locations of petroleum reservoirs. Also, the use of nondynamite energy sources provides added protection to the marine environment.

Another significant development has been the specialized recording and processing which has allowed the relative amplitude of certain reflections to be measured. Those with high amplitude are often called "bright spots." Some high amplitude reflections are associated with shallow gas accumulations, though many have other origins. Furthermore, while some of these gas accumulations are potentially commercial, many are too thin to justify development. Unfortunately, oil accumulations are usually not good generators of high amplitude reflections.

OFFSHORE DRILLING AND PRODUCTION TECHNOLOGY

The Joint Oceanographic Institutes Deep Earth Sampling Group (JOIDES) * has conducted research exploratory drilling in the deep ocean for the purpose of sampling the crust and oceanic sediments in water depths to 6,243 meters. One hole was reentered at a water depth of 3,939 meters. A second hole, in 1,841 meters water depth, was reentered nine times, and a third hole was drilled to 4,310 feet penetration below the seabed in 4,549 meters water depth. Reentry is accomplished by sonar techniques, with targets located on an ocean floor base from which conductor casing is suspended.

At the end of 1974, the JOIDES program had drilled more than 500 holes on 359 deepwater sites. The current program will terminate in August 1975, but a new research drilling program called International Phase of Ocean Drilling (IPOD) will continue this activity under the sponsorship of the National Science Foundation in cooperation with several other nations including the Soviet Union.

The IPOD program during its first phase plans oceanic crustal drilling involving the setting and cementing of up to 1,000 feet of surface casing where needed. A later phase involves research drilling into the continental margin and requires development of capability to set and cement protective casing and uses a "riser" system in water depth of more than 3,000 meters.

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* *Note:* JOIDES is funded within the context of the National Science Foundation's Ocean Sediment Coring Program by means of a contract with the University of California. The Scripps Institution of Oceanography is the manager of the project. The participating institutions are: Lamont-Doherty Geological Observatory; Institute of Marine Science; University of Washington; Woods Hole Oceanographic Institution and the Rosenstiel School of Marine and Atmospheric Science, University of Miami.

Petroleum exploration and development drilling operations, in addition to reentry capability, require a means of controlling well pressure and assuring the return of the drilling mud or other fluids to the drilling rig. This is accomplished by means of a tubular connection between the rig and the ocean floor called a "riser." Drill pipe runs through the riser into the well bore and drilling mud returns from the well bore to the rig through the riser. Pressure control lines for remote operation of blowout preventers at the ocean floor are an integral part of the riser. The risers must be kept in tension to compensate for wave and current forces along with mud weight loading and other forces which can induce undesirable stresses and cause buckling. Conventional devices can be employed for this purpose to water depths of about 300 to 450 meters. Below this depth, buoyant sections must be used to reduce stress in the riser and other parts of the systems.

Significant improvement in the development of riser systems has occurred during the past six years. One system is currently being used operationally in about 650 meters depth. This system has a water depth capability of more than 1,000 meters. Riser systems capable of use in up to 1,800 meters water depths are on order and are currently being designed. There would appear to be no water depth limitation on riser system design and use.

Blowout preventers and control systems have been designed and tested for use in water depths of about 3,000 meters. Mobile drilling vessel positioning systems have also been significantly improved. Mooring systems for use in water 1,000 meters deep have been designed. Dynamic positioning utilizing horizontal thrusters permits precise continuing location of the drilling vessel without the use of anchors regardless of water depth. Water depth is therefore limited only by subsea equipment. Ability to dynamically position drilling vessels in waters deeper than 6,000 meters has been demonstrated.

Platforms

Conventional or fixed platforms offer the best solution to offshore development drilling and producing operations where water depths and climatic conditions permit their use. Although platforms have not yet been installed in water depths exceeding 150 meters, engineering and planning have been completed for installations intended for water depths of over 300 meters and a 950 foot platform is now being fabricated for installation in 260 meters water depth offshore California. Current technology suggests that fixed platforms could be employed in waters as deep as 450 meters. Other types of structures are being designed or tested for greater water depths. Among these is the buoyant or bottom-anchored platform, sometimes called the "tension leg" platform. One design has been tested in Europe, and another of somewhat different design will soon be tested offshore California.

Other variations include the so-called articulated design and the guyed tower. These appear to be technically feasible for use

in water depths up to 1,000 meters and perhaps more. Developing technology may, however, make seafloor systems more economical in water depths of more than 300 meters.

A recent development is the concrete "gravity" bottom-founded platform which rests upon and depends on the seafloor for most or all of its support. Seven of these are being constructed for installation in the North Sea at depths to 140 meters. While these platforms may see wide usage, they will probably be confined to stable ocean bottom areas and relatively shallow waters.

Offshore Capability: The Polar Seas

Part of the ocean floor under polar seas is potentially productive of oil and gas. In these areas, ice poses special problems to petroleum operations. Nevertheless, the problems do not appear insurmountable.

In the shallow margins of Arctic waters offshore Canada, wells have been drilled from artificial islands composed of gravel fill in shallow water and one exploratory well has been drilled from an artificially thickened ice sheet in over 100 meters of water. Several other concepts are in various stages of development, such as seasonal drilling from ice strengthened floating vessels, bottom supported conical structures and concepts employing ice cutters.

Because ice islands (tabular icebergs) sometimes scrape the ocean floor, seafloor wellhead production and pipeline systems in those areas will require special protection. One method for providing such protection would be to recess the production and transmission equipment in the ocean floor. Arctic offshore pipe-laying technology is continually being studied and developed. For example, specific design studies are under way for a pipeline to permit commercial development of Canadian Arctic island gas.

Diving Capability

Conventional seafloor installations currently require the use of divers or one-atmosphere work chambers. Activities involving divers on the seafloor are limited presently by the water depth capability of divers. At present, deepsea dives can be made in water depths of 450 meters. This capability may be extended to about 600 meters within several years and, with adequate research and development efforts, dives as deep as 1,500 meters ultimately may be feasible.

Many specialists in offshore technology are of the opinion that the technology for one-atmosphere work chambers and remote control manipulators to handle the installation and maintenance of seafloor petroleum producing and transmission systems will develop to the point that the operation of such systems can be conducted without the need for divers. Others, however, feel that some seafloor operations still will require the use of divers and that the

depth at which seafloor petroleum activity can be carried out will be influenced by the depth at which man can do useful work on the seafloor.

Seafloor Production Systems

A number of seafloor production systems adapted to deepwater applications are being developed. Some of these new systems utilize one-atmosphere submersibles for installation and maintenance. Others are remotely controlled. Another system under development is being designed to use either divers or remote control, depending upon water depth. Two of these systems are being tested for water depths of 360 meters, and either of these could be ready for use at about 1,000 meters water depths within five years. A component of one system, the individual well, is currently under test in a water depth of 115 meters. This unit is designed for use in about 350 meters of water and can be modified for use in about 1,000 meters water depth. It is expected that 1,000 meters water depth capability will be developed within five years for a complete seafloor producing system.

Another system is designed to be assembled and operated by a remotely controlled manipulator system. A test of this 600 meter water depth capacity installation is being made in the Gulf of Mexico in some 50 meters of water depth. Three wells are to be drilled and completed by a drill ship through an ocean floor template and operated by remote control from a fixed platform a half mile away. The depth capability of this system is expected to extend to waters beyond 1,000 meters. Another system, which incorporates a one-atmosphere wellhead hemisphere and work chamber designed initially for 300 meters water depth is expected to be ready for testing in the North Sea during 1975.

Storage and Transportation

Pipeline, storage and oil transfer capabilities present particularly difficult problems in producing deepsea petroleum. Submarine pipelines, however, have been successfully laid for distances of several hundred miles. Currently a project is under way to develop techniques for laying large-diameter lines in 1,000 meters water depth. Research and testing are under way on several approaches to the laying of pipe in 2,000 meters water depth or even greater. In addition, deepwater pipeline maintenance units will be necessary and are being designed.

Where seafloor conditions permit and within reasonable depths, platforms resting upon the seabed provide a solution to the petroleum storage problem. Several units now in service provide capacities of up to 1 million barrels each. Where conditions for either platforms or pipelines are not suitable, buoyant structures incorporating oil transfer capabilities are required.

ENVIRONMENTAL PROTECTION IN EXPLORATION AND PRODUCTION OPERATIONS

The oil and gas producing industry has long recognized the need for protecting the environment in which it operates. This subject of oil and gas environmental conservation including exploration and producing activities is treated comprehensively in Chapter Four.

ECONOMIC AND FINANCIAL ASPECTS

Exploration Expenditures

The process of exploration includes all the steps necessary to locate potential sources of petroleum and to establish their presence in commercial size accumulations. This involves the drilling of one or more exploratory wells for each geophysical prospect. To provide relative values, a base case of exploratory expenditures for drilling in 200 meters water depth and in moderate climate conditions (Gulf of Mexico) has been developed. Associated exploration drilling expenditures have been assigned and aggregated in a factor labeled day rate. The principal items included in the development of the base expenditures are given in Table 5 and are expressed in 1974 dollars.

TABLE 5

BASE CASE EXPLORATORY DRILLING EXPENDITURES
(Thousands of 1974 Constant Dollars)

Item	Amount
Drilling Expenditures—Day Rate of $27 M/D x 80 Drill Days (10 - 12,000 Foot Well)*	$2,160
Equipping Expenditures—Day Rate of $27 M/D x 7 Equipping Days	189
Tubular Goods	264
Wellhead	50
Testing	26
Other	25
Total per Well Drilling and Equipment Expenditures	**$2,714**

Note: The Base Case is for 200 meters water depth, moderate climate, expressed in thousands of 1974 constant dollars.

* The day rate is directly related to the cost of the rig and is intended to cover depreciation, insurance, interest expense, variable general and administrative expense, direct operating expense and a financial return to the rig owner. A rig capital cost of $20 million is assumed.

It should be recognized that, while these drilling expenditures provide a basis for development of an index, no quantification has been given to the other significant offshore exploratory expenditures such as lease bonuses, geological and geophysical costs,

and certain overhead expenditures that would normally be allocated to the exploratory effort. These must be determined and added to each case to estimate total exploratory expenditures. The average expenditures involved in drilling one exploratory well under moderate climate conditions and in 200 meters of water depth are shown in Table 5 and the cost exceeds $2.7 million.

Understandably, as exploratory drilling progresses to greater water depths and to more severe climates, drilling expenditures will necessarily increase. The primary factors contributing to these increased expenditures are the rig capital cost (correspondingly affecting the day rate) and the drilling and equipping time involved. A substantial increase in expenditures applies in 800 meters and greater water depths since the semi-submersible vessels that can be utilized in the shallower depths (i.e., less than 800 meters) must be replaced by far more costly dynamically positioned drilling vessels.

In order to relate these effects of water depth and severity of climate on exploratory drilling expenditures, an index has been developed which compares drilling in these more difficult environments to the base case, Gulf of Mexico exploratory well (see Table 6).

Future Value of Ocean Petroleum Resources

Summary

Costs for exploring, developing and producing petroleum from seabed areas will increase markedly with water depth and climatic severity and to a lesser degree as distances from shore increases.* To assess the prospective value of these potential petroleum resources within the 1975-1990 time period, the estimated future cost of conventional petroleum has been compared with the estimated cost of other hydrocarbon energy forms that may be available. The following factors have been considered in judging the prospective value of petroleum resources under the ocean floor:

- The physical costs of installing and operating producing wells and facilities for various water depths and climatic conditions.

* *Note:* The Council calls attention to the fact that cost data utilized in this report's economic analyses of ocean petroleum exploration and producing activities were developed in early 1974. Since those data were developed, inflation and the increasing costs of conducting petroleum exploration and development have had a markedly escalating effect. Nonetheless, the comparisons of economic factors remain valid.

TABLE 6

OFFSHORE EXPLORATION DRILLING EXPENDITURE INDEX
(1.0 = $2.7 Million per Well in 1974 Dollars)

Water Depth (Meters)	Climatic Conditions				
				Ice Laden	
	Mild (1)	Moderate (2)	Severe (3)	75% (4)	100% (5)
200	0.8	1.0	1.8	2.3	4.6
500	1.0	1.3	2.1	2.8	5.4
1,000	2.5	2.8	3.6	4.3	6.4
4,000	3.8	4.0	4.3	5.6	7.5

Notes: For estimated dates of exploration capability, see Table 4.

Typical of the various climatic conditions are:

(1) Senegal, Gabon, Honduras, Mediterranean, Java Sea, Persian Gulf.

(2) Gulf of Mexico, South Atlantic, South Pacific*, Northwest Australia*, Sea of Japan*, Yellow Sea.

(3) North Sea, Bay of Biscay, South Australia, Gulf of Alaska*, North Atlantic, North Pacific, West Coast of Canada, Nova Scotiat.

(4) Bristol Bay Alaska*, West Greenlandt.

(5) Arctic Oceant, Chukchi Seat.

* Earthquakes.

† Icebergs.

- The cost of exploratory drilling that must be allocated to producing operations.

- Various nonphysical costs such as royalties, taxes, other government payments, and the cost of capital, including return on investment (ROI).

- The reservoir size, physical characteristics and productive capacities that might be developed at a single production installation.

- The timing of technical capability for developing reserves at various water depths and climatic conditions. (Considering the limits of current technology, no cost estimates have been made for water depths greater than 1,000 meters or for ice-covered areas. However, future developments very probably will extend the technological feasibility of offshore exploration and production activities well beyond current limits.)

- Future domestic energy balances (i.e., the likely future mix of energy alternatives) and the estimated costs of fuels against which seabed petroleum must compete.

Analyses of these factors provide the bases for assessing the potential value of seabed petroleum resources. While such estimation is necessarily imprecise, the comparative relationships are useful, as are the broad conclusions that can be drawn. In summary, the key conclusions are:

- Seabed petroleum resources are likely to be economic under many combinations of reservoir size, water depth and climate.

- As nonphysical costs, such as royalties and taxes are increased, the economics of seabed petroleum production deteriorate rapidly, particularly for smaller reservoirs, deeper water and more severe climatic conditions.

The future costs of developing seabed oil have been assessed for three reservoir sizes: (1) a "large" (100 to 200 million barrels recoverable oil), (2) a "medium" (50 to 100 million barrels), and (3) a "small" (10 to 50 million barrels) reservoir under various water depth and climatic conditions. A range of types of government financial exaction or "take" then was assumed and the comparative economics of these different conditions were determined. On Table 7, the symbol "E" denotes an economic condition of seabed oil that is competitive with alternative hydrocarbon energy sources at a projected long-term value of crude oil ($11 to $13 per barrel in constant 1974 dollars). Negative multiples of "E" (e.g., -2E) are uneconomic and indicate the degree by which such prospects fail to meet assumed economic standards.

As previously noted, a 20 percent cost of capital (i.e., ROI) has been employed as a guide in all cases analyzed. Whereas a somewhat lower ROI may be consistent with capital costs for money for some low risk, alternate energy projects, it is felt that in high risk capital intensive offshore petroleum operations, greater returns will be required to attract needed funds. This reasoning assumes that exploration and production companies engaging in high risk activities that involve large capital commitments for each attempt must target for higher than average expected returns (i.e., higher than returns that might be acceptable for less risky ventures) in recognition of the large potential losses that an operator faces.

Further, as shown on Table 7, as "government take" increases, the economics of various prospects deteriorate markedly. For example, petroleum from a large reservoir in 1,000 meters water depth could be developed economically under "low government take" conditions in all but the severest of climates; however, if this same reservoir were burdened with "high government take" payments, its economic prospectivity would be reduced substantially and resource development would be limited to discoveries in much shallower waters in only mild and moderate climates.

TABLE 7

INDICATED ECONOMICS OF OFFSHORE EXPLOITATION UNDER ALTERNATIVE LEVELS OF GOVERNMENT FINANCIAL TAKE

Water Depth (Meters)	Large Reservoir — Climatic Conditions			Medium Reservoir — Climatic Conditions			Small Reservoir — Climatic Conditions		
	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
	20% Return on Investment, Low Government Take*								
200	E	E	E	E	E	E	E	E	−1.5E
500	E	E	E	E	E	− 1.5E	E	−1.5E	−2.5E
1,000	E	E	− 1.5E	−1.5E	−1.5E	−2.5E	−2E	−2.5E	−4.5E
	20% Return on Investment, Medium Government Take†								
200	E	E	E	E	E	−1.5E	E	E	−2E
500	E	E	−1.5E	E	−1.5E	−2.5E	−2E	−2E	−4E
1,000	E	−1.5E	−2E	− 1.5E	− 2E	−3.5E	−3E	−3.5E	−6.5E
	20% Return on Investment, High Government Take‡								
200	E	E	−1.5E	E	E	−1.5E	E	-1.5E	−2.5E
500	E	−1.5E	—2E	− 1.5E	−1.5E	−2.5E	−2E	-2.5E	−4.5E
1,000	−1.5E	−1.5E	−2.5E	−2E	−2E	− 4E	−3E	−3.5E	−6.5E

Notes:

(1) E = Economic (20% ROI as a guide) at projected long-term value of seabed crude oil ($11 - $13/Bbl. in constant 1974 dollars).

(2) Negative multiples of E (e.g., -2E) are uneconomic and indicate the degree by which such cases would fail to meet assumed economic standards.

*No royalty or bonus and tax provisions similar to those that currently apply to U.S. federal offshore leases.

†Substantial royalty, no bonus and moderate taxes.

‡Substantial royalty, moderate taxes and $1.00/Bbl. additional government payment.

Development and Production Expenditures*

Offshore exploration, development and production expenditures are markedly increased as water depths increase and climatic severity intensifies. In water depths where seafloor producing units are to be utilized, the costs of producing facilities are not expected to show cost sensitivity to increasing water depth to the same extent as in the water depth range where platform type installations can be employed. Distance from shore will, of course, continue to affect expenditures. In contrast with exploration activity, which usually requires very few wells, a commercially successful offshore field requires a large number of wells together with associated gathering, separating, storage and transportation facilities, including safety and environmental protection facilities. For this reason, a system containing two multi-well platforms and associated facilities has been adopted as a typical unit. Regarding development and production costs, a base case has been developed for a moderate climate such as the Gulf of Mexico. Table 8 compares the expenditure requirements of this base case with those of other climatic conditions around the world.

While there exists considerable experience for developing the expenditures of the base case, much less information is available for other conditions covered in this table. Where available for other cases, actual expenditures have been used; where not, reasonable engineering estimates and extrapolations from these have been utilized.

Table 8 is based upon the following key assumptions:

- A 40-well producing system utilizing two platforms for wells ranging between 8,000 and 10,000 feet depth below the seafloor.

- In general, the expenditures are based upon experience gain ed in up to about 100 meters of water depth.

  From 100 meters to 500 meters water depth, these are based upon fairly detailed engineering estimates. Beyond that, to 1,000 meters, extrapolations of engineering data are used. Departure from fixed platform to subsea completion may occur between 300 to 500 meters water depth, depending

* *Note:* It should be stressed that estimates in this section regarding cost and comparative economics of petroleum seabed production are intended to reflect general worldwide conditions and should not be compared to particular projects. All cost and price data are in constant 1974 dollars. Further, these evaluations are based on current estimates of future technological capabilities. Improvements in such capabilities beyond those presently envisioned might significantly reduce future petroleum development costs, particularly in deeper waters and severe climates, and render certain cases that are assessed as "uneconomic" herein as being economic.

TABLE 8

DEVELOPMENT AND PRODUCTION ESTIMATED EXPENDITURE REQUIREMENTS
(1.0 = $95 Million per System in 1974 Dollars)

Water Depth (Meters)	Climatic Conditions: Mild (1)	Moderate (2)	Severe (3)	Ice Laden: 75% (4)	Ice Laden: 100% (5)
200	0.9	1.0	2.8	Unknown but estimated to be substantially greater than severe.	
300	–	–	6.2		
500	2.7	3.0	–		
1,000	4.3	4.8	10.2		

Note: Typical of the various climatic conditions are:

(1) Senegal, Gabon, Honduras, Mediterranean, Java Sea, Persian Gulf.

(2) Gulf of Mexico, South Atlantic, South Pacific*, Northwest Australia*, Sea of Japan*, Yellow Sea.

(3) North Sea, Bay of Biscay, South Australia, Gulf of Alaska*, North Atlantic, North Pacific, West Coast of Canada, Nova Scotia†.

(4) Bristol Bay Alaska*, West Greenland†.

(5) Arctic Ocean†, Chukchi Sea†.

* Earthquakes.

† Icebergs.

upon the environment, severity of operating conditions, and type and size of the hydrocarbon accumulation.

- It is estimated that mild climatic conditions will generally result in costs about 10 percent below those expected in moderate climates.

- Severe climatic conditions will occasion platform expenditures of approximately 6 times the Gulf of Mexico costs. Underwater completion systems for use under severe climatic conditions are estimated to cost about 2 to 3 times the expected cost of such systems for use in the Gulf of Mexico. Pipeline expenditures in severe climates are estimated at about 4 times those for moderate climates.

- For 75 percent ice-laden areas, drilling in open waters may be possible only during 3 to 4 months of the year. Platforms are not assumed feasible beyond 100 meters water depth and, therefore, floating drilling together with seafloor producing systems would be required. Meaningful estimates under these conditions cannot be made at this time.

Costs of Exploratory Drilling Allocable to Production Installation

The offshore search for petroleum understandably will require the drilling of many exploratory wells, the vast majority of which will likely be dry. Because the economic yield from petroleum pro-

ducing operations in the seabed must be such as to carry the costs of an ongoing exploration program, it has been assumed that for every discovery of sufficient size to warrant development, nine dry wildcat wells also will have been drilled. Accordingly, the costs of these nine dry holes are added to the basic cost of the production installation, and recovery of these dry hole costs will be allocated against the future petroleum production. Although the success ratio for significant discoveries (i.e., of at least 1 million barrels ultimate recovery) in the United States recently has been less than 1 percent of all new field wildcats drilled, probably in the more costly offshore areas, only the more promising prospects ultimately will be tested by the drill, and that an average 10 percent success ratio may be realized.* In the U.S. Gulf of Mexico waters, the overall success ratio for wildcat drilling in the 5 year 1969-1973 period averaged 12.5 percent according to American Association of Petroleum Geologists data. Since the Gulf of Mexico is a proven oil province, it is quite possible that untested seabed areas would yield results somewhat less than those recently experienced in the Gulf of Mexico. Accordingly, the 10 percent success ratio assumed for cost estimation in this study appears reasonable but may be somewhat optimistic.

The allocated costs of these exploratory failures are based on the preceding section, "Exploration Expenditures" (see Tables 5 and 6). Therefore, for a production installation in 200 meters water depth and a climatically moderate environment, the cost of dry wildcats that this installation will have to bear amounts to $24 million in constant 1974 dollars (9 wildcats x $2.7 million per well). At water depths of 1,000 meters, and in a severe climate, allocated dry wildcat costs will be nearly $90 million.

The Size and Productive Capacity of Seabed Petroleum Reservoirs that May Be Developed at a Single Production Installation

Assessing the economics of seabed petroleum operations, certain assumptions were made regarding the recoverable reserves, daily productive capacity, and depletion periods for the petroleum reservoirs drained by a single 40-well production installation. Performance of three reservoir types was considered--large, medium and small. The basic data that pertain to each of these assumed petroleum reservoirs are shown in Table 9.

Estimated Times When Technology May Be Available for Petroleum Producing Operations in Seabed Areas.

The estimated time frames within which technology will be developed sufficiently to permit petroleum producing operations in the several water depth/climatic categories evaluated herein are shown in Table 10. The more detailed data regarding water depth capability for specific areas offshore the United States are found in Table 4.

* AAPG Bulletin, August 1974, p. 1493.

TABLE 9

BASIC DATA AND PRODUCING CHARACTERISTICS FOR A PETROLEUM RESERVOIR DRAINED BY A SINGLE, 40-WELL PRODUCTION INSTALLATION

Basic Data	Large Reservoir	Medium Reservoir	Small Reservoir
Reservoir Depth (Feet)	8,000 - 10,000	8,000 - 10,000	8,000 - 10,000
Crude Gravity	30° API	30° API	30° API
Barrels of Oil Recoverable Per Acre-Foot of Reservoir Volume	400	300	250
Area of Reservoir (Acres)	2,900	2,900	2,000
Average Thickness of Oil Bearing Section within Reservoir (Feet)	150	75	50
Producing Characteristics			
Recoverable Reserves (MMB)	175	65	25
Initial Peak Capacity (MB/D)	50	30	15
Years at Peak Capacity	3	2	1
Decline Rate (Percent Per Year)	13	21	23
Depletion Period (Years)	20	12	12

Note: The above conditions are intended to describe hypothetical, but nonetheless reasonable situations; understandably, other situations or combinations of the variables are possible. In particular, the initial peak capacity numbers selected are near the maximum that could be expected for the reservoirs chosen. Many large, medium and small reservoirs can not reach and sustain the producing rates assumed above.

TABLE 10

CAPABILITY DATES FOR CONDUCTING PETROLEUM DEVELOPMENT OPERATIONS IN THE SEABED

Water Depth (Meters)	Climatic Conditions		
	Mild	Moderate	Severe
200*	Now	Now	Now
300†	Now	Now	1978
500‡	1980	1980	1980
1,000‡	1980	1980	1980

*Fixed platform completions.

†Fixed platforms (possibly complemented with seafloor systems).

‡Seafloor producing and gathering systems.

Whereas the technology now exists to develop fields in water depths of approximately 300 meters and in moderate climates using conventional multi-well platforms, it should be stressed that the largest platform presently under construction is for use in water of 260 meters depth in the Santa Barbara Channel. In waters deeper

than 300 meters, future oil field development probably will rely on seafloor production and gathering systems. Other than a few pilot components in comparatively shallow waters, complete seafloor production systems are not presently in operation. It is believed that by 1980, underwater technology will have progressed sufficiently to permit installation of a complete seafloor production system in water depths of up to 1,000 meters. However, it is not anticipated that significant producing capacity will be developed prior to the decade of the late 1980's and early 1990's in waters of that depth because at least 6 to 8 years of construction time between field discovery and commencement of production will be required.

Future Value of Seabed Crude Oil to the United States

In developing appropriate long-term future values for seabed crude oil in the United States, two possible alternatives should be considered: (1) the United States remains substantially dependent on foreign oil and (2) U.S. domestic energy supply is approximately equal to domestic energy demand in the long term.

Under the first alternative, any additional future supply of seabed crude oil from U.S. sources to the extent of its availability would replace foreign crude and would be valued at about $11 to $13 per barrel in constant 1974 dollars per Table 11.

TABLE 11

POSSIBLE FUTURE HYDROCARBON COSTS IN THE UNITED STATES
(Constant 1974 Dollars)

Source	Cost ($/Bbl.)
Crude Imports	11 - 13
Coal Liquids	12 - 13
Shale Oil	10 - 11
Coal Gas (High BTU)	9 - 11

Note: The costs of synthetic petroleum liquids and gas are based on prevailing U.S. tax rates and royalties, and a return on investment of 10-15 percent, a risk-free rate. Further these costs do not reflect the substantial preliminary expenditures that will be needed for research and development activities and which will impose a further burden on synthetic fuels costs--especially during the earlier years of production.

In Table 11, the imported crude costs estimated are of the long-range cost of imports in the United States in terms of constant 1974 dollars. The figures for coal liquids, shale oil and coal gas are estimates of the long-range costs of manufacturing these synthetic fuels, in constant 1974 dollars.

It should be noted that synthetic fuel costs, particularly with regard to shale oil, are sensitive to the volumes produced. An intensive development effort within the Unites States could necessitate mining of leaner and deeper deposits of shale and coal, with attendant higher costs. The volumes used here as the basis for cost estimation amount to 1.5 MMB/D of petroleum liquids synthesized from shale and coal by 1985.* Larger volumes will be more costly.

Under the second alternative (U.S. energy self-sufficiency), should seabed and other domestic oil supplies be developed in the United States in addition to its own requirements, the United States would be in a surplus position to the extent of such development. Thus, any such surplus oil could either be exported or used to replace the most expensive form of synthetic oil, i.e., coal liquids. If it is assumed that the landed cost of imported crude into West Europe will be approximately the same as the landed cost in the United States, Table 12 would be relevant.

TABLE 12

POSSIBLE FUTURE OIL COSTS
(Constant 1974 Dollars)

Oil Source	Cost ($/Bbl.)
Persian Gulf Crude, Landed West Europe	11 - 13
Less Marine Freight to U.S. (Est.)	(1 - 2)
Netback Value, U.S. (Export Value)	9 - 12
Coal Liquids	12 - 13

Therefore, under this alternative, it would be appropriate to place a value on seabed oil offshore United States of about $9 to $13 per barrel in constant 1974 dollars.

However, as there is scant prospect of achieving zero imports from foreign sources in the 1974-1990 time frame considered in this analysis, the values noted in the first alternative should be relevant; namely, that U.S. seabed oil should be valued at expected equivalent costs of foreign imports which are currently about $11 to $13 per barrel in constant 1974 dollars.

Future Costs of Seabed Crude Oil

The future costs of seabed crude oil have been estimated for three different sizes of reservoirs under various water depths and climatic conditions. These costs were calculated in terms of prices required to give at least a 20 percent ROI and are shown on Tables 13, 14 and 15.

* *Note*: See Case I of the NPC report, *U.S Energy Outlook--A Report of the National Petroleum Council's Committee on U.S. Energy Outlook*, December 1972.

TABLE 13

APPROXIMATE ECONOMICS OF VARIOUS SEABED CRUDE OIL RESERVOIRS
(20% Return on Invested Capital, Low Government Take)

	Large Reservoir (100 - 200 MMB)			Medium Reservoir (50 - 100 MMB)			Small Reservoir (10 - 50 MMB)		
	Climatic Conditions			Climatic Conditions			Climatic Conditions		
Water Depth (Meters)	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
200	E	E	E	E	E	E	E	E	−1.5E
500	E	E	E	E	E	−1.5E	E	−1.5E	−2.5E
1,000	E	E	−1.5E	−1.5E	−1.5E	−2.5E	−2E	−2.5E	−4.5E

Notes:

(1) E = Economic (20% ROI as a guide) at projected long-term value of seabed crude oil ($11 - $13/Bbl. in constant 1974 dollars).

(2) Negative multiples of E (e.g., -2E) are uneconomic and indicate the degree by which such cases would fail to meet assumed economic standards.

(3) Figures are based on current technology levels. It is possible that future technological advances may lower the costs of finding and producing oil in deeper waters and less favorable climatic conditions. Thus, some of the areas shown above as being uneconomic may move into the economic range at some point in the future.

(4) Table is based on a minimum 20% ROI on exploratory drilling, development and production expenditures, no royalties or bonus and tax provisions similar to those applying to U.S. federal offshore leases. Also, geological and geophysical costs and normal compensation for exploration project risk are excluded.

TABLE 14

APPROXIMATE ECONOMICS OF VARIOUS SEABED CRUDE OIL RESERVOIRS
(20% Return on Total Invested Capital, Medium Government Take)

	Large Reservoir (100 - 200 MMB)			Medium Reservoir (50 - 100 MMB)			Small Reservoir (10 - 50 MMB)		
	Climatic Conditions			Climatic Conditions			Climatic Conditions		
Water Depth (Meters)	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
200	E	E	E	E	E	−1.5E	E	E	−2E
500	E	E	−1.5E	E	−1.5E	−2.5E	−2E	−2E	− 4E
1,000	E	−1.5E	−2E	−1.5E	−2E	−3.5E	−3E	−3.5E	− 6.5E

Notes:

(1) E = Economic (20% ROI as a guide) at projected long-term value of seabed crude oil ($11 - $13/Bbl. in constant 1974 dollars).

(2) Negative multiples of E (e.g., -2E) are uneconomic and indicate the degree by which such cases would fail to meet assumed economic standards.

(3) Figures are based on current technology levels. It is possible that future technological advances may lower the costs of finding and producing oil in deeper waters and less favorable climatic conditions. Thus, some of the areas shown above as being uneconomic may move into the economic range at some point in the future.

(4) Table is based on a minimum 20 percent ROI on exploratory drilling, development and production expenditures. Includes substantial royalty, moderate taxes, but no lease bonuses or other acquisition costs. Also, geological and geophysical costs and normal compensation for exploration project risk are excluded.

TABLE 15

APPROXIMATE ECONOMICS OF VARIOUS SEABED CRUDE OIL RESERVOIRS
(20% Return on Total Invested Capital, High Government Take)

	Large Reservoir (100 - 200 MMB)			Medium Reservoir (50 - 100 MMB)			Small Reservoir (10 - 50 MMB)		
	Climatic Conditions			Climatic Conditions			Climatic Conditions		
Water Depth (Meters)	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
200	E	E	−1.5E	E	E	−1.5E	E	−1.5E	−2.5E
500	E	−1.5E	−2E	−1.5E	−1.5E	−2.5E	−2E	−2.5E	−4.5E
1,000	−1.5E	−1.5E	−2.5E	−2E	−2E	−4E	−3E	−3.5E	−6.5E

Notes:

(1) E = Economic (20% ROI as a guide) at projected long-term value of seabed crude oil ($11 - $13/Bbl. in constant 1974 dollars).

(2) Negative multiples of E (e.g., -2E) are uneconomic and indicate the degree by which such cases would fail to meet assumed economic standards.

(3) Figures are based on current technology levels. It is possible that future technological advances may lower the costs of finding and producing oil in deeper waters and less favorable climatic conditions. Thus, some of the areas shown above as being uneconomic may move into the economic range at some point in the future.

(4) Table is based on a minimum 20 percent ROI on exploratory drilling, development and production expenditures. Includes substantial royalty, moderate taxes, but no lease bonuses or other acquisition costs. Also, geological and geophysical costs and normal compensation for exploration project risk are excluded.

(5) Includes additional investment equal to present value equivalent to $1/Bbl. on total recoverable oil, i.e., $175 million for a large reservoir, $65 million for a medium reservoir, and $25 million for a small reservoir. This added expense is intended to illustrate the impact on ROI and economics of additional cost burdens such as lease bonus, etc.

As these tables and the foregoing discussion indicate, there is a direct relationship between the economic attractiveness of a potential reservoir and the burden of governmental financial exaction. Thus, governmental financial exactions can reach a point where an otherwise economically attractive reservoir would be so seriously burdened financially as to preclude its development. A technical paper outlining the assumptions and methodology used in developing these tables is attached as Appendic C of this report.

Chapter Two

JURISDICTION AND REGIME OVER OCEAN MINERAL RESOURCES

EXTENT OF COASTAL STATE JURISDICTION

The National Petroleum Council repeats its previous recommendation that:

A new Law of the Sea Convention should confirm the exclusive jurisdiction of the coastal state over the exploration and production of seabed mineral resources throughout the natural prolongation of its land areas into and under the sea.

The most logical guide to determining the limit of this natural prolongation of the submerged land areas of the coastal state, and thus to a boundary between areas of coastal state and international jurisdiction over mineral resources, is the base of the continental (or insular) slope (see Figure 2).

The base of the slope constitutes the approximate line of demarcation between continents (and islands) on the one hand and the deep ocean floor on the other. It is a widespread, impressive, natural, geomorphic feature marking the major change in slope of the submarine surface floor descending from the high stand of the continental blocks (and islands and banks) down to the floor of the deep ocean. It represents the outer edge of the submerged continent (or island), that is the continental margin (or insular margin) in its most restricted sense.*

Because it is often difficult to define the base of the slope precisely enough for it to serve as a boundary itself, it is recommended that the base of the slope be used principally as a guide to the boundary and that the exact jurisdictional boundary be drawn within a boundary zone of an agreed reasonable width extending seaward from the base of the slope (see Figures 3 and 4).

The principal purposes to be served by this concept of a boundary zone are:

- To allow for uncertainty in the identification of the base of the slope, and to make unnecessary any but a very general designation of a base-of-slope guideline.
- To facilitate the eventual designation of a precise definitive boundary by the coastal state itself, within internationally agreed limits, by means of simple straight lines

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* *Note:* The term continental margin is also used somewhat imprecisely and in a broader sense to include not only the continental slope but also the continental shelf and the continental rise, where a rise is developed.

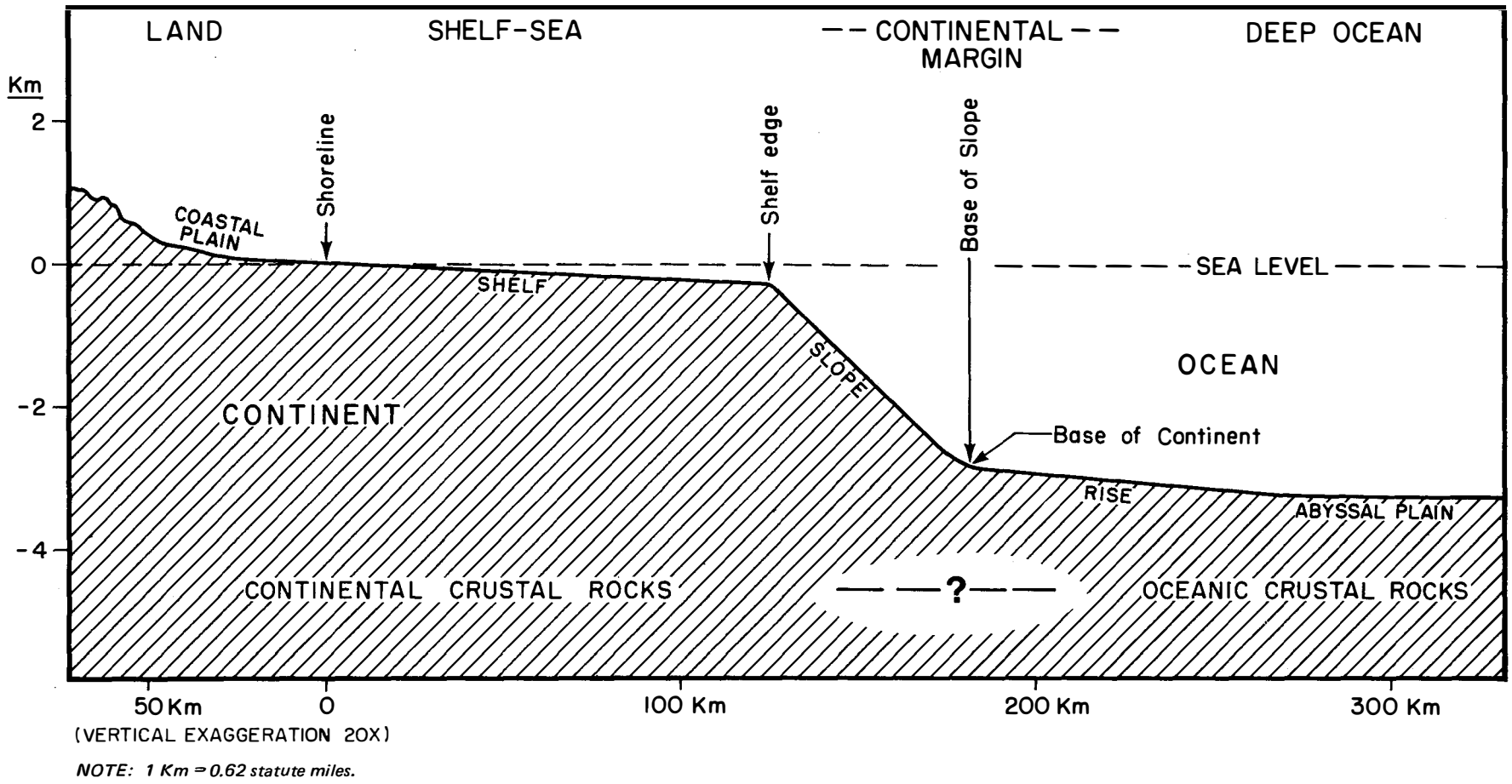

Figure 2. Geomorphic Features of the Continental Margin.

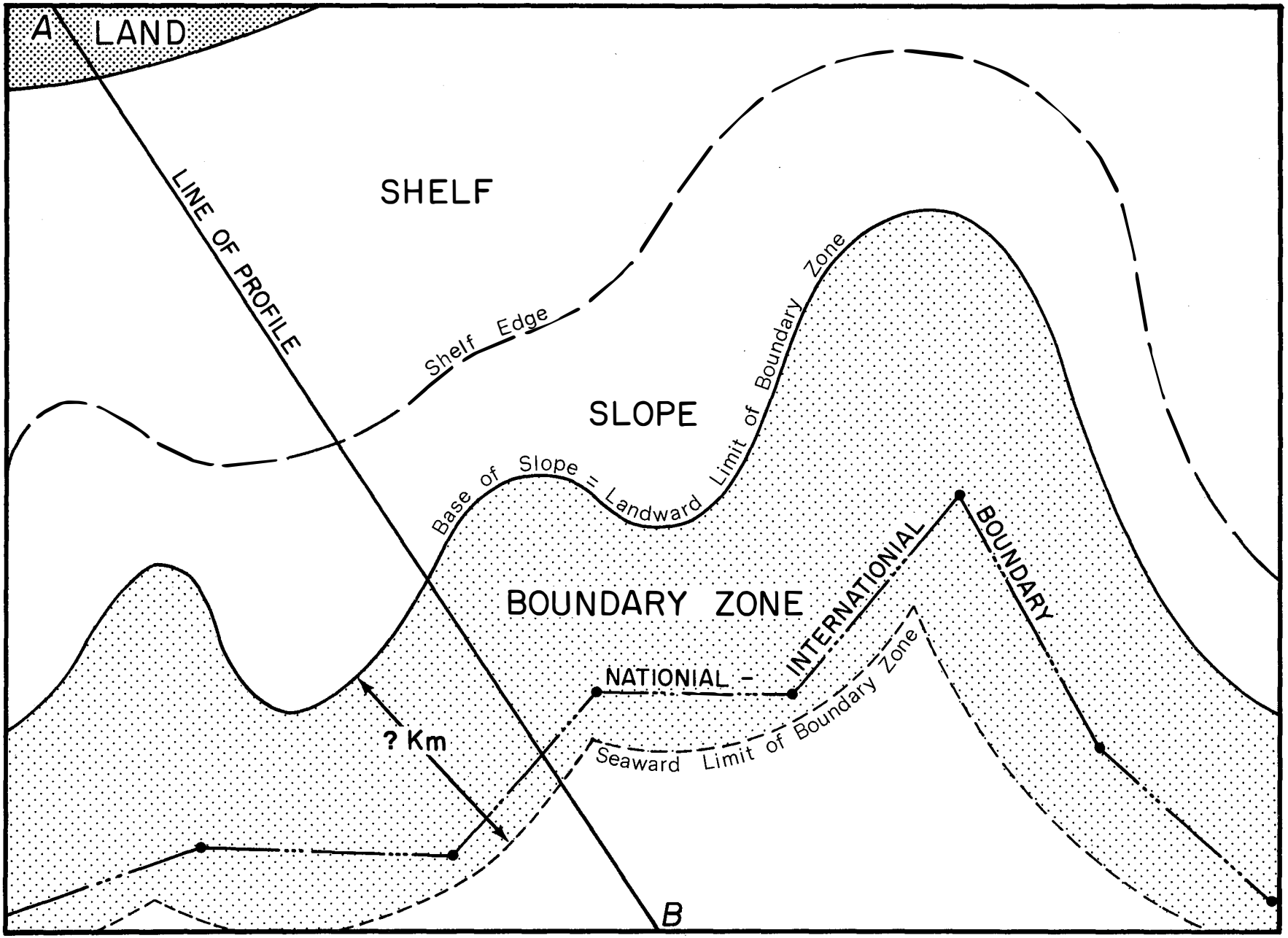

Figure 3. Delineation of a Boundary Between Coastal State and International Jurisdictions.

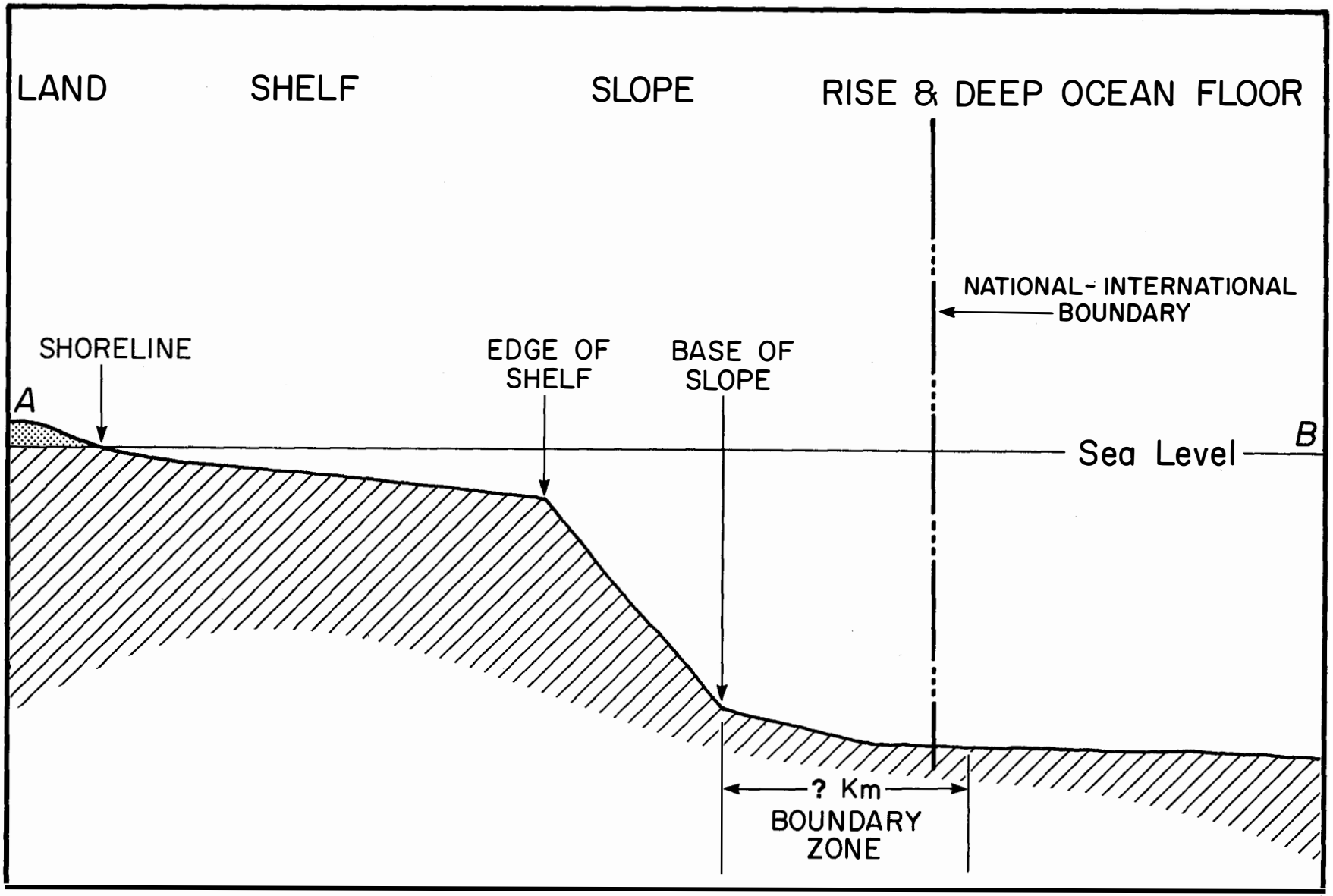

Figure 4. Profile of the Delineation of a Boundary Between Coastal State and International Jurisdictions. (Vertical Scale Highly Exaggerated)

within the boundary zone, connecting a minimum number of points fixed by coordinates of latitude and longitude (see Figure 3).

As would be the case in the application of any boundary formula, the establishment of an international boundary commission of oceanographic experts is necessary. Such a commission would determine in advance the approximate map position of the base of the slope* (or its reasonable projection through areas of uncertainty) and, after decision in the Convention by the nations as to the width to be prescribed for the boundary zone and designation by the coastal state of its proposed precise boundary, would determine whether the proposed boundary could be approved as falling satisfactorily within the prescribed limits. The international boundary commission would be expected to work with an advisory local oceanographic commission of the coastal state concerned on each boundary to be determined.

It would be impracticable for the prescribed width of the boundary zone to be less than 100 km (54 nautical miles). It might be considerably wider, depending on the consensus of the nations party to the Convention.

The base of the slope is a far more fundamental and significant reference line for the boundary than would be the present shoreline. Likewise, it is a much more meaningful boundary guide as regards deep oceanic petroleum potential, because the great thickness of sediments with promising petroleum prospects are found worldwide adjacent to the base of the slope, rather than at some fixed distance from the shoreline.

Similarly, it should be emphasized that the base-of-slope is a geomorphic, not a geologic, guide to the boundary. Geologic criteria such as the change from continental crust to oceanic crust, the source of sediments, or the thickness of sediments have been suggested and may be influencing factors when geomorphology is inconclusive but in general these are too uncertainly determinable to qualify as boundary criteria.

Closely associated with the continental margin and with island chains in many parts of the world are some 40 named marginal or semi-enclosed seas. Examples are the Gulf of Mexico, the East China Sea, and the Sea of Okhotsk. These marginal seas are particularly important with respect to petroleum potential because they contain thick sedimentary sections of favorable character. A boundary zone of sufficient width would place almost all of the areas of these small seas within the jurisdictional limits of the adjacent coastal states.

* *Note:* The traditional slope-rise contact along some coasts needs to be revised to be in accordance with new bathymetric data. Thus, off the mid-part of the eastern coast of the United States, it can now readily be seen that the true base-of-slope line (corresponding to the base of the continent) lies far oceanward and at much greater water depth than the commonly published slope-rise contact at about 2,000 meters.

With respect to islands, the use of the base-of-slope-boundary-zone concept avoids many of the problems involved in other boundary formulas. Where the island or group of islands constitute an independent country, connected with a continental platform, as in the case of Japan or Great Britain, clearly the same rules would apply as for a continental coastal state. The sea bottom rights of any island dependency situated on the submerged continental mass, that is, shelf islands and other islands landward of the base of the continental slope, would be merged with those of the coastal state if of the same nationality, as for example in the case of the Channel Islands off California. If of different nationality than the coastal state, they would simply have to be settled by agreement between the countries concerned, as in the case of the French islands of St. Pierre and Miquelon off Canada.

Islands in the deep oceans beyond the base-of-slope, if independent countries, would have the same jurisdictional rights over seabed mineral resources with respect to the base of the insular slope as continental coastal states would have with respect to the base of the continental slope. In the case of island dependencies in the deep oceans, the nations might consider relating the width of the boundary zone to such factors as the size or population of the island, although the simplest and probably the most equitable approach would be to use for all islands the same criteria for boundaries and boundary zones as for continents.

With respect to deep ocean archipelagic nations, their degree of territorial continuity on the sea bottom would depend entirely on the width of the boundary zone adopted. Again, as in the case of the small ocean basins, the adoption of a boundary zone of sufficient width would unify the territory of all existing archipelagic nations.

Alternatively to the base-of-slope-boundary-zone formula presented above and outlined in previous National Petroleum Council reports, it is said that a "developing consensus" of nations is now in favor of defining the outer limit of coastal state jurisdiction at (1) a line 200 nautical miles seaward of the base line from which the breadth of the territorial sea is measured, or, beyond that limit, (2) the seaward edge of the continental margin, whichever is broader in a particular case. If this proposal indeed has general support, the U.S. could accept the proposal by simply applying the boundary zone formula recommended in this report as an addition to the minimum 200 mile from shore provision of this alternative proposal. However, if the 200 nautical miles from shore minimum for mineral resource jurisdiction of coastal states is adopted, it would appear preferable to accomplish this by means of a boundary zone of appropriate width and to use only the one, simple, naturally based formula presented here, which could be applied to a all countries alike.*

* *Note:* A boundary zone of 300 km would essentially meet the objectives of narrow margin coastal states regarding interests in an economic resource zone off their coasts.

The principal difficulties with the 200 nautical mile proposal are (1) it would substitute a more artificial basis for the natural basis for the boundary, (2) it would involve problems resulting from the nonuniform systems of base lines currently used by coastal countries, and would be particularly difficult to apply on coasts with far offshore islands, (3) instead of a single simple formula, it would involve two, with the difficulties of both (a) accurate distance measurement and (b) accurate definition of the "margin" on the sea floor, (4) it would be unsatisfactory with respect to islands on broad shallow water banks, and (5) it would offer less promise of a simple satisfactory solution of the problems of marginal seas and archipelagic nations.

NATURE OF COASTAL STATE JURISDICTION

Resource Jurisdiction

Seaward of the territorial sea and in the area described in the previous section "Extent of Coastal State Jurisdiction," the exclusive jurisdiction of the coastal state should be limited to economic interests and should entail no territorial interests as such. Thus the coastal state would have jurisdiction over the exploration and development of the mineral resources of the seabed of that area. Under this exclusive mineral resource jurisdiction, the coastal state would decide whether to permit exploration for development of ocean petroleum resources, who should be permitted and the terms of any such permission.

Status of Superjacent Waters

The waters of the area constitute important avenues of seaborne commerce and are vital to trade among nations. These waters should continue to retain their character as high seas for freedom of navigation and the adjacent coastal state should have no jurisdiction over vessels exercising high seas freedoms in such waters except in the limited emergency circumstances provided for in Chapter Three and Part II of Chapter Four.

Integrity of Investments

There will be a need for a stable investment climate to provide incentives for investors to make available the vast financial and technological resources which will be necessary for exploration and development of ocean petroleum resources in the area under the exclusive economic jurisdiction of the coastal state. Without such an incentive and the investor confidence which it would engender, it seems doubtful that these financial resources will be made available. Thus, it is of the greatest importance that a Law of the Sea Convention provide that an agreement between a coastal state and a foreign investor or operator for exploration and development of ocean petroleum resources in the area be binding upon the parties according to its terms for the period specified in the agreement.

Accommodation of Uses

Experience to date respecting diverse uses of ocean space does not suggest that serious incompatibility or conflict will occur among them. Nonetheless, the National Petroleum Council reiterates its view that any lawful use of ocean space must be conducted compatibly and with due regard for other lawful uses in the area. As technology advances and more ocean uses are introduced, ocean space will be subjected to both more intensive and extensive activities. The problem will be to harmonize these activities one with another and thus permit all to be appropriately accommodated.

Among the more important current uses of ocean space are:

- Aesthetics
- Communications including submarine cables
- Fishing
- Mariculture
- Mineral resource exploitation--hydrocarbons and hard minerals
- National defense
- Navigation
- Recreation
- Sand and gravel extraction
- Scientific research
- Tidal energy
- Transportation facilities such as deepwater terminals
- Underwater petroleum gathering and trunk pipelines
- Underwater storage.

More uses under consideration for introduction are:

- Nuclear energy generating plants
- Airports
- Underwater and floating habitats.

A new Law of the Sea Convention should include provisions for developing international standards and criteria by an appropriate expert commission to be employed in harmonizing uses of ocean space

within the area seaward of the territorial sea but subject to the economic jurisdiction of the coastal state. Development of these criteria should involve close cooperation and consultation with coastal states party to the Convention.

In the event of conflict among users of ocean space in the area considered in this section and which involves rights and obligations under the Convention or under general rules of international law, the users should be authorized to resort to the disputes settlement procedures and institutions recommended in Chapter Five of this report for inclusion in the Convention.

Safety and Pollution Control Standards

The National Petroleum Council reaffirms its view that uniform design and construction standards concerned with performance of mobile offshore drilling units and fixed platforms with the objectives of safety of operation and environmental protection should be internationally developed and agreed. These standards should be developed and agreed upon for conditions under which the mobile rigs and fixed platform will be utilized.

Within its area of economic jurisdiction, the coastal state should be authorized by the Convention to enforce these internationally agreed standards respecting exploration and producing operations.*

Application of Disputes Settlement Procedures

Experience suggests that even where intentions and relations are good, differences are likely to arise between those authorized to conduct mineral development activities and the authorizing body. This conclusion in no way suggests where fault may lie in a particular case; rather it states a well-known fact. Thus it is of the greatest importance that if there is to be a new Law of the Sea Convention, it provide a peaceful, compulsory and objective means of resolving disputes--without disrupting mineral development and marine vessel transport.

Accordingly, mineral resource disputes between a foreign investor or operator and a coastal state which is party to the Convention should be resolved under the disputes settlement procedures recommended in Chapter Five of this report for inclusion in the Convention. Such disputes include those relating to mineral resource exploration or production in the area, which has been authorized by the coastal state and involving provisions of the Convention, regulations issued pursuant to it, other applicable conventional law, or general principles of international law.

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* *Note:* For full discussion of this matter, see the section in Chapter Four, Part II on "Seabed Exploration and Production Facilities and Deepwater Terminals."

Revenue Sharing

The National Petroleum Council recognizes that the question of revenue sharing from the area within coastal state jurisdiction is for states, party to the Convention, to decide. Certain difficult practical problems are presented in considering revenue sharing. The widely diverse mineral taxation methods now applied by various coastal states would make it difficult indeed to devise an equitable revenue sharing formula of general application. For example, taxation by the United States respecting its offshore leases occurs largely in the form of a large front-end bonus with comparatively small subsequent payments on production. Other nations, in contrast, collect little or no front-end bonus, but rely heavily on production--derived taxes and royalty payments. Such diverse approaches to taxation would be difficult, if not impossible, to reconcile equitably in a generally applicable treaty provision for revenue sharing. The very difficulty of attempting to do so could lead to acceptance of added financial burdens as a simplifying solution despite intentions otherwise when consideration of the matter had been initiated.

In any event, if revenue sharing by coastal states from mineral operations in the area were to be accepted, it should not constitute an additional burden upon the operation, but should be made available from those revenues that accrue to the coastal state from such operations. And, most importantly, revenue sharing should be an obligation of all coastal states on a basis of equality and not limited to any particular category of coastal states.

AREA SEAWARD OF COASTAL STATE JURISDICTION

As indicated in the previous chapter, the relative amount of producible petroleum resources estimated to be present under the deep seabed beyond coastal state jurisdiction is small. However, even a small percentage of a large quantity can be significant. Furthermore, as time progresses and the more easily located onshore and shallow water petroleum resources of the world are produced and consumed, the petroleum potential of the deep seabed will become increasingly important. Therefore, the National Petroleum Council believes that equitable and rational treaty arrangements for the exploration and production of petroleum and other mineral resources of the seabed beyond coastal state jurisdiction should be an integral part of the forthcoming Law of the Sea Convention.

Nature of International Seabed Resource Authority

Presumably, some type of international seabed resource authority responsible for seabed minerals in the area beyond coastal state jurisdiction will be included in the Convention being negotiated at the Third United Nations Law of the Sea Conference. Such an authority should be organizationally simple, and the provisions governing its creation and operations should contain adequate provisions against

discriminatory and arbitrary treatment. There should also be provisions for the protection of investments and for the binding effect of agreements with the authority. The Convention should define the powers, duties and responsibilities of the authority and provide for appropriate representation by the various concerned interests involved in its organs and activities. Disputes arising from seabed resource activities should be resolved in accordance with the recommendations in Chapter Five of this report.

The authority should be an administrative organization responsible for arranging for the encouragement of mineral resource development. Under no circumstances should it be allowed to claim for itself the ownership of any of these mineral resources, nor should it have any right to control rates of production, fix prices or make market allocations.

Rights of Access to Mineral Resources

Access to the seabed mineral resources beyond coastal state jurisdiction should be made available by the authority pursuant to the Convention to all qualified organizations, including private, commercial companies or groups of companies, as well as to states which ratify the Convention. There should be no discrimination among or between such companies and states, access being on an equal basis to all who qualify both technically and financially, nor should the authority enter into exploration and production of mineral resources either directly or indirectly through others.

Terms and Conditions of Arrangement for Recovery of Mineral Resources

Any treaty provisions and the detailed regulations which are enacted to control the arrangements governing the development of seabed mineral resources beyond coastal state jurisdiction should have as their primary goal the encouragement of the exploration, discovery and production of these resources with due concern for environmental protection in the area. Arrangements must be in the form of firm agreements between the authority and the private company or companies involved, or between the authority and the state involved. Such agreements should be binding in accordance with their terms for the exploration and exclusive right to produce in a given area, and for a specified period or periods of time. These agreements should provide for security of tenure, protection against unilateral revision, voluntary relinquishment, protection in case of *force majeure*, and the settlement of disputes arising out of performance of such agreements as recommended in Chapter Five of this report. They should provide for annual work expenditures as the only financial requirement for obtaining exclusive rights to produce. Once commercial producing operations have begun, some sharing of that part of the financial value of the produced mineral which exceeds the costs of exploring and producing should be received by the authority provided that this does not result in double taxation by the authority and any state. The share involved should be set at

a level that does not discourage operations because only if these mineral resources are discovered and produced will they be available to the benefit of the world community.

Financial Obligations

Determination of sharing from mineral recovery for the deep ocean area will be for states party to the Convention. In making that determination, states should provide for a pattern which will encourage investment and development of these resources. Such a pattern should recognize the essential requirement for the investor to be able to recover the investment and earn a rate of return commensurate with the extreme risk involved in operating under unknown and hostile conditions. It should also be equated to a rate of financial return which would encourage production rather than be imposed as an exaction on the volume of production which would discourage investment and production and thereby tend to increase worldwide consumer costs. In implementing such a system, the National Petroleum Council strongly urges that the financial obligation in the case of a private operator be only from it to its sponsoring state and, of course, consistent with that state's general taxation laws. The latter would be solely responsible for the obligation to the international authority.

State Sponsorship

While it is important that agreements should be concluded directly with the private companies involved in mineral resource development, it is also important that such companies be sponsored by states with which they have substantial economic connections. In such instances the states should, among other things, provide assurances to the authority that the sponsored companies are financially and technically competent to engage in the exploration for and production of minerals and to comply with the terms of the agreement.

Chapter Three

MARINE TRANSPORTATION

The economic well-being of nations is extremely sensitive to the availability and cost of energy. Economic growth can be severely affected by virtue of an unstable energy climate. While marine transportation does not affect the raw material cost of energy, it does contribute significantly to the final cost to the consumer. The past decade has seen the impact that marine transportation has had on the world economy. Assuming transportation in vessels of comparable size, higher freight rates and ship operating costs have contributed significantly to the sharply rising costs of petroleum. The downstream effect of increased petroleum cost has been felt by all consumers including those in industry, agriculture and government. It is apparent that the economic welfare of nations will be well-served by ensuring that marine transportation is not subjected to undue restrictions which would add unnecessarily to the delivered cost of petroleum.*

For example, denial of the right of unimpeded passage through the principal straits used for international transit would result in severe economic consequences.† If commercial shipments in or out of the Mediterranean Sea could be halted arbitrarily by a strait state, serious disruption would result to the economies of both exporting and importing states dependent on this route for trade.

The compelling reasons in support of the views expressed in this chapter have been clearly stated in earlier NPC reports and no change in the views and recommendations included in those reports is suggested.‡ The National Petroleum Council therefore repeats the following recommendations for inclusion in the Law of the Sea Convention:

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* *Note:* As an example of the importance of maintaining freedom of navigation and unimpeded passage through straits in limiting the costs of delivered petroleum by tankers to consumers, the per barrel cost of transporting crude oil on a 250,000 deadweight ton (DWT) tanker from the Persian Gulf to the U.S. West Coast (assuming terminal facilities are available to handle such vessels), using the Singapore Straits would be $1.10 per barrel under early 1975 operating costs. However, if the vessel were compelled to use the Bass Straits as an alternate route, the per barrel costs would increase to $1.37, a 25 percent increase.

† For identification and description of principal straits used by tankers, see NPC, *Law of the Sea*, May 1973, Appendix F.

‡ NPC, *Law of the Sea*, May 1973 and *Ocean Petroleum Resources--An Interim Report*, July 4, 1974.

- The first of these recommendations is fundamental: Merchant vessels engaging in mere transit through straits used for international navigation must enjoy a right of unimpeded passage provided such vessels in transit are in compliance with internationally agreed safety standards, including ship design and construction and pollution prevention provisions, and internationally agreed standards designed to accommodate other uses in the area.*

- The right of merchant vessels engaging in mere transit should be generally applicable in territorial waters subject of course to the compliance of those vessels with the same standards as those applicable to such vessels in straits used for international navigation.*

- In waters seaward of the territorial sea including those of the area in which the coastal state exercises limited resource jurisdiction, the present character of the waters as high seas must be preserved with continued freedom of navigation.

- Coastal and strait states should be authorized by the Convention to take reasonable enforcement action of a civil nature with respect to vessels not in compliance with internationally agreed "Rules of the Road" and traffic routing schemes in limited areas in the waters adjacent to their coasts. The Law of the Sea Convention should establish the responsibility of coastal and strait states, supplementary to the basic jurisdiction of the flag state, to enforce the internationally agreed navigation standards. The interests of all states in freedom of navigation, however, require that prompt procedures be agreed upon so as to permit the immediate release of a vessel upon provision of appropriate guarantees to comply with a properly adjudicated order enforcing such internationally agreed standards. In the view of the National Petroleum Council, such disputes should be settled in accordance with the dispute settlement procedures to be provided for in the Law of the Sea Convention (see Chapter Five). And in a case in which it is found under those procedures that a coastal or strait state, in exercising this limited enforcement jurisdiction against a vessel, acted arbitrarily or without reasonable cause, the vessel owner or cargo owner would be entitled to damages for any injury resulting from such exercise.

- Whatever general provisions of a Law of the Sea Convention might be adopted regarding the status of archipelagic waters, the right of navigation as described herein should

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* *Note:* Certification of compliance with such standards and provisions will be handled by the state of the flag in connection with its licensing of a vessel. Strait states will thus have no authority to inspect a vessel merely to determine such compliance.

be applicable to merchant shipping transiting archipelagoes. Such transit would only involve movement through the archipelago for the purpose of reaching points beyond.

The Law of the Sea Convention should take account of the particular interests of coastal and strait states in the safety of navigation and the problem of pollution in unusually congested coastal waters. Certain straits heavily used by merchant shipping are illustrative of such interests of the adjacent states. In such situations, the Convention could provide for the establishment of regional commissions comprised of coastal states flanking the area and other nations having an interest in navigation of those waters. These commissions could develop, and propose for approval through the procedures of the Inter-Governmental Maritime Consultative Organization (IMCO), international regulations relating to navigational safety and pollution prevention. (For comprehensive treatment of vessel source pollution and its prevention, see Chapter Four).

If the international community cannot resolve its differences through internationally agreed standards, it seems certain that coastal and strait states will increasingly resort to inconsistent and irreconcilable unilateral actions. The danger of such unilateral actions is then very real--the consequences of failure to achieve internationally agreed standards are obvious, and the need for agreement is compelling.

Chapter Four

PROTECTION OF THE MARINE ENVIRONMENT

PART I: MARINE POLLUTION--SOURCES, KINDS, CLEANUP AND ENVIRONMENTAL IMPACT

While most Law of the Sea Conference proposals are couched in terms of states' rights, national soverignty, boundaries, zones, freedoms and uses, one should not lose sight of the fact that the ocean, which constitutes about 71 percent of the earth's surface, is a vital subunit of the entire global biosphere. The complex oceanic ecosystem which constitutes the marine environment is unquestionably a fundamental segment of the total of man's life sustaining environment.

The National Petroleum Council submits that marine pollution problems, like the seas to which they relate, traverse territorial boundaries and legal concepts of national sovereignty. It is therefore particularly appropriate that these problems be subjected to international solutions.

SOURCES AND KINDS OF MARINE POLLUTION

A United Nations Conference has defined "marine pollution" as:

> ...the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water, and reduction of amenities.*

Marine pollution, as thus defined, has many sources. These include various land-based activities, vessels of all sizes and types, offshore terminal and related storage and transportation facilities, seabed resources exploration and development, and seabed scientific research. If marine pollution were more broadly defined, earthquakes and other natural phenomena including natural oil seepages would be considered significant contributing factors.

Although land-based activities constitute the greatest source of marine oil pollution--accounting for approximately 55 percent according to a recent authoritative estimate (see Table 16)--their

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* "General Principles for Assessment and Control of Marine Pollution," proposed by IWGMP, November 1971, and endorsed by 1972 Stockholm Conference on the Human Environment (U.N. Doc. A/CONF. 48/14, Annex III).

TABLE 16

SOURCES OF OCEAN PETROLEUM POLLUTANTS

Source	Petroleum Pollutants (MB/D)	Percent of Total
Land-based Activities	67	54
All Vessel Activities	43	35
Natural Seeps	12	10
Offshore Production	≤ 2	1
Total	**124**	**100**

Source: National Academy of Sciences, *Petroleum in the Marine Environment,* January 1975. Based on data from Table 1-5, p. 6.

regulation is primarily a national responsibility beyond the mandate of the Law of the Sea Conference. It is, however, recommended that the Convention include a provision along the lines of the International Working Group on Marine Pollution (IWGMP) Principle No. 17 to the effect that:

> [A] Coastal State...has the responsibility to protect adjacent areas of the environment from damage that may result from activities within its territory.

Since the occurrence of marine pollution from natural phenomena is for the most part beyond human control, and pollution from scientific research is relatively insignificant, these sources will not be treated in detail in this report.

The National Petroleum Council is particularly conscious of the problems of environmental protection inherent in the world's dependence on the movement of large and increasing quantities of petroleum by sea, as well as the increasing percentage of petroleum production furnished by offshore producing facilities.

The kinds of marine pollution upon which this report concentrates are those which directly pertain to the petroleum industry. These principally relate to marine transportation and offshore production which involve either accidental or operational discharges of pollutants into the sea. These pollutants may be grouped into four general categories: (1) oil and oily mixtures, (2) hazardous polluting substances, (3) sewage and (4) garbage.

It is estimated that the total amount of oil pollutants introduced into the ocean amounts to only 0.2 of 1 percent of worldwide daily petroleum consumption. From Table 16, it is apparent that over half of all petroleum pollutants results from land-based activities, about one-third originates from vessels, and only 1 percent

of ocean petroleum pollutants is caused by offshore production activities. About seven times more pollutants come from natural petroleum seeps than from direct producing operations.

While ocean dumping of pollutants is sometimes discussed in the same context as the accidental and operational discharges analyzed herein, dumping is primarily a land-related activity. Accordingly, it is recommended that it be treated as such and that the Conference confirm that it should be controlled by coastal states in accordance with the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. In this regard, it is noted that the United States ratified this Convention during 1973, and has adopted implementing legislation and regulations.

Vessels

It has been estimated that of the 36 percent of marine oil pollution caused by human activities offshore, more than 96 percent comes from vessels.* In quantitative terms, using Table 16, on an average daily basis, about 43,000 barrels of oil reach the oceans from vessels. Interestingly, although oil spills tend to receive sensational publicity, it is estimated that on an average daily basis only 6,000 barrels, or about 14 percent of this total, are attributable to vessel casualties. The balance, or 86 percent, of vessel source oil pollution results from routine operations of vessels such as cleaning and deballasting tanks, bunkering and bilge discharges.

Operational Discharges

As a consequence of intensive efforts of the international petroleum and shipping industries and the work of the Inter-Governmental Maritime Consultative Organization, a specialized United Nations agency, much progress has been made in the battle to eliminate marine pollution resulting from vessel operations. In a major effort to combat pollution from discharges of oily tank washings and ballast waters, the practice of "load-on-top" was developed by the petroleum industry and is now being voluntarily adhered to by the vast majority of tankers engaged in international trade.

Prior to implementation of load-on-top procedures, tankers which had delivered their cargoes, cleaned their oil storage tanks at sea with seawater and dumped the resulting oily water into the ocean. Tank cleaning operations are associated with ballasting procedures and changes in types of oil to be carried. As an oil tanker unloads, it takes on seawater in its oil carrying tanks to provide ballast for the return voyage to a port of loading. Under normal circumstances, safe and stable navigation requires approximately 10 to 40 percent of the deadweight tonnage of the vessel to be

* National Academy of Sciences, *Petroleum in the Marine Environment*, January 1975, p.6.

ballasted. The quantity of ballast may, however, be substantially increased when extremes of weather are encountered. Prior to arrival at the port of loading, this ballast must be discharged to make room for the cargo. To avoid discharging oil-contaminated ballast water in port, it previously was customary to flush out the tanks at sea on the ballast leg and take on fresh clean ballast. But when load-on-top procedures are utilized, the oily water mixture is collected in a single tank in the ship, and the oil and water are separated. This water is then decanted and the separated oil remains in the tank. Another load of oil is then loaded on top of the existing oil. As a result of load-on-top procedures, the operational discharge of oil into the ocean from tankers has been markedly reduced.

In order to assist tanker operators in practicing load-on-top in 1973, the International Chamber of Shipping (ICS) and the Oil Companies International Marine Forum (OCIMF) jointly published a procedural manual entitled, *Clean Seas Guide for Oil Tankers*. This manual has received wide acclaim and acceptance and more than 9,500 copies have already been distributed. More recently, ICS and OCIMF jointly published a supplementary guide entitled, *Monitoring Load-On-Top*, which suggests inspection procedures whereby the efficiency of load-on-top operations may be monitored by tanker terminals. Distribution of this manual currently exceeds 5,000 copies. Furthermore, the practice of load-on-top and adequate slop tank capacity is made mandatory by the 1973 International Convention for the Prevention of Pollution from Ships. This Convention also provides for: instrument monitoring of overboard discharges; slop tanks; certain pumping, piping and discharge arrangements; and the provision of adequate reception facilities to receive oily slops at tanker loading and repair ports.

The advent of segregated ballast design for new large tankers also promises to reduce further operational pollution resulting from washing and deballasting cargo tanks by eliminating, in most cases, the need to put ballast in cargo tanks and reducing the frequency of cargo tank washing. Because this will eliminate to a great extent standard operational practices which result in oil and water being mixed in cargo tanks, segregated ballast design avoids most of the human error and judgment necessarily connected with the practice of load-on-top. In accordance with the 1973 Marine Pollution Convention, all new oil tankers of 70,000 deadweight tons (DWT) or greater must be equipped with segregated ballast capacity pursuant to a prescribed formula.

A "new oil tanker" means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces (including combination carriers):

- For which the building contract is placed after December 31, 1975; or
- In the absence of a building contract, the keel of which is laid or which is at a similar stage of construction after June 30, 1976; or

- The delivery of which is after December 31, 1979; or
- Which has undergone a major conversion:
  - --For which the contract is placed after December 31, 1975; or
  - --In the absence of a contract, the construction work of which is begun after June 30, 1976; or
  - --Which is completed after December 31, 1979.*

Technological solutions, while not presently available, are under development and these would eliminate the historical practice by all types of vessels of discharging bilge accumulations of oily wastes directly into the sea. The 1973 Marine Pollution Convention addresses this problem by requiring all ships of 400 gross tons or above to be equipped with oily water separating or filtering systems or oil discharge monitoring and control systems as well as oily waste holding tanks. The mandatory capabilities of this pollution prevention equipment are made dependent upon vessel size.

Annex I of the 1973 Marine Pollution Convention also requires that a prescribed form of Oil Record Book be maintained by all oil tankers of 150 gross tons and above and every other type of ship of 400 gross tons and above. Oil Record Book entries must be made in connection with all oil cargo and oily waste handling operations and with regard to all accidental as well as operational discharges. Record Book requirements and other pollution control measures pertaining to hazardous pollution substances other than oil are prescribed by Annexes II and III of the 1973 Convention.

All vessels including tankers generate substantial quantities of sewage and garbage which traditionally have been discharged into the sea without due regard having been given to environmental considerations. This form of marine pollution has become a subject of increasing concern to industry as well as to governments. Technological methods of dealing with these wastes by means of onboard treatment prior to discharge or a combination of retention and discharge to onshore reception facilities have been rapidly developing. Annexes IV and V of the 1973 Marine Pollution Convention will regulate the onboard treatment and handling of vessel source sewage and garbage in coastal waters.

Accidental Discharges

Although accidental oil spills account for only 14 percent of marine oil pollution from vessels, they often occur in coastal waters and are given considerable publicity and sometimes result in substantial pollution damage. Recent increases of ocean oil

* 1973 International Convention for the Prevention of Pollution from Ships--Annex 1, Regulation 1.

carriage and in the size of tankers have been accompanied by increased government and industry research and development efforts to improve oil spill prevention and cleanup equipment and techniques.

Prevention of spills from tankers has been aided by several improvements. Most new giant tankers are equipped with automatic loading controls which are designed to minimize the chance of a spill caused by human error during transfer of cargo. More stringent maintenance practices and better vessel design features continue to be developed. In addition, modern collision avoidance systems, better crew education and training and more stringent operating, navigation, and traffic controls are helping to reduce the possibility of spills caused by collision or grounding. Improved transportation support services in the areas of communication, weather forecasting and navigational aids, for example, are also helping to reduce the incidence of such accidents.

The 1973 Marine Pollution Convention incorporates the standards of the 1971 Amendments to the 1954 Convention for the Prevention of Pollution of the Sea by Oil specifying cargo tank arrangements and tank size limitations which are aimed at reducing the quantity of oil outflow in collision and grounding situations. Additionally, the Convention includes design requirements intended to improve stability and survivability of tankers.

Offshore Exploration and Production Operations

Offshore exploration and production operations account for only about 1 percent of the total quantity of oil that reaches the oceans each year. Because these operations are rapidly expanding, potential marine pollution from them and related processing, storage and transportation facilities are constantly monitored.

Operational Discharges

Vessels engaging in ocean geophysical operations produce no more waste than other vessels of comparable size and therefore do not present particular environmental problems. In contrast, during normal offshore drilling and production operations a number of waste products are generated. Examples are:

- Drilling and workover fluids
- Engine cooling water
- Produced water
- Sewage and garbage
- Contaminated wash and rain water.

Whether these wastes would be considered pollutants by the United Nations definition--"the introduction by man...of substances

...resulting in deleterious effects"--is a matter of degree and judgment. Under applicable United States law, the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), industrial wastes are considered pollutants, ocean discharge of which in the near future will either be prohibited or only permitted pursuant to the terms of validly issued National Pollutant Discharge Elimination System (NPDES) Permits.

The effluent limitations of forthcoming NPDES Permits for offshore United States production facilities will be in accordance with guidelines being developed by the U.S. Environmental Protection Agency (EPA). In this regard, an engineering firm recently published an excellent report specifically dealing with oil removal from produced waters of production platforms operating in Louisiana coastal waters and the Gulf of Mexico, off the coast of Louisiana.* It is expected that final effluent guidelines for this point source category will be published by the EPA within the next six months, and that all NPDES Permits will be issued prior to the end of this year.

In the absence of an effective NPDES Permit, the discharge of pollutants from U.S. offshore exploration and producing facilities will continue to be governed by applicable OCS orders issued by the U.S. Geological Survey pursuant to 30 CFR Part 250 under the Outer Continental Shelf Lands Act. For example, OCS Order No. 8, currently under revision, applicable to Gulf of Mexico facilities, requires producing platforms to be equipped with "[w]aste water disposal systems...designed and maintained to reduce the oil content of produced water to an average of not more than 50 ppm" (parts per million). The maximum oil concentration permitted in produced water discharges into the Gulf is 100 ppm. Sewage disposal systems are also mandated and the sewage effluent is not permitted to exceed 50 ppm of biochemical oxygen demand, 150 ppm of suspended solids and have a minimum chlorine residual of 1.0 milligrams per liter (mg/liter) after a minimum retention time of 15 minutes. Additionally, OCS Order No. 8 contains monitoring and reporting requirements for oil as well as other pollutants.

In quantitative terms, the amount of oil operationally discharged from offshore production facilities is very small. For example, the oil content of U.S. regulated produced water discharges into several thousand square miles of Gulf of Mexico has been calculated to be only 6 barrels per million barrels of oil produced.†

OCS orders currently under revision and forthcoming NPDES Permit limitations will contain pollution control criteria for the conduct of these operations in all U.S. offshore areas. It can be

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*Brown & Root, Inc., *Determination of Best Practical Control Technology Currently Available to Remove Oil from Water Produced with Oil and Gas*, March 1974.

† National Academy of Sciences, *Petroleum in the Marine Environment*, January 1975, p.3.

expected that standards designed to protect the marine environment will eventually be prescribed for offshore exploration and production operations in other parts of the world.

Accidental Discharges

By far the most visible source of pollution and the most serious environmental problem to the offshore operator, as well as those in the vicinity, is the accidental discharge of oil. The Santa Barbara, California incident of 1969 followed by the Main Pass and Bay Marchand, Louisiana incidents in 1970, focused public attention on the pollution potential of the drilling and producing activities out of proportion to their contribution to marine pollution as compared with the total pollution of the oceans. It has recently been estimated that the daily average of 124,000 barrels of petroleum hydrocarbons reaching the oceans worldwide, 1,600 barrels or about 1 percent are attributable to offshore production accidental and operational discharges.* Based on a world offshore production of about 9 MMB/D in 1971, this represented a loss into the marine environment of 175 barrels per million barrels (0.0175 percent) produced.†

To put this figure of something less than a daily average of 2,000 barrels from production operations into proper perspective, note that in Table 16, natural oil seeps are estimated to discharge 12,000 barrels of oil per day on average into the oceans, or about seven times that attributed to offshore production.

While this estimated loss from production is quite small relative to total oil losses, it is a much higher rate than that reported for the U.S. Gulf of Mexico operations. Discharges of oil into the Gulf during normal operations have been calculated at a rate of 2.6 barrels from minor spills and as previously discussed, about 6 barrels discharged with produced water, per million barrels of oil produced.‡ Excluding the Main Pass and Bay Marchand incidents of 1970, and a single large pipeline leak in 1967, oil spills of 50 barrels or more into the Gulf from 1964 through 1971 averaged about 18 barrels per million barrels produced.§ Total Gulf of Mexico accidental oil discharges (excluding catastrophic incidents) and operational discharges are less than 27 barrels per million produced, or one-tenth the estimated average world offshore production loss rate.

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* National Academy of Sciences, *Petroleum in the Marine Environment*, January 1975, p.6.

† *Ibid*, pp. 4-7.

‡ *Ibid*, p.3.

§ U.S. Department of Interior, "Draft Environmental Statement of the Proposed 1973 Outer Continental Shelf East Texas General Oil and Gas Lease Sale," 1972.

The oil pollution prevention record of the U.S. offshore producing industry as evidenced by these figures is an encouraging one considering the level of operations and the volumes of production. Four large accidental oil discharges from producing operations were experienced, one during drilling operatons, two from production platforms and one pipeline leak. This number of accidents should be compared with more than 18,000 U.S. offshore wells which had been drilled to the end of 1973, and the 6 billion barrels of oil and lease condensate and 28 TCF of gas which has been produced from nearly 2,700 offshore producing platforms.*

Accidental discharges are kept to a minimum because of long-standing application of good platform design and prudent operating practices. Malfunction sensors and automatic shutdown devices further reduce the probability of large oil discharges. Small discharges are minimized by the use of drip pans, curbs, gutters and drain collection tanks, and by good maintenance practices. Close attention to oil spill prevention equipment and practices is mandatory under the more stringent OCS orders issued by the U.S. Geological Survey since 1969, and other applicable federal law.

Offshore Terminals

As the volume of imported oil has increased, the economics of ocean transport and terminal operations have become increasingly important, particularly to the consumer. A number of supertankers which cannot utilize many traditional port terminal facilities have been built and it is expected that there will be a significant increase in the number of deepwater ports being constructed throughout the world to accommodate them. In this regard, as recently as January 3, 1975, the United States enacted enabling legislation for the building of one or more such terminals.†

The types of pollutants which may emanate from offshore terminals--waste waters, sewage and garbage--are much the same as those previously discussed. Depending on the size of their storage facilities and whether or not they have facilities for receipt and treatment of dirty tanker ballast waters, they may present somewhat different accidental and operational discharge problems. However, for the most part, the oil spill prevention and waste disposal and treatment considerations discussed previously are applicable and will therefore not be repeated.

CONTAINMENT AND CLEANUP OF OIL SPILLS

Since the 1967 Torrey Canyon casualty and the 1969 Santa Barbara spill dramatized the need, a great deal of effort and large amounts of money have been expended by industry and governments in development of oil spill containment and cleanup systems. While

* API Data, Committee on Exploration, April 17 and May 1, 1974.

† Deepwater Port Act of 1974 (Public Law 93-627).

the U.S. Coast Guard has concentrated on air droppable systems for quick delivery to remote locations, industry has emphasized the development of heavy duty systems for long-term survival in rough seas, supplemented by light duty systems capable of rapid movement by fast boats. Waterborne devices employing the concepts of moving belts, centrifugal water and oil separation and dynamic response to wave action have greatly improved capability to recover spilled oil. Special sorbents and chemical dispersants are available as backups for use in special circumstances, but their use is strictly regulated by the United States and some other governments. The installation of small discharge containment devices on vessels and onshore and offshore facilities, together with improved personnel training and operating procedures have substantially reduced the number of small spills which reach the water during everyday operations. Government and industry sponsored cleanup cooperatives have been and are being established in numerous coastal areas subject to significant risks. With proper contingency planning and personnel training, presently available systems can effectively contain and pick up large oil spills in light to moderate seas.

While considerable effort is still being expended on oil spill control technology development, greater emphasis is being placed on oil spill prevention, techniques for monitoring the movement of spilled oil, the fate of oil in the marine environment and its effects on marine biota. Research currently sponsored by U.S. government agencies and industry reflects this changing emphasis.

ENVIRONMENTAL IMPACT OF PETROLEUM IN THE MARINE ENVIRONMENT

No documented evidence has been reported of lasting damage from massive crude oil spills.* However, the question is often asked what could be the long-term effect of oil industry activities on the marine environment and ecology, since some scientists fear that continuous small discharges may be more damaging than infrequent massive oil spills. To answer this and other questions on the environmental impact of offshore drilling and producing operations, the Gulf Universities Research Consortium (GURC), was engaged by a group of corporate sponsors to coordinate an extensive study of an area in the Gulf of Mexico and an adjacent bay where there have been continuous oil operations for many years. The study called the *Offshore Ecology Investigation* (OEI), was conducted by 23 principal investigators, representing eleven universities and two nonprofit research institutions, during the period from June 1, 1972 to September 15, 1974. Approximately one million measurements were made of biological, chemical, physical and geological parameters over a 400 square mile area from Timbalier Bay, Louisiana, out to 100 feet water depth in the Gulf of Mexico. Within the area there are 171 platforms, some of which have been producing since 1937.

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* J. G. Mackin, *A Review of Significant Papers on Effects of Oil Spills and Oilfield Brine Discharges on Marine Biotic Communities*, Texas A & M Research Foundation Project 737, February 1973.

The final report on the *Offshore Ecology Investigation* presented the following general conclusions:

- "Natural phenomena such as seasonality, floods, upwellings, and turbid layers have much greater impact upon the ecosystem than do petroleum drilling and production activities.

- Concentrations of all compounds of OEI interest which are in any way related to drilling or production are sufficiently low to present no known persistent biological hazards.

- Every indication of good ecological health is present. The region of the sampling sites is a highly productive one from the biological standpoint, more so than other regions thus far studied in the eastern and open Gulf of Mexico.

- Timbalier Bay has not undergone significant ecological change as a result of petroleum drilling and production since just prior to 1952 when other more limited baseline data were generated."*

These findings show that extensive offshore operations can be conducted without doing environmental or ecological harm, when carried on in a prudent manner under adequate regulations. In fact, the GURC *Offshore Ecology Investigation* reported that 25 percent of the 24 investigations reported beneficial effects from drilling and production operations, and 54 percent reported no adverse effects. Twenty-one percent required further interpretation.

The National Academy of Sciences report, *Petroleum in the Marine Environment*, concludes, in part, regarding the effect of petroleum discharges:

- "Conflicting reports of the biological damage following coastal oil spills can be attributed in some instances to differences in sampling procedures and analytical techniques, rather than to different environmental factors. In other instances, reports of damage to biota have not been placed in context of normal fluctuation of the biota caused by natural environmental changes.

- An accurate evaluation of the fate of petroleum through microbial degradation and biological uptake cannot be made until better designed and more rigorously conducted field studies are carried out.

- The most damaging and indisputable adverse effects of petroleum are the oiling and tarring of beaches, the endangering

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* Gulf Universities Research Consortium, "Final Consensus Report Project Planning Council," *Offshore Ecology Investigation*, Report No. 138, September 20, 1974, p. 34.

of seabird species, and the modification of benthic communities along polluted coastlines where petroleum is heavily incorporated in the sediments.

- Fish do not appear to suffer from oil spills as much as seabirds and benthic organisms.

- Although our information is limited, the effect of oil contamination on human health appears not to be cause for alarm.

- In general, much more research regarding the fates and effects of petroleum hydrocarbons in the marine environment is needed.

- Studies to date indicate that areas polluted with petroleum hydrocarbons 'recover' within weeks or years (depending on local conditions and the characteristics of the petroleum); however, composition of the local biological communities may be altered.

- The oceans have a considerable ability to purify themselves by biological and chemical actions. A basic question that remains unanswered is, 'At what level of petroleum hydrocarbon input to the ocean might we find irreversible damage occurring?'"*

The GURC *Offshore Ecological Investigation* and the National Academy of Sciences report, *Petroleum in the Marine Environment*, offer encouraging reassurances that the oceans have not been irreparably harmed from oil pollution. Notwithstanding these encouraging reports, the National Petroleum Council continues its strong support for the efforts of industry and governments to further reduce the volume of petroleum discharged into the marine environment.

* National Academy of Sciences, *Petroleum in the Marine Environment*, January 1975, pp. 105-107.

PART II: METHODS OF POLLUTION CONTROL AND JURISDICTION

Pollution emanating from vessels and other commercial facilities operating in the marine environment takes the form of both accidental and operational discharges. The setting of standards for the purpose of preventing and regulating these discharges should be based upon water quality goals, available technology and economic practicability. Effective operational discharge and accident avoidance standards may include design, equipment and operation requirements. Furthermore, operational discharge standards expressed in terms of quantitative or qualitative effluent limitations usually involve additional highly technical considerations. Also, expert knowledge in the fields of admiralty law, economics and marine insurance is necessarily connected with the setting of pollution liability and damage compensation standards.

What is being sought by the Law of the Sea Conference is a treaty expressing broad policies and principles rather than defined and precise technical specifications. Thus environmentally related provisions of a new convention should reflect basic values to be served and goals to be achieved. International pollution control, liability and damage compensation standards included in treaties currently in force, or submitted to states for ratification, which are designed to protect those values and effect those goals such as the standards contained in the 1973 International Convention for the Prevention of Pollution from Ships, should in the case of treaties be adhered to and to those pending should be taken into account. An appropriate international body through which such standards could be prescribed in the future should be designated. The status of the authority of coastal states regarding prescriptive standards and enforcement jurisdiction relative to international standards should be clearly defined.

In many respects, particularly with regard to vessels engaged in international trade, control of pollution from commercial facilities operating in the marine environment is a global problem requiring an international solution which, nonetheless, will be responsive to coastal state interests.

Many distinctions should be made when dealing with questions of establishment and enforcement of pollution standards. Accidental pollution should be distinguished from operational pollution. Permanently affixed structures should be distinguished from facilities which are transportation oriented or are capable of being utilized in various locations. Local considerations should be distinguished from those of general applicability. Costs should be weighed against potential effectiveness. All of these distinctions are important, but for the most part, like the seas to which they relate, they are not controlled by traditional concepts of national or territorial jurisdiction.

MARINE POLLUTION STANDARDS

Vessels

The Inter-Governmental Maritime Consultative Organization (IMCO)

IMCO was established in 1959 after the 1948 Convention on the Inter-Governmental Maritime Consultative Organization came into force. Since that time, the accomplishments of IMCO have demonstrated its capability as a highly skilled specialized agency of the United Nations and an effective forum for the promulgation of numerous important technical and legal international conventions codes relating to marine transportation.

IMCO membership is open to all states which are members of the United Nations. As of June 1974, its 85 full members included 18 African nations, 22 Asian nations, and 14 Latin American nations. The IMCO Assembly and Council are its principal governing organs. Its most important technical body has been the Maritime Safety Committee. In order to assure that its rapidly expanding membership is fully represented, an extraordinary session of the IMCO Assembly held in October 1974 adopted amendments to the IMCO Convention which when ratified will increase Council membership from 18 to 24, and open the Maritime Safety Committee membership to all IMCO members, while giving all states not IMCO members which are parties to Conventions with which the Committee is specifically dealing full participation rights.

IMCO's work in the fields of maritime safety and marine pollution is often interrelated. In the field of maritime safety, some of its most signficiant accomplishments are:

- 1960 International Convention for the Safety of Life at Sea, as amended in 1966, 1967, 1968, 1969, 1971 and 1973, and revised in 1974.
- 1966 International Convention on Load Lines, as amended in 1971.
- 1969 International Regulations for Preventing Collisions at Sea (revised in 1972).
- Recommendations, studies, codes of practice and guidelines on traffic separation schemes, crew training, navigational warning systems, carriage of dangerous goods, and many other subjects.

IMCO's efforts in the field of prevention and control of marine pollution include:

- 1962, 1969, and 1971 Amendments to the 1954 Convention for the Prevention of Pollution of the Sea by Oil.
- 1969 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, and

1973 Protocol (extends the Convention to harmful polluting substances other than oil).

- 1969 International Convention on Civil Liability for Oil Pollution Damage.
- 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage.
- 1973 International Convention for the Prevention of Pollution from Ships.

With regard to vessel source pollution prevention, IMCO's most noteworthy achievement to date is the 1973 International Convention for the Prevention of Pollution from Ships. The 1973 Convention is a comprehensive treaty which for the first time provides standards to deal with almost all potential forms of marine pollutants from vessel operations, as well as vessel design, equipment and performance requirements. Its rapid entry into force and tacit amendment provisions promise to permit its standards to remain current with technological advances and environmental requirements.

A number of the 1973 Convention's standards, requirements and prohibitions were discussed previously in connection with the topics of vessel operational and accidental discharges. In summary, they apply to nonpersistent as well as persistent oils, garbage, sewage and to other harmful polluting substances, notably chemicals. They relate to vessel design, waste treatment, monitoring and discharge equipment, records, overboard discharge limitations and prohibitions, operations, reception facilities, and to enforcement.

As to the adequacy of the 1973 Marine Pollution Convention to deal with the problem of vessel source pollution locally as well as internationally, the National Petroleum Council is in full agreement with the following assessment by the United States Coast Guard:

> ...The Coast Guard is convinced that the 1973 Convention is a strong document and one to which the United States should be an early signatory. The Convention offers the prospect of significant reduction of pollution from accidental releases, as well as reduction of operational discharges, fully in accord with the mandate of Section 7(A) of the Ports and Waterways Safety Act calling for minimum standards of design. The Coast Guard is also very cognizant of the international nature of maritime shipping and this nation's longstanding commitment to seek multi-national solutions. By working within the international framework the Coast Guard is certain that this country can best achieve its aims in the protection of the marine environment.*

* United States Coast Guard, "A Brief Discussion of Certain Tank Vessel Design Concepts," "White Paper" distributed during the fall of 1974.

The significance of the 1973 Marine Pollution Convention should be analyzed in the light of the establishment of the Marine Environment Protection Committee (MEPC). This new IMCO Committee, proposed by the United States, came into being during November of 1973 for the primary purpose of executing and coordinating all aspects of IMCO's work in the marine pollution field.* It has been designated by IMCO as the "appropriate body" charged with maintaining the current status of the technical standards of the 1973 Convention. It is open to all IMCO members and to all other states parties to conventions "in respect of which" particular MEPC work is directed. MEPC Committee members, not members of IMCO, will have the right to vote on issues involving conventions to which they are parties. In one important aspect, MEPC differs from other IMCO committees. It is unique in that in many cases when it functions as the designated "appropriate body" in respect of the 1973 Marine Pollution Convention and prospectively, other conventions, its decisions and actions do not require Council or Assembly approval and will be communicated directly to governments through the Secretary-General.

At the MEPC's first meeting held during March of 1974, its rules of Procedure and future Action Plan were agreed upon.† When the second session was held from November 18-22, 1974, the Committee was actively pursuing the technical activities within its frame of reference. Included among designated MEPC tasks which have been given priority status are: (1) development of a list of hazardous polluting substances to be annexed to the 1973 Protocol to the 1969 Intervention Convention (adopted at the second MEPC session); (2) development of improved methods of enforcement of the 1954 and 1973 Marine Pollution Conventions; (3) reviewing available vessel oil discharge monitoring and control equipment; and (4) development of a standard method of identification of oil pollution sources.

Another significant item on the MEPC work program is the fulfillment of the charge given to IMCO by Resolution 5 of the 1973 Marine Pollution Conference to continue work towards developing improved measures for the minimization of oil spills. These measures will relate to navigational safety, crew training and certification, collision avoidance and communication equipment, cargo transfer operating procedures and equipment and vessel design and construction standards.

A full understanding of the importance of the establishment of the Marine Environment Protection Committee and the future implications which can be drawn from its existence can be best derived from a detailed examination of the MEPC Action Plan. Accordingly, it is included in this report as Appendix D.

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* IMCO Resolution A. 297 (VIII), November 23, 1973.

† "Report of the Marine Environment Protection Committee on its First Session," IMCO Document MEPC I/10, March 8, 1974.

Setting of Standards

The National Petroleum Council reaffirms its view that the interests of mankind will best be served and the preservation of the marine environment will best be achieved with respect to vessel source pollution by agreed international standards covering ship design and construction, navigational safety, operational and accidental pollution, and pollution liability and damage compensation. As is demonstrated by the "special area" concept embodied in the 1973 Marine Pollution Convention, the particular environmental interests of coastal states, including those with straits, can be fully protected within such an international framework.

Vessel related marine pollution standards should be internationally formulated and agreed upon to avoid the chaotic disruption of shipping and unnecessary costs resulting from the construction of vessels to engage in limited trading between a few ports where unilateral standards must be met. Furthermore, unilateral standards and their enforcement would involve needless stopping and detaining of vessels--a consequence which would result in a typical large tanker being subjected to unjustified economic penalties.

By its work, IMCO has demonstrated that it is a highly competent institution with the necessary expertise, administrative machinery and broad representation through which formulation of international standards relating to vessel source marine pollution can best be accomplished. A new Law of the Sea Convention should therefore confirm IMCO as the agency responsible for this function.

Furthermore, with respect to foreign flag vessels navigating within territorial waters, internationally agreed design, construction and equipment standards should not be the subject of unilateral change by port or other coastal states. In this regard, this report agrees with the following statement by Coast Guard representatives which appeared in the January 1974 edition of *Marine Technology*.

> ...[U]nilateral action in such an aspect as vessel construction presents certain intrinsic dangers. First, it might place the U.S. merchant marine at an economic disadvantage vis-a-vis foreign vessels operating in foreign trade. Second, it would be likely to impede ratification of the Convention by other nations. Third, unilateral action by the United States could encourage the proliferation of differing regulatory schemes unilaterally imposed by other nations. It was a central article of faith at the Conference, in abandoning inclusion of an article formally limiting unilateral action, that signatory nations would act responsibly in substantial conformance with the provisions of the Convention.*

* "The Impact of the 1973 IMCO Convention on the Marine Industry" Rear Admiral W. M. Benkert and Lieutenant (j.g.) D. H. Williams, *Marine Technology*, January 1974, p.6.

Similarly, pollution liability and damage compensation standards should be uniform worldwide and internationally agreed in order to assure swift cleanup and insurability, together with adequate and certain damage compensation. Such international agreement would avoid wasteful and costly developments, including the proliferation of local pollution funds.

Following the 1967 Torrey Canyon casualty, much progress has been made by both governments and industry in the legal areas of oil spill liability and pollution damage compensation. The petroleum and tanker industries, recognizing the apparent inadequacy of traditional principles of admiralty law to deal with potential claims from major oil spills, created the Tankers Owners Voluntary Agreement Concerning Liability for Oil Pollution (TOVALOP) in 1969 and the Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution (CRISTAL) in 1971. In substance, TOVALOP is an agreement among owners of over 99 percent of the Free World's tanker tonnage which encourages owners to promptly clean up oil spills and assures national governments of reimbursement of their reasonably incurred persistent oil cleanup expenses arising out of negligent spills from entered tankers, up to a total of $100 per gross registered ton or $10 million, whichever is the lesser.

CRISTAL is a supplementary agreement among more than 90 percent of the Free World's oil company owners of persistent oil cargoes which is designed to assure that a total of $30 million per TOVALOP tanker spill incident is available to reimburse tanker owners for their cleanup costs and to compensate others sustaining pollution damage, after remedies under TOVALOP and other sources have been exhausted.

Thus far, TOVALOP and CRISTAL have proven to be successful nongovernmental measures which have encouraged swift oil spill cleanup and have demonstrated the capability of the tanker and petroleum industries to respond fully to just claims which may arise out of oil spill situations.

The 1969 International Convention on Civil Liability for Oil Pollution Damage and the 1971 International Convention on the Establishment of an International Fund for Oil Pollution Damage, promulgated through IMCO, are currently pending ratification and coming into force. Their provisions, although somewhat broader, are to a great degree parallel to those of TOVALOP and CRISTAL. In combination, they provide for reimbursement of cleanup costs and pollution damage losses up to a limit of about $36 million. When the Civil Liability and Fund Conventions come into force, TOVALOP and CRISTAL may probably go out of existence.

Domestic legislation seeking to implement the Civil Liability and Fund Conventions is currently before the Congress. The tanker and petroleum industries have and continue to support all such proposed government actions designed to rapidly bring these Conventions into force.

A new Law of the Sea Convention should encourage all United Nations members to participate actively in formulation through

IMCO of internationally agreed marine pollution standards. Also, all states should be urged to become parties to and domestically implement the numerous existing international treaties containing highly desirable standards such as the 1973 Marine Pollution Convention. In this regard, it is notable that the pollution prevention standards of the 1969 and 1971 Amendments to the 1954 Convention for the Prevention of Pollution of the Sea by Oil have been accepted by most maritime nations as well as the oil and shipping industries and incorporated into the 1973 Convention. However, they have yet to receive sufficient ratifications to bring them into force. In the interest of minimizing marine pollution, pending the coming into force of the 1973 Convention, parties to the 1954 Convention which have not ratified the 1969 and 1971 Amendments should do so as swiftly as possible.

Enforcement of Standards

The same basic considerations which underlie the previously discussed National Petroleum Council position on the subject of unimpeded passage of commercial vessels transiting straits and other coastal waters also govern the National Petroleum Council's recommendations with respect to enforcement of vessel related internationally agreed marine pollution standards.

The National Petroleum Council urges that the enforcement of internationally agreed pollution standards applicable to commercial vessels should be shared by flag, port and coastal states as follows:

- Enforcement of internationally agreed vessel design, construction and equipment standards should remain the primary responsibility of the flag state supplemented by limited port state authority in accordance with the 1973 Convention for the Prevention of Pollution from Ships.

- Emergency coastal state action taken to prevent or mitigate pollution of its coastlines in connection with a maritime casualty involving a vessel registered in another state should always be reasonable and nondiscriminatory. Seaward of territorial seas, in situations involving maritime casualties resulting in imminent danger of major harmful pollution damage to the coastline of a coastal state, authority for such emergency action by that state in accordance with the 1969 Intervention Convention, as amended, should be confirmed.

- Internationally agreed operational discharge standards should be enforced by a combination of flag and port state measures, recognizing the right of a coastal state to take reasonable emergency enforcement action of a nonpunitive nature against foreign flag vessels when a risk of substantial damage to its coastline or other economic interests subject to its jurisdiction arises from an operational discharge alleged to be in violation of the internationally agreed standards.

- Unresolved differences among states or between states and private parties (other than between a vessel and its flag state) arising out of any action taken or not taken by a state to enforce internationally agreed standards should be adjudicated by means of the disputes settlement procedure provided for in the Convention. In this regard, vessel owners should have a direct right of action for damages against nonflag states for arbitrary interference with vessel operations or other abuses of enforcement jurisdiction in violation for the Convention.

The limited port state enforcement measures recommended by the National Petroleum Council are based on mandatory loading port and repair port inspections. If, after having made an inspection, a port state has reasonable grounds for believing that a violation has occurred, it should so inform the flag state, furnish to the flag state all evidence obtained by it to support its belief, and should itself immediately institute proceedings against the vessel for a violation of the internationally agreed discharge standards. If the flag state informs the port state, within 90 days from the giving of the port state notice, that the flag state has itself instituted proceedings against the vessel for the same violation, the port state shall discontinue its own proceeding. In order to facilitate proof of discharge, it could be provided that the arrival at a loading or repair port with clean tanks when the record books show that the vessel left the last port of call with only residue on board constitutes a *prima facie* case of a violation.

With regard to observed high seas operational discharges allegedly in violation of internationally agreed standards and not involving the risk of substantial damage to a coastline or other economic interests subject to the jurisdiction of a coastal state, a witnessing strait or other coastal state should in carrying out the port state concept of jurisdiction be authorized to interrogate the vessel in question as to name, owner, flag of registry and its next port of call. This information, together with evidence of the alleged violation would then be transmitted to the state of the next port of call and the flag state. During the call of the vessel, the port state would be required to investigate fully and when appropriate to prosecute the alleged violation in a manner similar to that which would be involved in a prosecution by the vessel's flag state. In all cases, a full report of such port state enforcement action would be promptly transmitted to the reporting and flag states. Penalties imposed by port states should be monetary only, and, upon completion of its investigation, the port state should be required to release the vessel and its crew after receiving evidence of financial responsibility up to the amount of the maximum possible penalty. Port state action in a particular case should be subject to a reasonable statute of limitations. Flag state prosecutions should take into account previous port state prosecutions in order to avoid assessment of multiple penalties for the same infraction.

Seabed Exploration and Production Facilities and Deepwater Terminals

Setting and Enforcement of Standards

Facilities for offshore exploration and production and terminal facilities present many of the same marine pollution problems as vessels, but their fundamental nature is different. Although these facilities must initially be transported to a desired location and are sometimes moved from place to place, their design criteria and operating characteristics, unlike vessels, are primarily directed towards fixed operations. However, as is the case with vessels, because of the nature of the oceans in which they operate, potential marine pollution problems relating to them as well as proposed solutions to those problems are not and cannot be limited by geographical considerations and legal concepts of national and international boundaries.

When mobile offshore drilling units and other offshore petroleum facilities are in a navigational mode, they are generally considered subject to the same standards as traditional vessels. Accordingly, the 1973 Marine Pollution Convention includes all fixed and floating platforms within the definition of "ships," and, with the exception of discharges arising directly from exploration or development, will regulate oily water discharges from petroleum offshore facilities with standards approximately equivalent to those applicable to vessels (nontankers) of 400 gross tons and above.

Minimum internationally agreed operational safety and environmental standards should be formulated for drilling rigs and platforms in the form of capabilities of these to perform under given weather and climate conditions. When drilling rigs and platforms are designed and constructed in conformity with such standards, they should be permitted to be used in areas where the given or less severe weather and climate conditions prevail. Such standards should be developed through an appropriate international organization. The international organization should obtain and take into account the technical support of the industry associations that have specialized knowledge in the field; for example, Oil Industry International Exploration and Production Forum, International Association of Drilling Contractors, International Association of Geophysical Contractors, International Association of Classification Societies and International Petroleum Industry Environment Conservation Association.

The adjacent coastal state or other authorizing body should be authorized to prescribe higher standards of this type for drilling rigs and platforms, if it determines these to be necessary after consultation with the international standard setting organization and technically competent organizations such as those listed above.

The same considerations and recommendations made above for seabed exploration and production facilities are equally applicable to deepwater terminals.

Jurisdiction to enforce all safety and environmental standards applicable to offshore facilities which are fixed and operating should be confirmed in the coastal state or other authorizing body.

Forum for Development of International Standards

The accomplishments, broad representation, organizational structure, administrative capabilities and expertise of IMCO were previously examined in connection with the setting of international safety and pollution standards for vessels.

IMCO has already begun work in the field of developing international standards for the construction and equipment of offshore drilling rigs and production platforms to ensure their safety including the avoidance of collisions. The National Petroleum Council recommends that the Law of the Sea Convention designate IMCO as the appropriate international forum in which governments should formulate agreed international safety and pollution standards, not only for vessels, but for all petroleum and other commercial facilities operating in the marine environment. However, in making their recommendation, the Council emphasizes that it is conditioned upon the expansion of IMCO's frame of reference, its organizational structure and its use of expert industry consultants to assure separate and informed determinations with respect to applicable standards for each kind of marine facility.

It is further suggested that should IMCO be so designated by the forthcoming Law of the Sea Convention, that, in due course, it be charged with analyzing the possibility of amending the 1969 Civil Liability and 1971 Fund Conventions to cover liability and damage compensation for oil spills from all marine petroleum facilities. In this regard, the industry Offshore Pollution Liability Agreement (OPOL), entered into during August of 1974 by several operators of United Kingdom North Sea offshore exploration and production facilities, is noteworthy. OPOL has been characterized by some as the exploration and production TOVALOP.

Chapter Five

SETTLEMENT OF DISPUTES

More extensive and intensive use and exploitation of ocean space can be expected to give rise to differences and disputes among users--governments, private parties and international organizations. The fact that differences and disputes arise is in no way a reflection upon the users but rather a conclusion based upon past experience and the increasing complexities of ocean uses.

All nations have an interest in maintaining peaceful and harmonious conditions in the manifold uses of ocean space and thus a concern that disputes among users be resolved peacefully and justly. Therefore, a matter of high priority in a new Law of the Sea Convention should be provision for compulsory, impartial and effective resolution of disputes arising from activities under the Convention and under rules and regulations issued pursuant to it.

This chapter addresses only those disputes which would involve a private party although another party to the dispute could be a government or its agency or an international organization. Such disputes would include those arising out of arrangements between a private party and a state or the international authority for the exploitation of seabed minerals and disputes concerning a vessel, its owner or the owner of its cargo and a state or an international organization.

The Convention should establish a Disputes Settlement Center to deal with these types of disputes and the Center should be provided with a secretariat and an adequate staff to carry out its functions. The secretariat and staff would be headed by a Secretary General of the Center.

In the event a dispute involving a private party arises, which would be subject to the settlement procedures of the Convention, the Center should first seek to effect a resolution through the use of its good offices and through mediation and conciliation efforts utilizing the assistance of experts in the subject matter of the dispute.

The Center should maintain a broadly based list of persons who would be available to act as arbitrators to consider disputes which have not been resolved through good offices, mediation and conciliation. This list should include highly qualified and impartial jurists and experts in the various uses of ocean space. In preparing and maintaining this list, the Center should receive and take into account the suggestions of recognized associations and organizations such as bar associations and other legal organizations, geological and geophysical institutes, shipping and maritime associations and offshore engineering and technical associations.

When a dispute is referred to the Center for arbitration, the list of arbitrators maintained by the Center would be made available

to the parties to the dispute who would each choose from the list an agreed number of individuals who would serve on the arbitration panel for that dispute. Those so selected would choose another arbitrator from the list to serve as umpire of the arbitration. In the event the arbitrators chosen by the parties should be unable to agree upon a choice of an umpire, the Secretary General of the Center will choose an arbitrator from the list to serve as umpire.

An award of such an arbitration procedure would be binding upon the parties to it and would not be appealable to any other court or body. The Convention should provide for the enforcement of such an award in the states party to it.

It is essential that procedures and institutions be available to act in emergency situations and take interim action pending final resolution of the dispute. This need is particularly acute with respect to disputes involving vessels which may be detained by the authorities of a state.

Interference or unnecessary delay with shipping may be very costly, not only to vessel and cargo owners, but even vital to those countries immediately dependent upon vessel arrivals for essential supplies. Thus, it is extremely important that an appropriate body be authorized by the Convention to issue emergency, interim orders to free vessels and cargoes which may have been detained or held by a coastal state. Such a release would be without prejudice to subsequent procedures on the merits of the dispute, whether negotiation, mediation, conciliation or arbitration. As a condition to the issuance of an interim order for release of a vessel or cargo, the applicant should be required to give an appropriate guarantee or other undertaking adequate to meet the requirements of a potential award on the merits finding liability on such applicant's part.

States party to the Convention should undertake to enforce such orders in their own municipal legal systems and should be bound to effect prompt releases of vessels and cargoes when an order from the appropriate body has been issued.

It is recommended that the body for receiving and acting on applications for interim emergency orders for release of a vessel or cargo be the Secretary General of the Disputes Settlement Center.

The National Petroleum Council strongly urges that the U.S. Government in the Law of the Sea Conference continue to maintain its position that a convention must provide procedures and institutions for peaceful, compulsory and impartial settlement of all disputes arising under the Convention, rules and regulations pursuant to it, and under general principles of international law, including those disputes involving private parties. Such procedures and institutions are fundamental characteristics of an orderly society, whether domestic or international. If disputes involving uses of ocean space are not subject to compulsory, peaceful and impartial settlement with accepted legal standards as a basis for decision, grave threats to international peace may well develop.

Appendices

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JAN 9 - 1974

Dear Mr. True:

Thank you for the National Petroleum Council's Report of March 1973, entitled "Law of the Sea." This report has made a genuine contribution to the clarification and understanding of the important subjects which it treats.

In view of the decision of the United Nations General Assembly to convene a Third Law of the Sea Conference and to assist the Department of the Interior in the further preparation for it, the National Petroleum Council is requested to study and report further on several key matters which will constitute important parts of a comprehensive treaty dealing with Law of the Sea.

Accordingly, this Department requests that particular attention and expertise be directed toward the matter of design and construction standards for petroleum carrier vessels to ensure safety of operation and minimization of pollution hazards. Similarly, operating standards for such vessels should also be considered.

Since it clearly appears that accelerated petroleum exploration and producing activities on the seabed will be essential to meeting requirements for energy, it would be particularly helpful for the NPC to concentrate on the state of technology and the potential for offshore oil discovery and operations in the seabed under deep water around the globe. At the same time, the Department would appreciate receiving the views of the NPC regarding international minimum standards to govern safety and pollution control of such offshore operations.

As spokesmen for our government have made clear, we consider international standards for seabed petroleum production and vessel transport of petroleum to be among the important elements of a Law of the Sea Treaty. We recognize that scientific and technological development will lead to continuing change in such standards. Thus, we would like to

have the views of the NPC regarding the methods and institutional arrangements for formulating and bringing into effect such standards.

The U.S. Delegation to the United Nations Seabed Committee introduced in Geneva in August of 1973 a series of articles dealing with the settlement of disputes arising from ocean uses. The Department would find it helpful to receive any supplementary views of the NPC on this subject.

As you know, the Inter-Governmental Maritime Consultative Organization (IMCO) has for some years been concerned with the reduction and prevention of pollution of the oceans. IMCO has concluded a series of conventions directed towards this end, including one which was signed in October of 1973. We would appreciate the NPC reviewing these treaties including the one of 1973, as they relate to the Law of the Sea and give consideration to the adequacy of these treaties from the perspective of our nation's desire to eliminate pollutants from the sea and the interrelationship of IMCO competence and its potential future role in a broader Law of the Sea organization.

In view of the fact that the first substantive session of the Third Law of the Sea Conference is scheduled to begin on June 20, 1974, in Caracas, Venezuela, we are hopeful that the NPC will provide an early response to this request as well as such other views on any matters which may be found relevant.

Sincerely yours,

Stephen A. Wakefield

Secretary of the Interior

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and Production Economics
Shell Oil Company

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Assistant General Manager
for Exploration
Texaco Inc.

William R. Walton
Chief Geologist
Amoco Production Company

Conrad G. Welling
Manager, Ocean Mining
Lockheed Missiles and Space
Company

Irvin R. Yancey
Area Offshore Engineer
Mobil Oil Corporation

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ASSUMPTIONS AND METHODOLOGY USED IN RESERVOIR ECONOMIC VIABILITY CALCULATIONS

The reservoir economic calculations shown in Tables 13, 14 and 15 of Chapter One were developed by means of a computer program. The problem was approached as if 27 separate projects were being considered (3 different reservoirs, each under 9 sets of water depth and climatic conditions). The cash flows were determined for each of the 27 projects, and only those that yielded at least 20 percent on total investment were considered as being economic; these cases are labeled "E" on the comparative tables.

Exploration, development and production capital investments were taken from Tables 6 and 8 (previously Tables 3 and 4 of the NPC interim report, *Ocean Petroleum Resources*, July 4, 1974). For each project, it was assumed that nine dry wildcats were drilled, with the tenth wildcat resulting in a commercial discovery.

Since all capital investment figures in the interim report were stated in terms of constant 1974 dollars, it was assumed for purposes of simplification that 1974 would be Year 0 for each project. Total investment was assumed to be the sum of exploratory expenditures plus net development and production expenditures, i.e., development and production expenditures net of an investment tax credit on the tangible portion of the expenditures; a 50/50 split between tangible and intangible portions was assumed. Note that the historical intangible portion is greater than 50 percent; however, future equipment cost escalation and the equipment intensive nature of offshore activities is assumed to effect a 50/50 split. Lease bonus, other acquisition costs and geological and geophysical expenses were specifically excluded.

In terms of petroleum yields, the first reservoir was assumed to have an initial producing rate of 50 MB/D, and a production decline profile resulting in total recovery of approximately 175 million barrels after 20 years. The second reservoir was assumed to have an initial producing rate of 30 MB/D, and a production decline profile resulting in total recovery of approximately 65 million barrels in a 12 year period. The third reservoir was assumed to have an initial producing rate of 15 MB/D, and a production decline profile resulting in total recovery of approximately 25 million barrels over 12 years.

For each project, values (in terms of 1974 dollars) were selected for purposes of developing cash flows. Multiplying value per barrel in each year by total production in each year resulted in a revenue stream over the life of each project.

A gross income (before tax) stream for each project was obtained by subtracting royalties, operating expenses and depreciation

each year from the revenue stream of the project. A constant royalty rate of 16.7 percent (one-sixth) was assumed (except for the "low government take" case wherein the production was assumed to be exonerated from any royalty payments). Operating expenses (non-capital costs) were estimated for each project in terms of dollars per year cost (1974 constant dollars) and then allocated on a unit of production basis over the life of the project. Accelerated depreciation (sum-of-no.-years digits method) was taken on the tangible portions of capital investment previously described after deduction of the appropriate investment tax credit.

A net income stream for each project was obtained by applying an existing U.S. federal income tax rate (48 percent) and other applicable tax provisions to the gross income stream. Cash flow streams were obtained by means of the following equation:

$$\text{Cash Flow} = \text{Revenue less} \begin{cases} \text{Royalty} \\ \text{Operating Costs} \\ \text{Taxes} \end{cases}$$

The cash flow streams thus obtained were then discounted back to a net present value of zero by means of a computer program using continuous (as opposed to discrete) discounting. The appropriate

TABLE 17

ECONOMIC CONFIGURATION FOR SAMPLE PROJECT – 200 METERS WATER DEPTH, MILD CLIMATIC CONDITIONS, MEDIUM SIZE RESERVOIR, INITIAL PRODUCING RATE 30 MB/D (Constant 1974 Dollars)

Exploration

$2.7 MM/well x 0.8 (NPC index) = $2.16 MM/well
10 wells at $2.16 MM/well = **$21.6 MM Total**

Development and Production

$95.0 MM x 0.9 (NPC index) = $85.5 MM gross investment
$85.5 MM x 0.5 tangible = $42.8 MM tangible
$42.8 MM tangible x .07 investment tax credit = $3.0 MM credit
$85.5 MM investment – $3.0 MM credit = **$82.5 MM net investment**

Total Investment (After 7% Investment Credit)

Exploration	$ 21.6 MM
Development & Production	82.5 MM
Total	**$104.1 MM**

Operating Expenses (Average Throughout Life of Reservoir)

$ .97/Bbl. x 65 MMB = **$63.1 MM Total**

discount factor, or internal rate of return, was found by the computer.

In developing Table 15 (20 percent ROI with additional investment), the total investment was increased for each project by an amount equal to $1 per barrel of total recoverable oil (i.e., $175 million for the large reservoir, $65 million for the medium reservoir and $25 million for the small reservoir). This additional $1 per barrel was considered to represent the present value effect of any added form of government take that might be imposed on any seabed producing operation.

No assumptions were made regarding improvements in offshore drilling and production technology beyond those capabilities presently envisioned. Additional improvements which may occur could significantly lower the costs of petroleum production in deeper waters and severe climates and render certain cases that presently are rated "noneconomic" as being economic. A sample project is presented in Table 17.

TABLE 18

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
1. Statistical report on penalties	Article 11(1)(f) Resolution 4	(a) To develop a standardized form on penalties (b) To collect and disseminate information on penalties actually imposed for infringement of the Convention	–	To request the Secretariat to prepare a draft form for reports on penalties for consideration by the Committee at its next session
2. Effective date of requirements for special areas	Reg. 10(7)(b)(iii) of Annex I	To establish the date from which the requirements for special areas in respect of oil shall take effect for the "Red Sea Area" and "Gulfs Area"	–	To request the Governments concerned to submit relevant information when appropriate
	Reg. 5(4)(b) of Annex V	To establish the date from which the requirements for special areas in respect of garbage shall take effect for each special area	–	To request Governments to study further the problem and to submit available information and proposals on the subject
3. Control of discharge of light refined oils	Resolution 6	To review the problems created by the discharge into the marine environment of all petroleum derived oils, particularly light refined oils	Certain information papers for the Conference, e.g. MP/CONF/15/8 MP/CONF/15/9 MP/CONF/C.2/WP.19	To request GESAMP to complete its work on the impact of oil on the marine environment as soon as possible
4. Oil discharge monitoring and control system	Reg. 15(6) and Reg. 9(1)(a) of Annex I	To review the availability of oil discharge monitoring and control equipment particularly for light refined oils To develop procedures for discharge of light refined oils until such equipment is available	–	(a) To request Governments and Organizations to supply information on availability of such equipment (b) At the next session to consider information provided and decide on action necessary to proceed with the work on the matter
	Resolution 10	To develop sensitive, accurate and reliable oil content measuring instruments to cope with the full range of oils covered by Annex I	Resolution A.233(VII)	(a) To request Governments and Organizations to submit relevant information (b) To examine Resolution A.233 (VII) with a view to its improvement

TABLE 18 (Continued)

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
5. Identification of the source of discharged oil	Resolution 7	To develop a standard method to identify promptly discharged oil	The problem was studied by some countries (see MEPC I/INF.2, MEPC I/INF.5, MEPC I/INF.5/Add. 1	To urge Governments to continue research into the problem and to submit available information
6. Draught requirements for segregated ballast tankers	Reg. 13 of Annex I and Resolution 8	To examine ballast draught requirements with a view to determining whether any improvement is required with special regard to the need for a more specific requirement for tankers of less than 150 meters in length	Certain work was carried out by the Sub-Committee on Ship Design and Equipment and during the Conference	To request the MSC to study this matter with high priority
7. Tonnage measurement of segregated ballast oil tankers	Resolution 9	To study the matter of equitable determination of gross and net registered tonnage for segregated ballast oil tankers in comparison with existing oil tankers of equivalent productive cargo deadweight	–	To request the MSC to study the matter
8. Categorization of liquid substances	Reg. 3(4) of Annex II Resolution 14	(a) To review the criteria used to define category D substances and to categorize liquid substances provisionally assessed by governments (b) To revise Appendices II and III of Annex II in order to include there all liquid substances known to be carried in bulk	Over 400 substances have been categorized by an Ad Hoc Panel of IMCO and GESAMP Experts. MP/CONF/INF/15/4 (ICS) contains a list of over 500 substances known presently transported in bulk which have not yet been assessed or categorized	(a) To request Governments and Organizations to pursue and encourage studies on environmental hazards of such substances (b) To provide information as specified in Annex to Resolution 14 (c) To ask GESAMP if it can continue work on the problem in a similar way as was done previously (d) To review at its next session the information received and consider further action to be taken

TABLE 18 (Continued)

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
9. Procedures and arrangements for the discharge of noxious liquid substances	Regs. 5(2)(b) 5(3)(b) 5(8)(c) 5(9)(b) of Annex II Regs. 5(5) 5(10) of Annex II and Resolution 13(a) Reg. 8(4)(a) of Annex II and Resolution 13(a)	(a) To develop standards for: (i) Procedures and arrangements for the discharge of noxious liquid substances in Category B and C (ii) Ventilation procedures for removal of cargo residues containing noxious liquid substances (iii) A preliminary procedure for cleaning of a tank which carried noxious liquid substances in Category A, in order to achieve the prescribed residual concentration as an alternative to actually sampling and analyzing the effluent	Certain studies have been carried out by Norway – Study IX Netherlands PCMP/4/15 USA (MP XIII/2(a)/12)	(a) To invite Governments and Organizations to initiate and continue studies on the matter and submit available information (b) To review at its next session the information received and consider further action to be taken (c) To inform MSC of planned activities which should be carried out in cooperation with the MSC
	Resolution 13(b)	(b) To review the Cargo Record Book contained in Appendix IV of Annex II, taking into account the standards for procedures and arrangements developed	–	
10. Development of scientific information on water quality criteria	Resolution 12	To examine the method of procedure necessary to establish water quality criteria for the protection of the marine environment	–	(a) To bring Resolution 12 to the attention of GESAMP (b) To request Governments to encourage studies on the matter and submit available information for transmission to GESAMP
11. The amendment of the Bulk Chemical Code	Resolution 15	To amend the Code to include requirements necessary from the marine pollution prevention point of view and also to ensure consistency with the provisions of the Convention	See paragraph 23 of MEPC I/3	To request the MSC to continue its work on the Code

TABLE 18 (Continued)

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
12. Prevention of pollution by liquefied or compressed gases carried in bulk	Resolution 16	To complete the Gas Carrier Code	The Code is under preparation by the Sub-Committee on Ship Design and Equipment	To request the MSC to continue its work on the Code
13. Prevention of pollution by noxious solid substances carried in bulk	Resolution 17	To pursue and encourage studies of the impact that the carriage of noxious substances in bulk by ships may have upon the marine environment	Investigations were carried out by Norway (Study IX) which also prepared draft Regs. for the control of pollution by noxious solid substances carried in bulk (PCMP/WP. 17)	(a) To invite Governments and Organizations to submit relevant information and comments on the draft Regulations (PCMP/WP.17) (b) To consider further at a future session draft Regulations on the basis of information and comments on the draft received
14. Prevention of pollution by harmful substances carried by sea in packaged forms or in freight containers, portable tanks or road and rail tank wagons	Resolution 19	(a) To pursue and encourage studies of the impact that the carriage by sea of such harmful substances in packaged forms etc. may have upon the marine environment (b) To revise the International Maritime Dangerous Goods Code to cover marine pollution aspect (c) To develop further the provisions of Annex III of the 1973 Convention	Work is under way within the CDG Sub-Committee	(a) To invite Governments to encourage and continue studies on the matter (b) To request the MSC to continue its work
15. Research into the effect of discharge of ballast water containing bacteria of epidemic diseases	Resolution 18	To take appropriate action and initiate studies of the matter on the basis of any evidence and of proposals which may be submitted by any Government	–	(a) To invite Governments to submit information and evidence, if any (b) To request the Secretariat to maintain contact with WHO on this matter
16. Standards and test methods for operational requirements of a sewage treatment plant and rate of discharge	Reg. 3(1) (a) (i) and Reg. 8 of Annex IV, Resolution 20	To develop standards and test methods	Investigations of sewage treatment systems and discharge standards were carried out by Canada – Study VIII (MP/CONF/INF.14/1)	(a) To invite Governments to submit proposals on discharge standards (b) To study information and proposals provided by Governments at the next session of the Committee

TABLE 18 (Continued)

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
17. Promotion of Technical Cooperation	Resolution 22	To promote support for those States which request technical assistance relating to the prevention and control of pollution of the marine environment by ships	Technical assistance is being provided by IMCO to developing countries in the field of maritime transport within its competence including both ocean and coastwise aspects in the form of experts, fellowships and specialized training	To request the Technical Cooperation Committee to consider and initiate appropriate action for the exchange of views among Governments through the Organization, in the field of technical cooperation regarding the 1973 Convention in general and the early implementation of the provisions of Resolution 22 in particular
18. (a)-(d) Intentional pollution of the sea and accidental spillages	Resolution 5(a)	(a) To collect scientific data on the identification of harmful substances	Work by the Ad Hoc Panel of IMCO and GESAMP Experts	To review the work programme of the Organization from a marine pollution point of view and formulate an outline for special projects which will be an effective measure for the promotion of safety at sea and the protection of the marine environment. Such outline should be formulated in cooperation with other relevant bodies of the Organization
	Resolution 5(b), 5(c)	(b) To collect ship casualty statistics	Some work is being carried out by the MSC	
	Resolution 5(a) (i)- (iv)	(c) To develop measures for the prevention of accidents to ships	Most of the items are being dealt with by the MSC	
	Resolution 5(b)	(d) To develop measures for the minimization of the risk of escape of harmful substances after accidents	Certain work is under way by the DE Sub-Committee	
18. (e) Tank cleaning	Resolution 5(c) (i)	(e) To develop new techniques and methods for cleaning, recycling and disposing of hazardous substances carried by ships	Certain work has been carried out by ICS and OCIMF in developing Clean Seas Guide (see MP XIV/6/6)	To request ICS and OCIMF to study further the problem and to make proposals for consideration by the Committee (a) To consider at its next session draft of outstanding sections of the Manual on Oil Pollution to be prepared by "lead countries" (b) To review the "Manual on Oil Pollution" with a view to its updating, particularly on the methods dealing with large scale spillages (c) To consider the extension of the Manual to cover substances other than oil
18. (f) Pollution manual	Resolution 5(c) (ii)	(f) (i) To develop devices and chemicals used in dealing with oil and other harmful substances discharged in the sea (ii) To complete pollution manual	MP Sub-Committee has carried out certain work (MEPC I/6, paragraphs 7-9)	

TABLE 18 (Continued)

ACTION PLAN OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Subject	Source	Action Required	Previous Work	Initial Course of Action
19. Reception facilities for residues	Resolution A.235 (VII). Regulations: 12 of Annex I 7 of Annex II 10 of Annex IV Resolution 21	To ensure the provision and maintenance of adequate reception facilities as soon as possible in compliance with the provisions of the Convention and its Annexes	IMCO Publication "Facilities in Ports for the Reception of Oil Residues"	(a) To request Governments and other interested bodies to supply data on availability of reception facilities as required by the Convention and its Annexes as soon as possible. (b) To consider the need to initiate technical studies into the most efficient and economical methods of providing reception facilities and destruction of residues, especially of chemical noxious substances.
20. The complete elimination of oil pollution from ships	Resolution 3	To identify projects necessary for the achievement of the goal set out in the Resolution 3	–	To request Governments to initiate studies into the problem and to fix target dates for the completion of the necessary projects
21. Marine environment protection	Resolutions 23, 24 and 25	To undertake necessary action on matters which will arise from the United Nations Conference on the Law of the Sea	–	To consider any matters arising from the United Nations Conference on the Law of the Sea which would have an impact on the work of MEPC
22. Methods of enforcement of the present Convention	Resolution 1	To initiate action by Governments towards early implementation of the 1969 and 1971 Amendments to the 1954 Oil Pollution Convention	Resolution A.236(VII) Resolution A.237(VII)	(a) To urge Governments to give effect to the 1969 and 1971 Amendments to the 1954 Oil Pollution Convention as soon as possible (b) To request Governments to examine possibilities of tanker inspections at loading ports and repair ports and to submit proposals on other methods of enforcement of the Convention

Source: "Report of the Marine Environment Protection Committee on its First Session," IMCO Document MEPC I/10, March 8, 1974.


A. Petruccelli