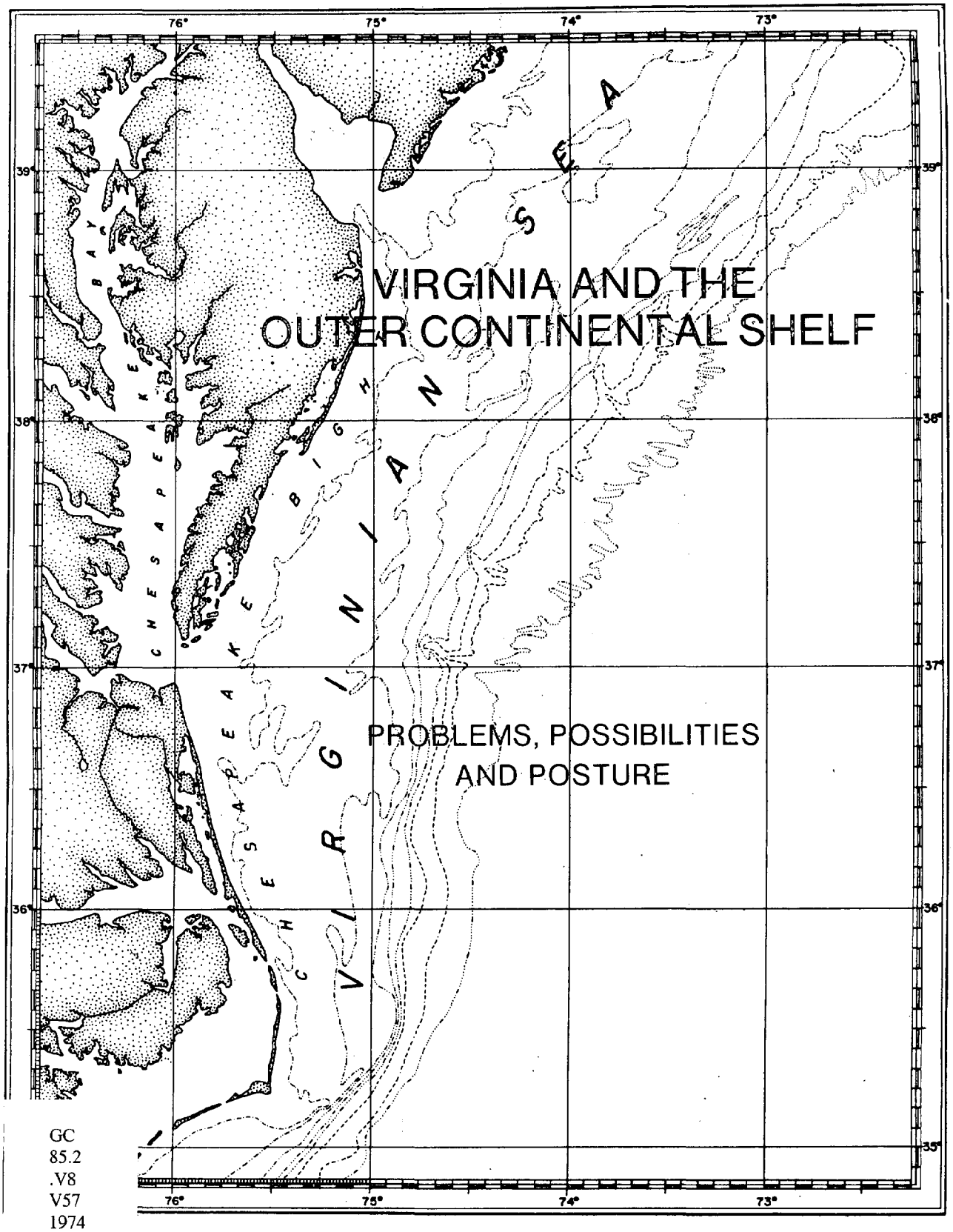

VIRGINIA AND THE OUTER CONTINENTAL SHELF

PROBLEMS, POSSIBILITIES AND POSTURE

VIRGINIA
AND THE
OUTER CONTINENTAL SHELF:
PROBLEMS, POSSIBILITIES,
AND
POSTURE

A

Report

of the

Outer Continental Shelf Advisory

Committee

(Ad Hoc)

November, 1974

COMMONWEALTH OF VIRGINIA

OFFICE OF THE GOVERNOR

COUNCIL ON THE ENVIRONMENT

GERALD P. McCARTHY
ADMINISTRATOR
P. O. BOX 790
RICHMOND 23206

November 7, 1974

Honorable Earl J. Shiflet
Secretary of Commerce and Resources
Commonwealth of Virginia
910 Capitol Street
Richmond, Virginia 23212

Dear Secretary Shiflet:

I forward herewith the report of the Outer Continental Shelf Advisory Committee prepared in response to your request for a proposed State policy for the Commonwealth related to the development of the Outer Continental Shelf (OCS).

The report states that damage to the offshore environment is not likely to be great, but warns of gaps in our knowledge of the inhabitants and environment of the area, as well as the effects of oil spills upon them. The possibility of a catastrophic spill, with its attendant effects upon wetlands and beaches, must be considered. Permanent structures on the OCS will interfere with navigation, and constrain commercial fishing in the area, although they may act as artificial reefs, enhancing sport fisheries.

The entire OCS area of study, understandably, poses many legal and governmental problems that could not be addressed within the time constraints of this project, especially in view of yet to be determined rights in all the lands and natural resources of the bed of the Atlantic Ocean beyond three geographical miles from the coastline; nevertheless, these problems impinge upon the area of state and local concern. Our control of the OCS lands is not assured. The Committee, therefore, believes that our opportunity to control potential development from the discovery of oil and gas on the OCS of Virginia is dependent, in part, upon the outcome of the Commonwealth's offshore litigation now pending in the United States Supreme Court. Accordingly, alternative recommendations are proposed by the Committee, recommendations that are based upon the degree of Virginia's control of the waters and lands adjacent to the onshore areas.

The report recommends that measures to control development should insure preservation of the traditional lifestyles and values of Virginia's coastal citizenry. In this regard, the Committee believes that the state should develop criteria for the siting of facilities with greater than local impact.

The Committee is cognizant of the complexities of our subject, and offers this report in the hope that its recommendations will catalyze the necessary action to fulfill the expectations initiated by your request. It is the hope of the Committee that this report can be useful to you, the Governor and interested members of the General Assembly in order that the entire spectrum of OCS problems and proposals can be given early consideration.

On behalf of the Committee I thank you for the opportunity to contribute to Virginia's preparation for meeting the challenges posed by the development of the Outer Continental Shelf resources.

Sincerely,

Gerald P. McCarthy

Gerald P. McCarthy
Chairman

GPM:dja
Enclosure

PREFACE

The Outer Continental Shelf Advisory Committee was established by the Secretary of Commerce and Resources, Earl J. Shiflet, in July, 1974. This action was taken based upon the realization that the Atlantic Outer Continental Shelf (OCS) was a likely area for the development of offshore oil and gas resources, and that such development could have profound and far reaching impacts upon the Commonwealth. Such impacts could either be beneficial or detrimental or both, depending greatly upon the preparations made by the Commonwealth beforehand. Accordingly, Secretary Shiflet charged the OCS Advisory Committee to consider all facets of the situation, and to prepare a report recommending a posture for the Commonwealth.

The following report represents a first step in an effort to engender debate and discussion of the issues involved in the question of OCS development. It is the feeling of the committee that, while further discussion is necessary, and encouraged, on some particulars, there is general consensus on the content, conclusions, and recommendations presented herein.

OUTER CONTINENTAL SHELF

ADVISORY COMMITTEE

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Council on the Environment

Chairman

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Project Leader

ACKNOWLEDGEMENTS

This report is the result of the joint efforts of the agencies of the Outer Continental Shelf Advisory Committee. All made valuable contributions. Worthy of special note was the work of the personnel of the agencies designated as "core" agencies in the preparation of this report. These were:

Mr. Julian Alexander
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Virginia Institute of Marine Science
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The core agencies furnished the authors for the individual sections, and to these people is due a large share of the credit for this report. They, and the sections they wrote, are as follows:

Dr. Donald Boesch - VIMS
III - Offshore Area

Mr. Thomas Bernard - VIMS
IV - Interface Area

Mr. Daniel Jones - DSPCA
Mr. Keith Buttleman - DSPCA
V - Onshore Area

Mr. Gerald Baliles - Attorney General's Office
Appendiz A - U.S. v. Maine, et al

Section I - Executive Summary, and Section II - Background, were written by the project leader, who also served as editor. The remaining section, VI - Recommendations, was a group effort.

In addition to these "core" agency personnel valuable assistance was made by the following individuals:

Mr. Bill Craft
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Mr. O. H. Adams
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Mr. James F. McInteer
Commission of Game and Inland
Fisheries

Mr. Henry J. Hughes
State Air Pollution Control
Board

Mr. Carl Schreiber
Commission of Outdoor Recreation

Input from the petroleum industry was provided by Dr. Wilson Laird of the American Petroleum Institute, who not only provided voluminous amounts of literature, but also traveled to Gloucester Point to discuss the situation with members of the core agencies. His assistance is gratefully acknowledged.

Mrs. Virginia Camechis patiently typed and retyped the many drafts and the final copy.

Mr. W. S. G. Britton and the Virginia Department of Highways are responsible for reproduction of the document.

To all these people goes the sincere thanks of the project leader. Lady and gentlemen, it has been my pleasure.

John B. Pleasants
Virginia Institute of
Marine Science
Project Leader

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I

Executive Summary

The possibility exists for the discovery of both oil and gas off the coastline of Virginia. The area of interest is called the Baltimore Canyon Trough, which is near the edge of the continental shelf in our waters. This report attempts to evaluate the impact of such a discovery on Virginia and to make plausible recommendations for action by the Commonwealth to control any resulting development, both offshore and on.

The area of our concern for purposes of this report has been divided into three sections as follows:

Offshore - from the edge of the shelf to the three mile limit of the marginal sea

Interface - from the three mile limit to the upper of the limit of the wetlands, and

Onshore - from the upper limit of the wetlands inland

The quantity of oil and gas on the Outer Continental Shelf (OCS) - or even its existence - is unknown. We have assumed a major find on the assumption that if our posture is adequate for a large find, it will also prove sufficient for anything less. Other necessary assumptions are also made, including:

(1) Development of related industry onshore will

take place on the Eastern Shore, in Hampton Roads, or in the York River entrance.

(2) Leasing by the Federal government could begin as early as late 1975.

One of the primary facets of the problem of OCS development is in the yet unanswered question of ownership. Virginia is party to a suit against the Federal government (U.S. v. Maine, et al.) for title to the continental shelf to a distance of one hundred miles. Should the Supreme Court rule in favor of the states, all royalties, rents, and bonuses from the leasing of OCS oil lands would accrue to the commonwealth, but a mechanism within the state government would have to be established to handle these complex affairs.

The United States has become increasingly dependent on foreign petroleum. This dependence will continue, but the development of OCS oil and gas could serve to reduce the rate of growth of these imports. This would have a favorable effect on our balance of payments. If petroleum is brought ashore from the OCS by pipeline, it would likely be environmentally less damaging than if an increasing number of tankers were used.

Currently, about one eighth of our domestic oil and gas production is from offshore wells, largely in Louisiana and California. Many foreign countries also exploit their OCS areas. There have been only four spills of greater than 5,000 barrels from the more than 17,000 wells drilled at sea. A recent study by the federal Council on Environmental Quality

(CEQ) estimates very little probability of oil from a spill in Virginia's OCS area impinging on the coast. The most likely month for such an occurrence is August, and the probability then is five percent. This has been questioned by some scientists.

Further, oil was spilled in great amounts on Virginia's coast during World War II and has had no readily apparent long-term effects.

Also to be considered, however, are the effects of chronic hydrocarbon pollution in minute amounts on the biota of the OCS area. These effects are largely unknown. By-products of drilling may also have localized effects.

The possibility for financial benefits of considerable importance accruing to the state is excellent if oil or gas are found off our coast. Jobs will be created not only in the oil industry itself, but in supporting industries, as well as secondary development such as restaurants, shopping centers, and housing.

Against these benefits must be weighed the possibility of environmental damage, which could affect such established industries as tourism and commercial fishing. Other costs would be incurred in the area of public services.

The major concerns by area are as follows:

Offshore Area

(1) The incorporation of oil in sediments either through the catastrophic or chronic discharge of petroleum to the environment.

(2) Sub-lethal effects of chronic discharges of petroleum.

(3) The effects of oil spills on sea birds.

Interface Area

(1) The effects of large scale dredging if new port facilities are developed. The disposal of spoil is also of concern.

(2) Effluents, wetlands destruction, water usage and the increased chance of spills of refined products due to location of satellite industries in the Interface area.

(3) The effects of a spill of refined products in Chesapeake Bay. This could seriously affect the estuary for up to five years. A spill of refined or crude oil could severely affect tourism at Virginia Beach if it reached shore, and could have serious effects on the water bird population.

(4) Present techniques for cleaning up oil spills are not satisfactory, especially in rough seas.

Onshore Area

(1) Uncontrolled development, particularly on the Eastern Shore.

(2) Air and water pollution from industrial and secondary development.

(3) Water demand to support the projected development.

(4) The requirements for increased public services.

In order to control the situation, recommendations are made as follows:

Overall Recommendations

(1) Insure compatibility between any OCS actions and the currently evolving Coastal Zone Management Plan.

(2) Oppose any drilling on OCS lands until an effective oil spill cleanup association similar to those in other areas has been formed.

(3) Support research designed to fill the gaps in our knowledge of the marine environment and the effects of hydrocarbons on the biota, particularly in the offshore area.

(4) Formalize and continue the present OCS Advisory Committee (ad hoc).

Recommendations for the Offshore Area

If Virginia is awarded control:

(1) Establish leasing, production, and inspection regulations similar to those of the Federal government.

(2) Assign responsibility for all OCS lands to a state agency. The Virginia Marine Resource Commission, if greatly expanded and properly equipped and funded, might be a logical choice. Alternatively, a new agency could be created.

Should the federal government be awarded control:

(1) Create an office to coordinate all contacts between state and Federal agencies and industry in regards to the OCS area.

(2) Support federal legislation requiring sharing of monies received by the Federal government from OCS lands.

Recommendations for the Interface Area

(1) Restructure the Wetlands Act to encourage planning instead of reaction on a case-by-case basis.

(2) Develop criteria for approval of permits for the placing of structures, including pipelines, in the marine environment.

(3) Control pipeline access through the Interface area to keep the number of corridors to a minimum.

Recommendations for the Onshore Area

(1) Encourage and assist local governments to plan for and regulate projected growth in their areas.

(2) Conduct a study as to the use of any funds derived from the OCS lands.

(3) Frame and enact legislation requiring the state to increase its role in planning for and controlling siting of developments, such as refineries, of regional as opposed to local impact.

II

Background

Scope of the Study

This report concerns itself with the impacts upon Virginia and Virginians of the possible exploration for, and exploitation of petroleum resources on the Outer Continental Shelf (OCS) lying to the east of our state. It further recommends courses of action to control the development of these resources as well as that of the possible supporting industries which may be based in our state.

In order to address these problems, this report will discuss our current coastal environment, the effects of drilling, the laying of pipelines, and air and water pollution that could be caused by industrial and secondary development on shore. The possible effects of catastrophic and chronic oil spills will also be considered.

The social effects will be addressed. As an example, should a predominantly rural area become the setting for a refinery or a large logistical support operation, the social implications--the changing lifestyles, patterns of employment, the arrival of large numbers of outsiders--might create problems with which the local area is ill equipped to cope.

Legal problems will be discussed. These include consideration of the outcome of the court case (U.S. v. Maine, et al) to which Virginia is party, as well as the

possibility of future decisions by the upcoming Law of the Sea Conference to be held in 1975, which may increase the breadth of the territorial sea.

The economic effects of the development of the OCS will also be considered.

To facilitate this study, we have divided the area of concern into three geographic areas as follows:

Offshore Area - This is defined as extending from the outer limits of exploitation up to the three mile limit of the marginal sea.

Interface Area - This area covers the three mile marginal sea and extends inland to the upper limits of the wetlands as defined by Virginia's Wetlands Act of 1972 (one and one half times the tidal range above mean low water).

Onshore Area - This includes everything landward of the upper limit of the wetlands.

Each area will be discussed in detail in separate sections of this report.

Assumptions

There are many factors involved in the development of the OCS which are at this point in time completely indeterminant. Basic to the entire study, of course, is the question "Is there oil off Virginia's Coast and, if so, how much?" Since there has been no known exploratory drilling to date, this question cannot be positively answered at present. This and other presently unquantifiable factors led

to the necessity of making certain assumptions. Since the entire report is based on these assumptions, it seems logical to state them here.

For the purpose of this report, it is assumed that:

(1) The area of the petroleum discovery considered will be somewhere off the coast of the middle Atlantic States, most importantly between latitudes 36 32'N and 38 05'N, and will be on the continental shelf or slope.

(2) The volume of production will be in the high range of possibility, on the order of .75 million barrels per day by the year 1985, and 1.5 million barrels per day by 2000. Gas discoveries will produce on the order of .9 billion cubic feet per day by 1985, and 3.6 billion cubic feet per day by 2000.(1)

(3) Development or related industry will take place on the Eastern Shore, in the Hampton Roads area, and possibly to some degree in the York River entrance area. The year 1985 is the target year for which impacts are assessed.

(4) If the State should be granted title to 100 miles of the OCS, leasing for exploratory drilling would likely begin sometime in late 1976 or early 1977. If the federal government is assigned control, leasing might begin

as early as January 1976. Based on these starting dates, the following schedule is assumed.

Action	OCS Title Holder	
	Virginia	Federal Govt.
Leasing	1977	1976
Exploratory Drilling	1978	1977
First Production Platforms	1981	1980

(5) The years of 1986 and 1987 are assumed to cover the period of peak construction effort.

(6) The period of production will be on the order of 30 to 40 years.

Discussion

During its industrial era, our contry has always had access to abundant, inexpensive energy. Consequently, we have developed a society that is centered upon this abundance. We are the world's most mobile people. Our automobiles are more numerous and larger than those of other countries. We, constituting about 1/17th of the population of the earth, utilize nearly 1/3rd of the world's energy. Of this, approximately 78 percent comes from oil and gas. (1) Energy consumption in the U.S. has doubled in the past thirty years on a per capita basis. By 1985, total consumption may be twice what it is today.

With this in mind, it is unfortunate that we have become increasingly dependent on imported petroleum. This

fact was brought sharply home to us during the winter of 1973-74, when the Arab Oil Embargo lowered speed limits, thermostats, rate of production and morale.

The end of the embargo, however, did not mean the end of the supply problem. The petroleum was there, all right, but the price had quadrupled. Even without price increases, economists had predicted problems with our balance of payments vis-a-vis the Arab world due to our soaring demand for oil. With the increases, these problems become even more acute.

All predictions indicate that continued petroleum imports will be required, whether or not the OCS resources are developed, at least until 2000. This will be despite any savings that may result from even very stringent conservation measures. Our best approach to closing the gap between supply and demand therefore consists of reducing dependence upon imports to the maximum extent practicable by increasing domestic production to complement present or potential sources of energy such as coal, shale oil, geothermal, and nuclear fission. Nuclear fusion, which promises clean, nearly inexhaustible energy, may be the long term solution.

In our current situation, however, the environmental trade-off appears to be:

(1) Increase imports of foreign crude oil.

This implies either a much greater number

of standard tankers, or the establishment of deepwater ports to handle VLCC (Very Large Crude Carriers). If standard tankers are chosen, transportation costs will be much higher than for VLCC, and the risk of spills in inshore estuarine waters is much more severe. If VLCC are chosen, the fuel must either be transshipped at a deepwater port to smaller tankers that can enter our ports, or pipelines from single point mooring systems or islands must be laid. Dredging channels for VLCC is considered impracticable due to the depths (on the order of 100 feet) required.

(2) Develop our OCS petroleum resources. This involves certain environmental risks, including the laying of pipelines, but reduces the number of tankers entering port, as well as promoting our national independence of foreign oil and having a beneficial effect upon our balance of payment. Some increase in importations may still be required, however.

Against this background, the United States under Presidential direction has embarked on a program to develop independence of outside energy sources by 1985. As an important part of this drive for independence, it has been decided by the federal government to increase drastically

the acreage of the continental shelf available for leasing to ten million acres in 1975. At the time of the Presidential energy message (23 January 1974) in which the tripling of the original OCS leasing was directed, a commitment was made to conduct an environmental study by the federal Council on Environmental Quality (CEQ) prior to any leasing. This study has been completed, and forms a very valuable source book for this report.(1)

It is important to understand at this point that there is nothing new or untried about offshore drilling. In 1972, some 12% of our domestic petroleum production and 13% of our natural gas production was from offshore wells, and many foreign countries as well depend upon American developed equipment and expertise in the exploitation of the petroleum resources of their continental shelves.(1) According to Mr. Charles D. Mathews, President of the National Ocean Industries Association, over 17,000 wells have been drilled at sea. Of these, only four have had spills in excess of 5,000 barrels. He feels, to be fair, this very small percentage should be considered when one contemplates the possibility of an oil spill affecting the coast. As an example, the CEQ study gives as the greatest possibility of oil from the southern end of the Baltimore Canyon Trough reaching shore as five percent in the month of August.(1) If we follow Mr. Mathews' argument, this five percent should be multiplied by the chance of the spill oc-

curring in the first place, which would give a nearly negligible chance of oil impinging upon the coast.

Oil spills upon our coast are not unknown. During World War II, about four million barrels of oil were released by torpedoed tankers and other ships off our Atlantic and Gulf Coasts. No clean-up effort was made due to the press of wartime activities. Although no baseline data are available, and sub-lethal effects are unknown, there was no readily apparent long term damage from this massive pollution.(4)

Estimates of resources available on the Atlantic Continental Shelf vary widely, but are in the range of 5 to 20 billion barrels of economically recoverable crude oil, and 55 to 110 trillion cubic feet of natural gas.(1)

The most likely portion of the continental shelf off the middle Atlantic States for the discovery of petroleum is known as the Baltimore Canyon Trough. The trough, which is a depression in the basement rock in which a thick layer of sediment has been deposited, commences at about 40° north latitude (roughly the latitude of Philadelphia). It parallels the edge of the continental shelf with a bulge towards the mouth of Delaware Bay. At about the Virginia-Maryland boundary it crosses the edge of the shelf going seaward to the south.

The trough, then, is in somewhat the shape of the cross section of a shallow bowl, with the base of the bowl off Delaware Bay. Here the trough seems to reach its

greatest depth and consequently here the area of the thickest sediments is found. According to Dr. Wilson Laird of the American Petroleum Institute, this is the area of predominate interest.(5) The trough continues down into our waters and though the sediments are not as thick here, considerable interest remains.

As previously stated, there has been to date no reported exploratory drilling on the Atlantic OCS of the United States. However, off the coast of Canada, in similar sedimentary deposits on the Nova Scotia Shelf, 89 exploratory wells have been drilled. These indicate the presence of hydrocarbons, particularly natural gas and natural gas liquids. At the time of the preparation of the CEQ report, four wells had indicated commercial quantities.(1)

The prospective resources of the Atlantic OCS must be viewed against the national supply of, and demand for petroleum. During 1973 the situation was as follows:

1973 CRUDE OIL AND NATURAL GAS DATA

	Crude Oil (Thousand Barrels)	Natural Gas (Million Cubic Feet)
Domestic Production	3,360,903	22,647,559
Total Consumption	*4,549,734	22,965,914
Imports:		
Crude Oil	*1,183,996	1,032,901
Unfinished Oils	* 50,161	(Canada accounted for
Plant Condensate	* 37,475	99.5% of the total
Refined Products	* 991,891	imports above.)

*Preliminary Figure - Subject to Change - Final Figures will not be available until January 1975.

Source: U.S. Bureau of Mines

Transportation of petroleum or natural gas resources from the area of their discovery to shore will of course be of crucial importance to any study of the impact of the development of the OCS. The means employed for such transportation depend greatly upon the size of the resource to be transported. In the case of oil, a large discovery would dictate the use of pipelines; in line with our basic assumption, this is the prognosis for our shelf. Tankers or barges are utilized for smaller amounts and, as well, may be used in the early stages. It is not clear at what level of resource recovery pipelines become economically viable, but the savings accruing through the use of a pipeline must amortize the line within a reasonable period of time (on the order of twenty years).(5) Natural gas will in any case require pipelines, since no technology currently exists for liquifaction at sea for transport by tankers.

Pipelines have much to recommend them from an environmental standpoint once they are in place. Their record as regards spillage is generally excellent as compared to tankers. Burial of pipelines which are laid in less than two hundred feet of water is now required by the regulations of the U.S. Geological Survey. Of course, the area affected by dredging for pipelines is miniscule when compared to the total area of the shelf. On shore, it is most common to lay pipelines in wetlands in dredged canals. This can obviously cause serious local environmental damage by disrupting drainage patterns and burying the biota as well as physically removing it. Turbidity, variations in salinity and changes in current flows can also result.

A further possibility to be considered is that of temporarily storing petroleum at sea in the area where it is produced. This may be done in elevated, floating, or bottom standing depots. The first is quite limited in size. The floating storage barges currently in use may hold as much as one million barrels, and be secured to a single point mooring system (SPM), which also serves as a loading/unloading facility.(1)

The bottom standing systems may be completely submerged, as in the Persian Gulf, or a surface-piercing type similar to Ekofisk in the North Sea, which also has a capacity of one million barrels. Both of the above systems employ single point mooring for loading and discharging their contents.

As a final thought, the problem of transportation of

refined products from Virginia must be weighed. These refined products (such as number 2 fuel oil) are far more hazardous to the marine environment than crude oil or gas, and consideration must be given to the method of their removal from areas in the Commonwealth where they may be produced. Barges, tankers, trucks, tank cars and pipelines are all possibilities.

Description of the Area

The area of our primary concern is between Cape Cod and Cape Hatteras, named "The Virginian Sea" by Captain John Smith circa 1607. Particularly, of course, we are interested in that portion that lies off the ocean coastline of Virginia. When one contemplates the possibility of the use of barges or tankers to transport petroleum, plus the possibility of effluents from supporting construction, it becomes apparent that some consideration must also be given to Chesapeake Bay, and at least the lower James and York rivers. The description in this section is intended to be general, with more detailed discussions contained in succeeding sections of the report.

Essentially, the continental shelf off our coast is gently sloping and relatively smooth. There are some sand ridges separating troughs wherein the sediment tends to be finer. These systems are usually oriented parallel to the coast, and are the result of the actions of waves and currents. There are patches of shell, sand, gravel and mud.

The slope is much steeper as it descends to the abyssal floor, and rocky projections are frequent.

The biota is varied, and many sport and commercial species are represented, including the American lobster in the rocky cover of the slope. The shelf itself produces surf clams, several species of flounder, sea bass, scup, hake, and other commercial species. The superjacent waters produce tuna, dolphin, bluefish and mackerel, as well as menhaden. Much of the area is used as a spawning grounds for several marine species, with a great fan shaped deep current acting as a transport system to carry the larval forms into the Chesapeake Bay. Although exact parameters for this inward flowing current are not known, the overall concept must be kept clearly in mind, since the implications for the eventual transport of deep offshore pollutants into the bay are clear.

Additionally there are many varied species of plankton, seasonally dense, which are the base of the food web, and great numbers of benthic organisms which, while not commercially exploitable, are of vital importance in the overall scheme.

The oceanic coast of Virginia is divided into two parts by the entrance to Chesapeake Bay. The northern part is characterized by a chain of barrier islands protecting extensive salt marshes from the Atlantic Ocean, with associated lagoons and winding creeks. Since there is relatively little fresh water inflow to the system, the salinities are usually fairly high, ranging upwards from about 18 parts per thousand to normal sea salinity of 35 parts per thousand. The area is in a nearly natural state, and most of the barrier islands are in the hands of the federal government, The Nature Conservancy or the state.

The beach front south of the bay entrance is a long continuous beach, the greater portion of which is devoted to the tourist industry, and well developed for that purpose.

Chesapeake Bay is an estuary, which implies the mixing of fresh water from rivers with the heavier saltier water from the ocean. The bay follows the classic pattern of estuaries, with fresher water flowing seaward on the surface, and saltier water moving upstream along the bottom. Due to the effects of the earth's rotation, one finds saltier water along the eastern shore as opposed to the western bank. The entire system moves in and out with the ebb and flow of the tide. Virginia's three great rivers--the James, the York, and the Rappahannock--enter the bay from the west, as does the Potomac, which lies largely within the state of Maryland. The rivers are estuaries themselves and grow less saline as one proceeds upstream. They also follow in general the classic estuarine pattern described above.

The bay floor is relatively smooth and flat, with its deepest portion following the river bed of the ancient Susquehanna. The bay is actually the drowned valley of this river and in fact, the Susquehanna still provides about 50 percent of the annual freshwater input to the bay.

The bay is extremely shallow for its width. As a comparison, if the width of the paper upon which this is written is taken as the width of the bay, the thickness of the sheet is relatively greater than the bay's depth. All along the bay shore there are extensive areas of shallows

and wetlands upon which the productivity of the bay depends to a great degree. This is particularly true of the western shore.

There are many commercial species dependent upon the bay and its wetlands at some point in their life cycle. Rockfish, shad, herring, croaker, spot, flounder, bluefish, menhaden, blue crabs, oysters, clams, scallops--the list is very extensive. All are important to Virginia's economy, and all could be affected by the chronic or catastrophic release of hydrocarbons.

The oyster industry, one of the most valuable of Virginia's commercial fisheries, is particularly vulnerable to any disruptions in the James River, since the seedbeds there produce the majority of the seed oysters upon which the industry depends.

The land environment in the area of our concern is also of importance, since it is here that development to support the exploitation of OCS resources will occur.

The Eastern Shore is a peninsula flanked on the west by Chesapeake Bay, and on the east by the Atlantic. It is flat, with a maximum elevation in the area of 20 feet. The sea side is bounded by a chain of sandy barrier islands, largely unspoiled, to which the only access is by boat. Behind these islands are extensive areas of shallows and salt marsh, drained and divided by nearly numberless winding creeks and channels.

The bay side of the shore has long beaches and low

headlands, with many small inlets and creeks, which contain wetlands of varying salinity regimes. These, as previously mentioned, are important in the food web, but are not nearly as extensive as those on the other side of the peninsula.

Fishing and agriculture are the traditional employments of residents of the Eastern Shore, and such manufacturing and trade as occurs is related primarily to natural resources such as fruit and vegetable canning, and seafood and fowl processing. Tourism is also important to the area.

The Hampton Roads area (which is considered here to consist of the cities of Hampton, Newport News, Virginia Beach, Norfolk, Portsmouth, Chesapeake, and Suffolk) is basically a large urban center surrounded by rural areas containing smaller urban centers. Considerable port-related activity is based upon the famous port of Hampton Roads at the confluence of the James River and Chesapeake Bay. The federal government is also heavily involved here, with the Norfolk naval complex the largest in the world. Manufacturing, tourism, seafood, wholesale and retail trade, and agriculture also play important parts.

The Lower York River area (here considered to encompass parts of York County and Gloucester County) is a curious mixture of both preceding areas. It is rural in nature, but with some industry. There is an extensive area under the control of the Federal Government, but little manufacturing. Seafood is harvested here, and tourism is very important. Here, too, is Virginia's only refinery (AMOCO, at Yorktown), with a

current capacity of 50,000 barrels per day.

Legal Aspects

In 1969, the state of Maine assigned certain exploratory rights to a private corporation beyond the three mile limit. A suit was thereupon brought against the state by the United States, to which the twelve other Atlantic Coastal States became party, to determine rights on the Continental Shelf beyond the three mile territorial limit. Virginia, represented by the Attorney General's Office, has taken a leading role in these proceedings. The matter is still in dispute; the Special Master appointed by the Supreme Court of the United States has recently filed a report recommending that the position of the federal government be sustained. The Court has called for briefs from the states and from the federal government, all of which are to be filed before December 31, 1974. The case is expected to be argued in January or February, 1975, with a decision to be announced by June. For a full explanation of the legal issues involved, see Appendix A.

As a secondary consideration, a series of international conferences on the Law of the Sea are currently underway, the first (at Caracas, Venezuela) having recently been completed. While there were no concrete results, one of the items under consideration involved the possible establishment of an internationally recognized limit of twelve miles for territorial waters. It is felt that this will again be put forward (probably as some part of a package proposal) when the Law of the Sea Conference reconvenes

in Geneva in 1975. Although there is a possibility that this limit will become a recognized part of International Law, it is not considered likely for purposes of this study. As a matter of interest, however, it should be noted that there is no indication of any petroleum resources within twelve miles of the coast of Virginia, and according to Dr. Wilson Laird of the American Petroleum Institute, there is no present interest in drilling there.(5) There are of course other mineral resources between the current limit of three miles and twelve miles, with sand and gravel being an example.

As to the first consideration, should Virginia's claim to one hundred miles of subaqueous lands be upheld, all the bonuses, rents and royalties which would normally accrue to the federal government from the leasing of drilling sites would instead belong to the state. On the debit side, the extensive leasing, regulating and monitoring procedures currently conducted by the Federal Government with all the difficulties attendant thereto would become Virginia's responsibility. There is currently under study by the Attorney General's Office a legal analysis of mechanisms for these procedures in our state government, and the time required for the development of such mechanisms is the reason for differences in dates given in the assumed schedule (assumption #4) between Virginia and the federal government.

In view of the above discussion, legal

considerations at this junction preclude an analysis of related legal problems involved with OCS development until the matter of United States v. Maine et al., is resolved.

Meteorological Conditions

An obviously important aspect of the environmental safety of OCS development is the meteorological conditions in the area of our consideration. It should be stated here that we believe the CEQ Study is misleading in regard to our area since it apparently considers meteorological conditions on the Middle Atlantic OCS to be more severe than those in the North Sea.(1) While it may be true that our offshore area is subject to hurricanes, whereas the North Sea is not, the whether conditions in general, particularly in the winter months, are believed more severe there. Only two spills from offshore structures of over one thousant barrels have been ascribed to hurricanes.(1)

Bad weather has a greater controlling effect on poloratory drilling than any other phase of the petroleum recovery operation, since mobile rigs are involved. Of course, the threat of extreme weather would cause the temporary abandonment of any sort of OCS operation.

Prevailing winds in the Virginian Sea are generally from the northwest during the fall and winter, and from the southwest in spring and summer. Wind speeds during summer average six to eight knots and during winter eight to ten knots. In summer, winds blow onshore in the daytime, and offshore at night.(2)

Temperatures are generally moderate in our area, with the mean annual temperature at Norfolk being 53.5°F. At sea, temperatures usually are somewhat warmer in the winter and cooler in the summer, due to the moderating effect of the ocean. Temperatures seldom are in excess of 100°F, and freezing is probable about one day in three from November through March. Icing in mid Atlantic offshore areas should not interfere with operations.(2)

Precipitation in the area of concern averages about 43 inches per year, and can be in the form of snow or freezing rain in the winter months.

Fog occurs the year around, but is most frequent during the autumn and winter months. Visibility can also be severely restricted during periods of intense precipitation such as summer thunderstorms or gales, and snow in the winter. Days with less than five miles visibility occur from five to fifteen percent of the time.(1)

Seismic activity is considered moderate in the Atlantic OCS, with the northern portion the most vulnerable. According to the CEQ study, earthquakes of a magnitude of 7 on the Richter scale can be expected on an average of once every 100 years in the Atlantic OCS area. Such a shock could cause damage to or the failure of OCS structues in the near vicinity.(1)

Tsunamis, which are long period waves caused by seismic activity, have not to date been recorded in our area. Such waves travel at enormous speeds (up to about 600 mph)

and are not noticeable in the open sea due to their low amplitude there. They become very high in shallow water, however, and can cause considerable damage onshore. There is no record of tsunamis in the Virginian Sea, and they are not expected to affect OCS operations there.(2)

Clearly, it is important that any plans for construction and operation of OCS facilities include provision for these and other environmental factors which would effect safety and security of the facilities themselves, the personnel on them and the environments and resources within their range of influence.

Introduction to the Report

The foregoing has been a general discussion of the area that would be involved in the development of Virginia's Outer Continental Shelf, and some of the prospects and problems that must be considered by those who hope to approach the very real issues in a logical fashion. The three succeeding sections will discuss in detail the geographic divisions--Offshore, Interface, and Onshore--that have been previously laid out. The last section in the report will make recommendations for action to control the situation in order to assure that Virginians, their property, and their environment are protected, and that resources are reasonably managed.

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III

Offshore Area

A thorough consideration of the environmental effects of development of OCS oil and gas resources should take into account the existing environmental conditions of the offshore area, the activities which may potentially impact this environment, and the susceptibility and response of the environment to these activities. Assessments of the effects of OCS development on the offshore areas must necessarily be imprecise and vague because of both the lack of detailed knowledge of the continental shelf environment and the inadequacy of knowledge of the effects of the contemplated developmental activities on this environment.

The Continental Shelf Environment off Virginia

The continental shelf environment off Virginia is distinctly different from the coastal environments of the Chesapeake Bay and Eastern Shore, in terms of physical, chemical, geological and biological processes, yet the environments interact intimately--one affecting the other.

The offshore water masses in the Virginian Sea affect the movement and characteristics of shelf waters. The Gulf Stream, flowing well off our coast, affects the direction and velocity of shelf currents, causing predominantly southerly flows. Yet the tidal flux of water through the Virginia Capes and into the Chesapeake Bay also affects the flow of water--particularly bottom cur-

rents--over a wide expanse of shelf.

The temperature of shelf waters varies less than the waters inshore. The salinity is of course higher and more stable, but it too is influenced by Bay discharges. Nutrients in shelf waters, which are necessary for phytoplankton growth, are in concentrations intermediate between those in the rich coastal waters and those in the surface waters of the open Atlantic. Nutrients are injected into the shelf waters both from coastal discharges and "upwelling" from nutrient rich deep sea waters.

The continental shelf is broadly covered by sand, some of which is from relict beach deposits and some from recent contributions from rivers. Much of this sand is in frequent motion and is generally arranged in dynamic ridges parallel to the shore. Only near the edge of the shelf are appreciable amounts of fine sediments--silts and clays--found.

Many of the fishes of the shelf also show a considerable dependence on coastal waters and estuaries. Most are migratory, moving inshore and offshore depending on the season. Many have long north-south movement, also in season. Some species move into the Bay and other estuaries to spawn, and the young of others move inshore to grow up in the estuarine nursery areas. The plankton is composed of oceanic and estuarine forms as well as those types more or less confined to shelf waters. The bottom-dwelling (benthic) organisms include not only some characteristic of the lower Chesapeake Bay but also many northern species unable to

tolerate the summer temperatures of the Bay. There are also specialized forms adapted to live in the dynamic sediments of the shelf such as the commercially fished surf clams.

Activities in OCS Development Having Potential Environmental Impact

This portion contains a discussion of activities in the exploitation of offshore oil field which may impact the environment adversely. The effects of some of these activities are likely to be insignificant. On the other hand, the effects of seemingly innocuous practices may be insidious, with currently unknown but far-reaching consequences. Thus, for completeness, all of those activities potentially affecting the environment will be discussed without presumption of the relative seriousness of their impact.

Not only must the effects of producing oil and gas on the OCS of Virginia be considered, but also the more imminent effects of exploration, exploratory drilling, and developmental drilling should be evaluated.

Exploration

Early in the exploratory phase of oil field development, extensive seismic surveys must be conducted to investigate the subsurface geological structure of the area. From these surveys petroleum geologists determine if the sedimentary environments represented in subsurface deposits are conducive to the formation of petroleum and if faults, domes and other features which trap and concentrate oil and gas are present. In the past, seismic surveys involved detonating explosive charges in the water resulting in

localized mortalities to fish and other marine organisms. Nowadays, substitute energy sources, such as the propane-oxygen "guns" or high powered oscillators, are used. These are far less damaging to the environment. Apparently, little or no long term environmental damage was done by the seismic techniques employed in our area, and much of the exploratory seismic work has already been accomplished.

There is presently no method of positively identifying oil and gas deposits without actually drilling into them. Drilling is not allowed by federal regulatory agencies until after lease sales, and even coring requires a permit from the U.S. Geological Survey. Exploratory drilling is now generally carried out from drilling ships, jackup rigs, or semisubmersable rigs. Drill cuttings and drilling mud are usually disposed of overboard. These may smother bottom-dwelling organisms and otherwise alter benthic habitats in the vicinity of the drilling operations. Also, drilling mud sometimes contains oil and various toxic components, notably barium compounds. Such overboard discharge can presumably be controlled by regulation if need be. Further, since exploratory drilling probes unknown geological structures, the risk of blowouts is substantially higher during this phase of oil field development than in the production stage, though still a very small percentage. Debris from drilling operations may find its way overboard, either through accident or carelessness, as it can from any maritime operation. Although exploratory drilling in deep water need not result

in permanent obstructions, the operations themselves may impair other uses of the OCS, such as commercial trawling and transportation during the period of active exploration.

Development and Production

Once significant discoveries are made by exploratory drilling, development and production activities may proceed in the oil or gas field. Again, drill cuttings and drilling mud disposal may have local environmental impacts.

Once the oil well is in production, "bleedwater" brought up with and separated from the oil by "oil-water separators" is usually disposed of overboard. Bleedwater is usually of very high salinity and contains substantial amounts of oil--on the order of 50 ppm (parts per million). Sand is also often brought up with the petroleum and it must be separated and discharged overboard where it may impact benthic communities. As previously stated, the risk of blowouts is substantially less during production than in the exploratory drilling and development stages. Nonetheless, production blowouts can occur if pressure in the well suddenly increases. Production and development rigs are usually built resting on the bottom, or sub-sea well heads are employed. Too often the incentives to remove unused or obsolete platforms and sea bed structures do not out weigh the costs of removal, resulting in semi-permanent obstructions to other uses of the OCS. Again, the accidental or careless loss of debris and refuse from production rigs may impact the environment.

Transportation

If it is decided to transport oil and gas from offshore production by pipeline, the emplacement of these large diameter objects would require considerable dredging with the accompanying disruption of local benthic habitat. Further, the risk always exists, particularly on a high energy coastline such as ours, for rupture of the lines. However, the record of offshore pipelines has been very good and on past experience the probability of accidental breakage seems small. Pipelines require maintenance which may involve disruptions to bottom life and the long-term environmental effects of abandoned pipelines should be considered. Section IV- Interface Area contains a fuller discussion of pipelines and their effects.

In the event that tankers or barges were used to transport oil from the OCS to shore, oil spills from transferrals and accidental spills resulting from collisions and groundings may pose a problem. Routine discharges of bilge and ballast waters may also introduce oil into the offshore environment. The use of deep draft tankers to transship oil would necessitate deepening navigation channels extending well past the three mile boundary, with the attendant problems associated with dredging. This, however, is considered unlikely in our area as previously stated.

Shipment by vessel would also require offshore storage facilities which could rupture, or might result in more frequent small spills associated with handling oil.

They would also be an obstruction to other uses of the continental shelf.

Environmental Effects of OCS Development

Solid Wastes

Overboard discharge of drill cuttings, drilling mud and sand from wells may cause smothering of the benthic organisms or benthic habitat alterations localized in scope. This is not a necessary practice and can be controlled by regulation.

Potentially more serious is the introduction of compounds which may be harmful in trace amounts. Drilling muds can contain substantial quantities of refined oil--similar to number 2 fuel oil--which is used to achieve proper viscosity and lubrication. Because this oil is thoroughly mixed with the mud itself, much of it will be deposited on the bottom. It is well known that petroleum hydrocarbons can persist for long periods of time in bottom sediments where they may affect benthic organisms, leach into bottom waters, or be resuspended by currents. Chemical additives in drilling muds include barium compounds which are toxic to marine organisms. Widespread deposition of trace amounts of these and other toxic compounds may result from drilling activities.

Chronically Discharged Effluents

Discharges of bleedwater and other liquid wastes from offshore production platforms would probably be diluted so rapidly that any toxic effects on marine life would be

quite local. It is possible, however, that petroleum hydrocarbons, trace metals, and other materials may be adsorbed to suspended sediments and eventually deposited on the bottom where they may concentrate and persist. Further, very low concentrations (in the parts per billion range) may cause sublethal effects on marine organisms. Particular concern has been voiced over the possible effects of small concentrations of hydrocarbons on the ability of organisms to sense low concentrations of other compounds which are important in their feeding, mating and migration.

Oil Spills

Most concern and virtually all research about the effects of spilled oil has centered on the intertidal or coastal environment. For example, the Council on Environmental Quality based their assessment of the relative risks of OCS drilling sites on the probability of spilled oil reaching the shore. Whenever oil has been looked for in subtidal sediments following a spill it has been found. There is therefore no reason to preclude possible effects on offshore benthic organisms resulting from blowouts, tanker spills, pipeline leaks or other episodic inputs of oil. Oil was found in relatively deep water sediments following both the Santa Barbara and Gulf of Mexico blowouts. The lack of adequate consideration of effects of oil spills on offshore organisms as well as of the effects of chronic discharges are two deficiences of the CEQ's offshore impact analysis.

Further, it should be noted in passing that some

skepticism has been voiced by the National Academy of Sciences regarding the validity of the mathematical models which allowed CEQ to predict that the chance of floating oil reaching the shore of Virginia from OCS drilling sites is virtually nil. The oceanographic and meterological data base on which these predictions are based is inadequate, and the model itself is at variance with some of these data.

Those offshore organisms potentially most susceptible to the effects of spilled oil are seabirds, which may be coated with floating oil, organisms which live at the air-sea interface (the neuston), and benthic organisms, because sedimental oil may concentrate and persist in the bottom. Reliable predictions of effects, except perhaps on birds, are not possible because of inadequate knowledge of the offshore effects of previous oil spills.

Dredging

Dredging activities attendant to navigational channels and pipeline placement may impact offshore organisms primarily through the removal of benthic habitats and the suspension of sediment and associated compounds. Generally speaking these effects are not considered as serious as they may be in inshore waters because bottom sediments over much of the shelf are naturally dynamic and thus the ability of most of the biota to recover from damage is good. Further, shelf sediments are mostly sands, whereas it is typically the finer particles which have adverse effects if resuspended.

Extension of navigation channels onto the shelf

would, however, involve alteration of local benthic habitats and would probably require frequent maintenance dredging due to the dynamic nature of the bottom. As previously mentioned, such dredging seems unlikely.

Obstructions and Debris

Habitat changes may occur where construction debris and other material is jettisoned. The environmental effects resulting would be localized and of unknown, but probably minor, overall importance. Perhaps more important is the obstruction to other uses of the shelf such as fishing and transportation caused by semi-permanent or abandoned structures such as platforms, subsea well heads and pipelines.

It must also be mentioned that oil and gas rigs have the capability of acting as artificial reefs and attracting game fish. In Louisiana, "rig fishing" has proved to be extremely productive, and charter boat operators as well as private vessels fish these rigs frequently. In the case of Virginia, however, the area of interest is on the order of seventy five miles offshore, which may preclude or reduce such fishing.

Major Concerns

The effects which are probably or potentially the most serious include:

(1) The incorporation of oil in sediments, either through the catastrophic or chronic discharge of petroleum to the environment.

(2) Sub-lethal effects of chronic discharges of

petroleum.

(3) The effects of oil spills on sea birds.

Conclusions

The threats posed by OCS development to the environment and organisms of the offshore area of the Virginian Sea are unknown. Assessments of impact such as that by the Council on Environmental Quality have, in general, not given proper consideration to effects on offshore environments. This has probably been due to pressures to develop predictive models and make definitive statements about impacts on little known environments. It is not sufficient to base impact assessments largely on the basis of the probability of spilled oil reaching shore.

If exploitation is to proceed, strict regulation to ensure environmental protection should be developed and enforced. Specifically, spill prevention devices and regulations need to be adequately policed, since some blowouts in offshore oilfields elsewhere have followed inadequate enforcement of the regulations by federal and industrial authorities. Standards must be set to regulate chronic discharges from production platforms. To this end, effluent limitations are currently being developed by the Environmental Protection Agency. However, these effluent limitations are based exclusively on technological considerations. Research is needed on the effects of these discharges so that environmentally relevant discharge standards may be implemented.

IV

Interface Area

General Description

Although the Interface Area includes the subaqueous lands out to the three mile limit, the impacts of offshore oil activities will be felt primarily in the relatively shallow inshore areas and in the intertidal and wetlands habitats. Major discussion in this section will therefore center on the three above-mentioned subareas within the larger Interface Area.

Virginia's shoreline, of which there is almost 5,000 miles, is best characterized by its variety. This variety extends from the serene fragility of the barrier islands of the Eastern Shore to the glittering strip of Virginia Beach, and from the industrial activities of Hampton Roads to the quiet productivity of Chesapeake Bay marshes. In its shoreline, Virginia has a natural resource of inestimable value.

The Eastern Shore of Virginia is a low-lying peninsula bounded on the east by a barrier island - marsh-bay complex and on the west by a marsh-tidal creek complex. Extensive and highly productive shallows occur on both coasts and in the tributaries. The Eastern Shore contains about 70% of Virginia's ocean front shoreline, and from Wallops Island south it is the only portion of the eastern barrier island chain (from Cape Cod to Cape Hatteras) which remains in its natural state. The Eastern Shore also con-

tains approximately 84,000 acres of wetlands, one-half of the Commonwealth's total.(1) The entire complex fringing the Eastern Shore must be considered a unique resource by the Commonwealth. At the present time the barrier islands are marked for conservation. The marshes, because of their value to the seafood industries of the Commonwealth, are protected by the Virginia Wetlands Act of 1972. The relatively clean waters, complexed with the islands and marshes, are used primarily by commercial and sport fishermen.(2)

In contrast to the Eastern Shore oceanfront, that of Virginia Beach is quite commercialized. From Cape Henry to Sandbridge, the beach is a highly active resort area with only three exceptions, where military bases are present. Despite a sometimes severe erosion problem, Virginia Beach development has continued to mount. From Sandbridge to the North Carolina line, however, the beach area and the lagoons behind it are presently marked for conservation. The Back Bay Wildlife Refuge and the planned False Cape State Park are extremely valuable areas from this viewpoint.

The Back Bay area is approximately 45 sq. miles of primarily marsh and shallow lagoons. Both this area and the barrier island - marsh bay complex on the Eastern Shore are invaluable to birdlife since they are integral parts of the Eastern flyway, used each year by thousands of migrating waterfowl.

The port of Hampton Roads includes the most highly developed portion of Virginia's shoreline. Very little of

the shoreline of the Elizabeth River is unaltered and the sediments in the river are highly contaminated from one source or another. The northern side of the James River is also highly developed in the Hampton Roads area but the river itself is still important as a seed oyster and clam producing area. Except for the Nansemond River, which also appears to be headed towards heavy industrial development, a few small tidal creeks, and the Ragged Island Marsh, most of the natural shoreline of the lower river has been developed. Because of the rapid population growth of the Hampton Roads area, the rivers are highly stressed by sewage and other effluents. It is also important to note that the channels of both Hampton Roads and the Elizabeth River are scheduled for expansion or deepening, or both, in the near future.

Except for its lower southern bank, which has several industries and military establishments, the York River retains its natural character with residential areas spotted between large marsh areas and small tidal creeks. Water quality is relatively good and the river supports a considerable commercial seafood industry.

North of the York River the shoreline is characterized by small fringing marshes and tidal creeks. The natural character of the shoreline remains since coastal development has taken the form of residential housing small commercial seafood operations, and small marinas.

In summary, the oil industry will have to compete

with a variety of other interests which are already established on Virginia's shoreline. Because of the dependence of the seafood industry on marshes, the Virginia Wetlands Act controls wetland development. Most of the barrier islands are owned by the federal government, the Commonwealth or The Nature Conservancy. The tourist industry, primarily centered around Virginia Beach, will take a very close look at offshore oil development. Further, a large portion of the citizens living along the shoreline will likely be opposed to oil development because of the possibility of associated pollution, real or imagined.

Discussion of Problems

A discussion of the problems of the interface zone may best be accomplished by dividing the subject into six lesser subjects and covering them individually. For this purpose the following problems are considered as major:

Port Development

Effluent Effects

Tanker Traffic

Catastrophic Oil Spills

Oil Cleanup, and

Pipeline Effects

Each will be discussed in turn.

Port Development

It does not appear likely at present that OCS related offshore port development will take place within the three mile limit because of the extensive dredging which

would be required, and because the preferred method of transporting crude oil from offshore fields is by pipeline. As previously stated, vessel transport will be employed only if the fields are small. Port development will be needed, however, for the staging of materials and men during exploration and construction periods and this is most likely to occur on the Eastern Shore or the Hampton Roads area.

Most of the existing channels in the Hampton Roads are adequate to handle the vessels necessary, but if the Eastern Shore or undeveloped portions of Hampton Roads are utilized, new channels will have to be dredged. In this case, dredging and disposal of the dredged soil will have a major impact.

Depending on the amount of dredging necessary, impacts may be in the form of destruction of benthos (bottom) communities and fish feeding and spawning grounds, altered salinity regimes and current patterns, destruction of marshes, and interference with water column productivity and fish migration routes through increases in turbidity. Large amounts of spoil from such dredging will have to be disposed of, and this may well place more stress on wetlands and benthic habitats, since these are the most economical disposal areas in the short term.

Most of the impacts described above may be avoided if the state takes strong measures to insure that the oil industry utilizes the existing port facilities and channels of Hampton Roads and the Eastern Shore. With the planned

deepening of Hampton Roads to 55 feet and the facilities which already exist, the adverse impact of port development derived from OCS activities should be held to a minimum.

Effluent Effects

A large OCS oil or gas find will almost certainly precipitate the establishment of various industries directly and indirectly related to the oil industry. One can expect such industries as oil refining, gas processing and petrochemical production as well as secondary development including sewage treatment plants to locate as close as possible to the oil fields. The primary impacts of these industries on the interface will be in the areas of effluents, water use and possible wetlands destruction.

The effluents from various refining industries potentially could pose as great a threat to water quality in the Commonwealth as the drilling and transportation of crude oil, since it is generally recognized that refined hydrocarbon products are more toxic than crude oils and that petroleum processors are chronic pollutant contributors.(2) Strict control of effluents will be required.

Very little research has been done in the area of chronic hydrocarbon contamination and sublethal effects, but it is known that chronic inputs can have significant impacts in confined estuarine areas.(3) A large area of saltmarsh vegetation was killed by refinery effluent at Southhampton, England.(4) Another researcher reported bottom

organisms in Los Angeles Harbor have been reduced to one tolerant species of oil industry wastes.(5) In more open areas where there is greater dispersion of the effluent, the biological effects,where known, do not appear to be as serious. Where chronic effects have appeared, such as in Los Angeles Harbor and the Houston Ship Channel, not only direct toxicity is involved but also depleted oxygen levels due to high oxygen demand by contaminated sediments and other oxygen consumers.

On the Eastern Shore, receiving waters are naturally somewhat organically loaded and the interactions of other variables such as stream morphology, freshwater inflows, tidal forces and salinity make these streams less than satisfactory as receiving waters.(6) Numerous shellfish beds are found in waters surrounding the Eastern Shore and stringent water quality standards and criteria have been set to protect both general water quality and the quality of water required to support shellfish and finfish. Any development by the oil processing industry on the Eastern Shore, unless closely controlled, could adversely affect the survival and quality of fish and shellfish there because of the poor suitability of the surface waters to receive effluents. This would have substantial impact upon the seafood and recreational fisheries of the area.

The fact remains, however, that the proximity of the Eastern Shore to the continental shelf and the undeveloped and therefore relatively inexpensive land available make

the area a prime development site for the oil industry. This could drastically increase pressures to drain and fill the marshes, and thus adversely affect the seafood and recreational fishing industries since marshes are directly linked to seafood productivity and water quality.(7) Lyle St. Amant has stated before the National Advisory Committee on Oceans and Atmosphere that the greatest impact of oil development on the Gulf coast was in the area of filling and draining wetlands.

Satellite industry development in the Hampton Roads area, if property sited, constructed, and operated, might not have the adverse impact that it would on the Eastern Shore because of the better flushing characteristics of the James River estuary. It is apparent, however, that with approximately 50% of the shellfish grounds in Hampton Roads presently condemned, addition of further improperly treated effluent could severely affect the James River seed oyster beds and the seafood industry in Hampton Roads. Tourism may also be affected, since spills might reach beach areas such as Buckroe and Ocean View.

The Nansemond, Elizabeth and Pagan rivers, because of low freshwater inputs, are either highly stressed at present or unsuitable for large effluent loading. The Nansemond and Pagan rivers have large marsh areas which are very important to the lower James River system. It is possible that these marshes along with others, such as the Ragged Island-Candy Island complex, could be looked on as desirable develop-

ment areas for housing or industry. Hopefully, the Wetlands Act will control such development so that essential natural habitat will be preserved.

The lower York River has experienced some water quality problems associated with domestic and industrial waste discharges. A new sewage treatment plant is planned in the area, but water quality at this time is generally good. This area does contain large wetlands, which may be threatened by development because of a lack of suitable upland industrial sites.

In addition to increasing pressures on the environment in the form of wetlands destruction and effluent releases, development of petroleum related industry will increase the chances for spills of refined products. The effects of such spills are discussed more fully below.

Tanker Traffic

It is difficult to project the effects of an offshore oil discovery on the number of tankers utilizing Virginia waters. As previously stated, however, it appears that if a pipeline is used to transport the oil, the number of tankers entering Hampton Roads might be smaller than if no oil were discovered at all. Further, the transport of refined products from refineries must be considered.

According to Porricelli(9), tanker and barge transport of oil and oil products amounts for 30% of the oil released into the marine environment. The same study estimates that 75% of the spills from tankers are caused by human error and 25% by mechanical failure. This record points to the need for improved design of handling systems to prevent such

occurrences. The spills charged to mechanical failure accounted for a much larger volume of oil spilled even though there were fewer of them. The newer pipelines which are better constructed than older ones and have built-in safety devices, have an excellent record.

From a crude oil transportation point of view only, an offshore discovery with pipeline transport of oil might prove to be a lesser environmental risk than the increase in tanker traffic which might occur if the oil, needed to meet now planned refining capacity increases, had to be brought in from other areas.

Catastrophic Oil Spills

Even though the literature on oil pollution is voluminous, very few conclusions as to the effects of oil in the marine environment are agreed upon by everyone involved. Most of the work done to date has been concentrated in the intertidal area; hence, very little is known of the effects of oil on subaqueous organisms. It is generally conceded that different oils, both crude and refined, have different effects but few researchers agree on what these effects might be.

All are agreed, however, that refined products are more damaging to biota than crude petroleum. It is instructive in this regard to review what many consider a "worst case" episode, the West Falmouth (Massachusetts) spill, which released refined petroleum into a confined area on the Atlantic seaboard.

The West Falmouth spill was relatively small by volume. Between 171,000 and 184,000 gallons of #2 fuel oil were released into Buzzards Bay when an oil barge grounded. The immediate effect was a massive kill of marine life including fish, shellfish, crustaceans, and worms and other invertebrates. Sampling showed a 95% mortality of organisms in the spill area. It is important to note that although all visual effects of this refined product were gone within a few days, scientific sampling techniques demonstrated that after eight months the oil was still spreading along the bottom and killing the organisms there. Bottom sediment was contaminated in 42 feet of water at the deepest point in that part of Buzzards Bay. Very little bacterial breakdown of the oil had occurred eight months after the spill. Commercial shellfishing was prohibited for two years in the area, and it appears that shellfish productivity will be affected for a much longer period. Destruction of the Buzzards Bay biota reduced the stability of sediments and this has resulted in increased erosion. Damage to shellfish for the first year alone has been estimated at $118,000 by the town of Falmouth. Another $200,000 was paid to the Commonwealth of Massachusetts for resource losses. The actual ecological damage is estimated to be much greater.(10,11)

As for crude oil, one of the primary impacts of a spill in the Interface Area would be its effects on the coastal birds. The Torrey Canyon, Santa Barbara and San Francisco Bay spills have all demonstrated that oil releases

can kill significant proportions of local sea bird populations. During the Santa Barbara blowout, for instance, over half of the local populations of loons and grebes were killed. Since many sea birds have relatively low reproductive rates, population recovery may be a very slow process. All of this has particular importance to the Commonwealth because of the large numbers of sea birds which utilize the Eastern Shore and Back Bay areas each year.

The treatment of oiled birds has received considerable publicity, but thus far survival of treated birds has been very low. Less than 1% of the birds treated during the Torrey Canyon disaster survived(12), and even under the best conditions survival has been 20% or less.(2)

Most of the research conducted after previous spills has concentrated on the intertidal zone, and thus the long term effects of the oil which reaches the subtidal area are virtually unknown. Intertidal organisms suffer primarily from smothering when crude oil comes ashore, but may also be affected by direct toxicity and fouling. The differences in effects noticed seem to be related to the type of oil spilled as well as the type of shoreline which receives it. Very little is known of the effects of oil on beach communities.

Marshes can be adversely affected by single oil spills, but generally their recovery is good. Experimental studies have shown that marsh flora are highly vulnerable to a series of oil dosages and that under these circumstances recovery is poor. Marsh fauna appear to be more susceptible

to the effects of oil, but little research has been conducted in this area.

Forecasting the economic impact of a catastrophic oil spill on the Tidewater area is difficult, but it can be said that the impact may be considerable under the proper circumstances. Direct effects of the Santa Barbara spill on commercial fish species have not been demonstrated, but the presence of the oil prevented fishermen from trawling, and thus affected their incomes. Other studies such as that of the West Falmouth spill have shown tainting of shellfish to be a problem which can last for years, with the exact duration still unknown. Many oil pollution scientists are also concerned about the possible retention of carcinogenic hydrocarbons by shellfish and other species well after any noticeable taint has disappeared.

A large oil spill in the vicinity of or reaching the Virginia Beach resort area would have a significant impact on tourism in the area. Even if the spill did not occur during the summer season, the adverse publicity would have some impact on tourism even though the beach might well be cleaned beforehand. In addition to aesthetic considerations, the present erosion problem at Virginia Beach could be exacerbated by the removal of beach sand during cleanup operations as well as by changes in the normal beach processes brought about by the mixing of oil and sand and the destruction of normal biota.

Oil Cleanup

There are presently a wide variety of oil spill containment and cleanup procedures available which attempt, with varying success, and sometimes an environmental impact of their own, to reduce the effects of spills. These methods include the use of floating booms, sorbent materials, burning agents, dispersants, sinking agents, biodegradants, and others. In general, none of these methods has yet proved satisfactory under natural conditions.

The National Petroleum Council, an oil-industry advisory group to the Department of Interior, says of booms, "Containment devices that will restrict the movement of oil in the open sea are not available. There have been no demonstrations of oil recovery devices with the ability to pick up oil from large spills in rough waters at the needed rates and efficiencies."

Milgram(2) regards sorbents as having the greatest potential use in the cleanup process, but Ahern(8) states that the state of the art cannot handle waves in excess of five feet and is thus unsatisfactory. Most dispersants are so toxic to marine life that they cause more damage than the oil they are used to disperse. New formulations may be able to lessen this problem in the future. Sinking agents appear to work well with weathered crude oil spills but the danger here is that the effects and the persistence of the oil once it is on the bottom are virtually unknown. Burning agents have met with little success and can cause temporary air

pollution. Although no quantitative data exists on the use of biodegradation, indications are that there is a potential for enhancing the natural activity of oil-degrading bacteria and yeasts.(2)

Since environmental awareness in the oil industry is relatively new, there is a great deal of research needed to improve all of the above cleanup and containment techniques. New methods and materials will be forthcoming in the near future since considerable research is already underway. For the present, however, natural processes will generally have to be counted on to do much of the cleaning up after a spill.

Pipeline Effects

Both from an industrial and environmental viewpoint, the transport of crude oil from offshore fields by pipeline is preferred to transport by tanker and barge. This is not to say, however, that there are no problems associated with pipeline use. Pipelines generally have a better record as regards spills than tankers simply because there are fewer opportunities for a spill to occur. The major impact of a pipeline on the environment occurs during installation.

All pipelines placed in less than 200 feet of water must be buried according to federal regulations. This involves large amounts of dredge spoil and temporary disruption of the benthic area. Wetlands in Louisiana have experienced significant temporary and permanent damage since the two methods developed there for laying pipelines in

marshes involve the excavation of canals. The canals may cause disruption of natural drainage and water current patterns as well as accelerated erosion. Biologically productive areas are lost and disturbances such as changes in turbidity, salinity, acidity, hydrogen sulfide levels and biological oxygen demand may occur.(13)

The ocean coast of Virginia may be compartmented into three zones on a north-south basis for the sake of discussion of pipeline effects in the Commonwealth. These zones are the Eastern Shore barrier island-marsh complex, the Chesapeake Bay entrance, and the headland coast and barrier between Cape Henry and the North Carolina-Virginia boundary.

Since the pipeline must be buried in transiting nearly all subaqueous lands the impact question relates primarily to the method for crossing the shoreface and area behind it.

In the case of a pipeline coming ashore on the Eastern Shore or south of Cape Henry in an unburied or surface mode, the pipeline and its armoring will interact with the littoral drift system with inevitable adverse impact. More importantly, the pipeline is exposed to severe wave attack. The likely result would be local scour caused by the concentration of wave energy and the resulting current with the possibility of inlet formation and pipeline failure at the shoreface. Therefore, even if the pipeline is elevated after passing the shoreface, the risk of failure is high.

If the pipeline crossing the shoreface is buried there is less environmental risk involved and the excavation impact may be temporary in nature, provided that trenches are backfilled and marsh species replanted. It is very important, however, that the location of the crossing point be given careful consideration. For example, the location chosen should not be one which has had a history of temporary inlet formation since the pipeline could be scoured out by a reoccurrence(14)

A pipeline through the Chesapeake Bay entrance would have a temporary impact due to dredging. There would be, however, the advantage of less wetlands destruction as well as that of ultimately coming ashore on a lower energy coast than than found on the ocean front.

Major Concerns

The following are the major concerns in the Interface Area which are occasioned by OCS development:

(1) If new port facilities are developed major impacts will be caused by the dredging of channels. Care must be taken that spoil from such dredging is disposed of in accordance with accepted standards.

(2) Satellite industries may be expected to locate on the Virginia coast and these may cause impacts in the form of effluents, wetlands destruction, water usage, and increased chance of spills of refined products. The

requirements of the National Pollutant Discharge Elimination System (NPDES) should reduce these problems.

(3) OCS development may, if a pipeline is used to transport the oil from the fields, reduce the number of tankers entering Hampton Roads from what it would be were OCS oil not developed. This could be significant, since tanker transport accounts for 30% of the oil which reaches the oceans and offshore rigs only about 2% by some estimates.

(4) An oil spill involving a refined product inside Chesapeake Bay could severely affect the estuary for a period of perhaps five years. A crude oil spill, whether in ocean waters or in the bay, might be less damaging due to the general lower toxicity of the crude. Virtually nothing is known of the effects of the oil which is deposited below the intertidal area. Adverse effects of sea bird populations can be expected from almost any spill. Oil reaching Virginia Beach could severely impact the resort primarily through the effects of adverse publicity.

(5) Although much research is underway to develop and improve oil spill cleanup methods and materials, the present state of the art does

not allow satisfactory recovery of spilled oil, especially in rough seas. It appears that more adequate techniques will be forthcoming in the near future.

Conclusions

Virginia's shoreline, measuring some 5,000 miles, is a natural resource of an estimable value to its citizens and the hundreds of thousands of tourists which visit the area annually. Already stressed by population pressures, this coastline would undoubtedly face further stress from OCS oil and gas development. The commonwealth must take the necessary steps to learn the impacts associated with all ramifications of OCS development. Little is known of the sublethal effects of hydrocarbon compounds on estuarine organisms. A much greater knowledge of such characteristics as carcinogenicity, persistence and toxicity must be acquired to properly assess the impacts of development of a petroleum industry in Virginia. Spill prevention and cleanup methods are as yet inadequate and must be refined.

The unknown adverse factors mentioned above as well as the known adverse factors such as wetlands destruction, benthic community disruption and the effects of effluents could all have an undesirable impact on the state and its citizenry. Firm control backed by adequate knowledge of all impacts associated with OCS development is necessary if the seafood and tourist industries as well as the present quality of life in Virginia is to be maintained.

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V

Onshore Area

The area that must support any development of the OCS off our shores is the land itself. Here could be located not only the refineries, the tank farms, and the petrochemical complexes, but also the housing, schools, restaurants and shopping centers required to support the workers. The land and its people would reap the benefits of such development, but would also be required to bear the burden of costs for the added public services required, including police protection, firemen, local administration and hospitals. There are the further considerations of increased water requirements (both domestic and industrial), solid waste, and sewage, plus the attendant potentials for air and water pollution. All are discussed below.

General Approach

The impacts of high level OCS oil and gas development upon the onshore portion of the Commonwealth have been projected for 1985 by means of a three step process. First, an industrial development scenario was drawn based on the production level assumptions of Section II and a number of known or reasonably projected product demand and plant location constraints. This scenario resulted in a description of statewide impacts which can be applied to either of two primary impact areas (Eastern Shore or Hampton Roads/York River entrance) or to the remainder of the state. The

second step was to project employment and population figures attributable to OCS development for each area. The third step in this process was to assess the social and physical effects of this development on each area.

These social and physical impacts, as well as the economic impact discussed in step two, would be the results of two basic types and levels of development. The most direct and obvious changes will result from the construction and operation of those facilities and industries involved in actual oil-and gas-related activities. These will include exploration related facilities such as onshore bases and supply yards, production related facilities, a major platform fabrication facility, processing plants for natural gas, refineries for oil, and associated petrochemical plants, as well as storage and transmission facilities such as tank farms and pipelines. These impacts are relatively easily quantified and assigned to specific areas. Less direct and less obvious, but of greater overall importance in many respects, are the impacts which will result from the domestic and other development generated by the direct oil and gas related activities. These impacts will include other induced manufacturing plants, service employment generated to support the basic industries, and the total population increase associated with this overall increase in the labor force. These impacts may be quantified and attributed to geographic impact areas by inference from projections of the primary impacts.

Finally, mention must be made of the impact of new air pollution control regulations and federal court rulings upon both industrial and secondary developments. Indirect sources, for instance, such as facilities which attract more than a certain number of vehicles, will be controlled by permit after 1 January 1975. New industrial sources must also be permitted. Further, new industrial sources to be located within a standard metropolitan statistical area (SMSA) must not prevent maintenance in that area of National Ambient Air Quality Standards. Outside the SMSA's, EPA non-degradation requirements may pose problems.

Assumptions

Major assumptions of the onshore section of this report, which are in addition to the overall assumptions of Section II, are discussed below. Many of these assumptions are based on the findings of an earlier report entitled "Off-Shore Port Facilities" which was completed in February of this year by the Virginia Off-Shore Port Facilities Task Force. The assumptions are as follows:

(1) Base case I assumes that capacity of the Yorktown refinery will increase by 60 percent to 80,000 barrels per day and that the Suffolk refinery will be built with production of 184,000 barrels per day. Under the base case I assumption, Virginia would have total refinery capacity of 264,000 barrels per day by 1985.

(2) Base case II assumes that capacity of the Yorktown refinery will increase by 100 percent to 100,000 barrels per day and that the Suffolk refinery will be built as outlined in base case I. In addition, the Transco refinery is assumed to be operational with a 200,000 barrel capacity. In base case II an off-shore port facility would be built off the coast of Virginia. Under the base case II assumption, Virginia would have total refinery capacity of 484,000 barrels per day by 1985.

(3) With development of the outer continental shelf (OCS), Virginia's total refinery capacity would reach 750,000 barrels per day. In addition to the assumptions made in base case I and base case II, it is assumed that the Yorktown refinery will increase capacity to 150,000 barrels per day, that the Suffolk refinery will increase capacity to 300,000 barrels per day, and that the Motor Gas, Oil, and Refining Corporation will build its facility with a 100,000 barrel per day capacity.

(4) For each 50,000 barrels per day refinery capacity, 135 employees are needed.

(5) Each refinery, gas processing, and petrochemical worker is expected to create employment for one

additional construction worker, one additional utility worker, and two additional manufacturing workers. Also, each additional "basic industry" type worker is expected to create an additional service or "supporting" type worker.

(6) All of Virginia's present and future (through 1985) refinery capacity growth will be in the Hampton Roads/York River area.

(7) Two gas processing facilities will be built on Virginia's Eastern Shore by 1985, employing a total of approximately 100 persons.

(8) Two petrochemical facilities will be built in the Hampton Roads/York River area by 1985, employing a total of 2,275 persons.

(9) Brown and Root, a major metal fabricator, is assumed to employ about 1,700 persons on the Eastern Shore by 1985 with OCS production.

(10) Of the 7,520 persons estimated by Resource Planning Associates to be employed in east coast oil and gas recovery by 1985, one half is assumed to be employed in Virginia. Of the Virginia total (3,760), one half or 1,880 would be employed on the Eastern Shore and one half in the Hampton Roads/York River area.

(11) Ratios used to generate figures for the ten social and physical system indicators from

1985 population figures are in some cases the averages of similar determinations made for four east coast hypothetical case studies done by Resource Planning Associates for the Council on Environmental Quality. These case study locations are Bristol County, Massachusetts; Cumberland/Cape May Counties, New Jersey; Charleston, South Carolina; and Jacksonville, Florida. Other quantitative values are commonly accepted for Virginia where different from those presented by RPA. Specific ratios used are:

School enrollment	262.5 per thousand population (RPA)
Hospital beds	3.64 per thousand population (RPA)
Police manpower	1.54 per thousand population (RPA)
Government overhead	$7.53 per person (RPA)
Government employees	30 per thousand population (VA.)
Water demand - domestic	100 gallons per person per day (VA.)
Water demand - Industrial	(petroleum industry figures based on RPA report)
	Refineries - 40 gallons per barrel
	Gas processing - 15,000 gallons per plant
	Petrochemical - 24 million gallons per day per plant

Sewage - domestic	100 gallons per person per day
Solid waste	3 tons per thousand population per day (VA.)
Residential structures	3.0 persons per household (VA.)
Commercial structures	24.5 sq. ft. per person (RPA)

Finally, it is well to reiterate here that this section of the report is based on a major discovery of gas and oil on the Virginia OCS. This assumption is made so that the greatest conceivable impact will be considered on the theory that if Virginia's posture is adequate to handle such impact, it will also prove sufficient for anything less.

Potential Impact Areas

Possible economic impacts of the assumed high OCS development are indicated in Tables 1 through 3. The major factors analyzed include population, employment, and the labor force participation rate. Within total employment, specific areas of analysis include construction, mining, agriculture, manufacturing, utilities, and services.

For historical reference 1972 population and employment figures were used. Projections were then made to 1985 using three different sets of assumptions in reference to refinery capacity in Virginia and OCS development. The absolute change in population and employment resulting from each of the three 1985 development levels is also shown.

The impacts of a high level of OCS oil and gas

production on social and physical systems are projected and illustrated (Table 4) in terms of a set of ten systems factors, five for each overall system. Each of these factors represents a valid component of the respective system to which it belongs, but in addition, the five in each category can serve as a set of indicators of trends within the overall system brought about by stress being applied to that system. In this case, the stress is the hypothetical impact of a large oil find off the coast and the trends are those of increases in the overall level of performance required of the social and physical systems of the state and each respective impact area. It should be noted that the systems components used here for indicators are only samples of the total set of many similar components that make up each system. They are hopefully a representative sample, but are by no means exclusive. Projections for each of these indicators are dependent upon the overall population increase figures projected for the OCS production assumption case. Each is linked to the population figure in a direct positive correlation based on current ratios of level of each indicator's performance to population. The figures shown thus represent increases in each category over what that same category level would be under 1985 base case II assumptions.

The social systems changes for the state and the two impact areas are indicated by changes in school enrollment, required hospital beds, police manpower, government overhead, and government employees. Physical systems changes

are shown as changes in water demand (domestic and industrial), domestic sewage discharge, solid waste generation, numbers of residential structures, and required square footage of commercial facilities. The division between social and physical systems used here is admittedly tenuous. Several indicators have aspects which could fall into either category. Solid waste, for example, impacts upon the physical system by being a physical commodity which requires land for disposal or for an incineration system. At the same time, however, it impacts upon the social system by requiring an effort by local government for its collection and disposal. In general, the physical systems components involve the use or commitment of physical resources such as water and land, while the social indicators involve services.

Eastern Shore[1]

As of July, 1972, the Eastern Shore of Virginia had an estimated population of 43,500. Total employment for the same year was approximately 16,600 persons with the single most important employment sector being agriculture. However, agriculture, traditionally the most important employer in the area, is yielding its dominance to manufacturing activity. Other traditionally large "basic" activities in the area include fishing and the tourist industries. The labor force participation rate as a percent of population on the Eastern Shore currently stands at 43.2 percent.

[1] Consists of Accomack and Northampton Counties.

In base case I, which assumes the building of no off-shore port facilities and no development of the outer continental shelf (OCS), the Eastern Shore population is expected to reach 47,200 by 1985. With considerable growth anticipated in manufacturing activity (primarily Brown and Root) and continued employment declines in agriculture, manufacturing by 1985 will be the Eastern Shore's most important employer in place of agriculture. In base case I total employment is projected to reach 17,800 and the labor force participation rate is expected to fall slightly to 41.3 percent.

In base case II the Eastern Shore population and employment figures would remain unchanged because refinery capacity increases built into this case would affect the Hampton Roads/York River area only.

With OCS development the Eastern Shore population is projected to increase by 5,700 persons, while employment will expand by approximately 7,400 by 1985. The largest "primary" or "basic" industry employment gain would be in mining (oil and gas extraction). For purposes of simplification, employment associated with exploration, platform development and oil and gas production are all grouped into the oil and gas recovery[2] or extraction category. The

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[2] Resource Planning Associates, Inc. estimates that a total of 7,520 persons would be employed in oil and gas recovery on the east coast by 1985. Of this total 1,550 would be employed in exploration, 3,720 in platform development and 2,250 in oil and gas production.

Eastern Shore mining employment total for 1985 is projected to be 1,880 with 390 persons in exploration, 930 in platform development, and 560 in oil and gas production. It is assumed that one quarter of total east coast oil and gas recovery employment for 1985 will impact on Virginia's Eastern Shore.

An employment gain of 1,500 is anticipated in "other" manufacturing, specifically fabricated metal products with expansion of Brown and Root. Approximately 100 persons would be employed in the two gas processing plants assumed to be located on the Eastern Shore by 1985. Secondary employment gains totaling approximately 3,900 persons would occur in the construction, utilities, and service categories.

Thus, with OCS development the Eastern Shore will have a 1985 population total of 52,900 and total employment of 25,260. The area's labor force participation rate is projected to increase to 50 percent.

Social system impacts on the Eastern Shore associated with the projected population increase of 5,700 include almost 1,500 new school children, 21 new hospital beds, a manpower increase in the local police of nine men, and a rise in state and local government employment of 171. In addition, local government overhead costs would rise by nearly $43,000.

The physical system would see a rise of 0.6 million gallons per day (mgd) in total water demand and 0.57 mgd of domestic sewage for the 1,900 new households gene-

rated. To serve these, almost 140,000 square feet of new commercial floor space would be required. Solid waste generation would rise by 17.1 tons per day.

Hampton Roads/York River[3]

Virginia's Hampton Roads/York River area was estimated to have a 1972 population of 1,044,400. Total employment including military was approximately 503,400 with the federal government (both military and civilian) being the largest single employer. As shown in Table II, federal employment totaled approximately 170,500 persons. Nearly 60,000 persons are currently employed in manufacturing jobs, with approximately one half of these working in Newport News with the Newport News Shipbuilding and Dry Dock Company. Also included in the manufacturing sector are 225 persons employed by American Oil Company at its Yorktown refinery. As previously stated, this is the only refinery in Virginia. Its daily production is about 50,000 barrels of refined products. The entire area represents the most populated and one of the most highly industrialized regions within the state. Currently the area has a labor force participation rate of 49.3 percent.

Base case I assumes that refinery production in Virginia and the Hampton Roads/York River area will increase

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[3] Consists of the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, Virginia Beach, Hampton, Newport News, and Williamsburg, and the counties of James City and York.

to 264,000 barrels per day. By 1985, the Yorktown refinery in base case I will have a capacity of 80,000 barrels per day and a newly-built Suffolk refinery will have daily production of 184,000 barrels. The population of the Hampton Roads area is expected to reach 1,244,600 by 1985 without off-shore port and OCS development. Total employment is expected to increase to approximately 600,800 persons with the largest gains coming in manufacturing employment. Within the manufacturing sector, more than 700 persons are projected to be employed in petroleum refining. The area's labor force participation rate is expected to increase slightly to 49.6 percent.

As indicated in the assumptions for this section, in base case II an off-shore port facility is built, and refinery capacity increases to 484,000 barrels per day. It is further assumed that all refinery capacity gains would occur in the Hampton Roads/York River area. In base case II the area's population would increase by 4,000 persons over the base case I population for 1985. Total employment would increase by approximately 6,400 persons with a gain of nearly 1,800 in manufacturing. Refinery employment would be up by nearly 600 to 1,300 persons. In base case II the area's labor force participation rate is projected to reach 50.0 percent.

The population of the Hampton Roads area with OCS development is projected to increase by nearly 67,000, reaching a 1985 population total of 1,315,500. Total employment

is expected to grow by nearly 46,800 with a nearly 13,000 person gain in manufacturing. Employment in petroleum refining, gas processing and petrochemicals would increase by 4,300 thus reaching a 5,600 person total. Included in the figure of 4,300 would be 2,025 persons actually employed in refineries. The remaining 2,275 persons are estimated to be employed in two major petrochemical operations. A significant gain (1,880 persons) is also anticipated in oil and gas extraction (mining). As on the Eastern Shore, one quarter of total east coast oil and gas recovery employment for 1985 is expected in the Hampton Roads/York River area. As indicated earlier, all refinery capacity associated with the 750,000 barrel per day OCS production assumption would be refined in Virginia's Hampton Roads/York River area. With OCS development, the Yorktown refinery would produce 150,000 barrels per day, the Suffolk refinery 300,000 barrels per day, and the two Portsmouth refineries 200,000 and 100,000 barrels per day.

The area's relatively high labor force participation rate is expected to increase slightly from 50.0 percent to 51.0 percent with OCS development.

In the Hampton Roads/York River area, a population increase of 66,900 would result in over 17,000 new school enrollments, new hospital capacity of 244 beds, 103 new police positions, and 2,007 new state and local governmental employees. Local government overhead would rise by more than $500,000.

Large increases would be felt in water demand with 78 mgd required for new industry and 6.7 mgd for domestic supply. Domestic sewage discharge would rise by 6.7 mgd as well. An increase of two hundred one tons per day of solid waste would accompany the 22,000 new households and 1.6 million square feet of new commercial space.

Commonwealth of Virginia

Virginia's 1972 population was estimated to be 4,764,000. Total employment was estimated at 1,860,000. Only ten persons were employed in oil and gas extraction--primarily in southwest Virginia. As previously mentioned, only 225 persons were employed statewide in refinery production, all of whom were employed on one Hampton Roads/York River facility. Statewide in 1972, the labor force participation rate was 40.2 percent.

In base case I the state's total population is anticipated to reach 5,650,000, and total employment is projected to reach 2,376,000. Refinery employment for the state would be the same as for the Hampton Roads/York River area--approximately 700 persons. The state's labor force participation rate is projected to reach 43.2 percent.

In base case II the changes in Virginia's population and employment totals resulting from refinery employment gains are exactly the same as for the Hampton Roads/York River area in that all changes are anticipated there.

In the case of OCS development, the impact figures for the Eastern Shore and Hampton Roads/York River were aggregated to arrive at the total for Virginia. Virginia's total population would increase by 72,600, and total employment would be increased by 54,120. For the entire state in 1985, approximately 5,700 persons would be employed in petroleum refining, gas processing and petrochemicals, and an additional 3,785 in oil and gas extraction. Secondary employment gains resulting from OCS development include an additional 4,400 persons in both construction and utility activity and an additional 70,100 persons in other manufacturing jobs. Service employment would be increased by approximately 27,000. With OCS development, the state's labor force participation rate would be expected to go up slightly to 43.7 percent.

The social and physical system impacts on Virginia as a whole are also treated here as simple aggregates of the impacts on the two specific areas. The 72,600 additional persons attributable to OCS development would result in 19,058 new school enrollees, 264 additional hospital beds, 112 additional police personnel, and a rise in state and local governmental employment of 2,178. Local government overhead would increase by $546,678.

Water requirements would be up by over 85 million gallons per day and domestic sewage up by over 7 mgd. A solid waste increase of 218 tons per day would accompany more than 24,000 new housing units and almost 1.8 million

square feet of new commercial space.

Major Concerns

Major concerns associated with OCS development in the Onshore Area are:

(1) The possibility of rapid, uncontrolled growth, particularly in the relatively rural Eastern Shore.

(2) Air and water pollution resulting from both directly and indirectly OCS-related industrial development, as well as secondary development.

(3) The demand for large amounts of water which will be required to support any development. Problems in this regard are already projected for the Hampton Roads/York River area, and the Eastern Shore has only limited supplies.

(4) The requirements for increased public services and for increased overhead of local government.

Conclusions

In general, the results of this analytical procedure have some significant impacts likely to occur under these assumptions with the possibility for even greater impacts under different working assumptions. The Eastern Shore, for example, would experience modest population increases and concurrent demands upon social and physical systems. Of possibly greater impact would be the significant shift that could occur from an economy, lifestyle,

and landscape pattern based primarily upon agriculture, fishing and food-related industry to one based more upon general and oil-related industry.

The Hampton Roads/York River area would experience much greater increases in both population and industrial development. These increases could severely tax not only the social and physical support systems of the area but also something as basic as available space as well. Both water supply and air quality considerations could conceivably act as limiting physical factors. Supplying sufficient water to the Hampton Roads/York River area is a problem today, and demand increases of over 80 million gallons per day by 1985 may prove impossible without reclamation of treated domestic wastewater, the importation of water from other river basins, or the desalinization of seawater. Air pollutant discharges of over 30,000 tons per year (particulates) could likewise prove to be intolerable in an area with "air space" for less than 2,000 tons.[4]

Along with impacts upon the above geographic areas, the state as a whole could feel major effects of OCS development. The nature of these impacts, though not as easily projected, could be one of healthy progress and financial benefit if properly directed by sound planning and judicious regulation.

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[4] Air Pollution Control Board, Estimate of the Effect of Outer Continental Shelf Development on Air Pollution Control.

TABLE 1.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON VIRGINIA'S EASTERN SHORE

	1972	1985				
	Actual	Base Case I[a/]	Absolute Change	Base Case II[b/]	Absolute Change	OCS Development[c/]
Population	43,500	47,200		47,200	5,700	52,900
Labor force (including military)	18,810	19,500		19,500	6,960	26,460
Unemployment	2,175	1,600		1,600	-400	1,200
Total employment (including military)	16,635	17,900		17,900	7,360	25,260
Construction	361	420		420[h/]	100	520[h/]
Mining						
Oil and gas extraction					1,880	1,880[l/]
Other[d/]						
Agriculture	3,360	2,500		2,500		2,500
Manufacturing						
Petroleum refining, gas processing and petrochemical						
Other[e/]	3,353	5,400		5,400[i/]	1,500	6,900[i/]
Utilities[f/]	509	630		630[i/]	100	730[i/]
Services[g/]	9,052	8,950		8,950[k/]	3,680	12,630[k/]
Labor force as a percent of population	43.2	41.3		41.3		50.0

a/ Base case one assumes that refinery capacity at the Yorktown refinery will increase by 60 percent to 80,000 barrels per day and that the Suffolk refinery will be built with production of 184,000 barrels per day. Under the base case I assumption, Virginia would have total refinery capacity of 264,000 barrels per day by 1985.

b/ Base case two assumes that refinery capacity at the Yorktown refinery will increase by 100 percent to 100,000 barrels per day and that the Suffolk refinery will be built as outlined in base case I. In addition the Transco refinery in Portsmouth is assumed to be operational with a 200,000 barrel refinery capacity. In base case II an off-shore port facility would be built off the coast of Virginia. Under the base case II assumption, Virginia would have total refinery capacity of 484,000 barrels per day by 1985.

c/ Under the third option, development of Virginia outer continental shelf is assumed. Total refinery production would reach 750,000 barrels per day. In addition to the assumptions made in base case I and base case II, it is assumed that the Yorktown refinery will increase capacity to 150,000 barrels per day, the Suffolk refinery will increase capacity to 300,000 barrels per day and that the Motor Gas, Oil and Refining Corporation will build its Portsmouth facility with a 100,000 barrel per day capacity.

d/ Includes all mining except oil and gas extraction, which is SIC group 13.

e/ Includes all manufacturing except petroleum refining and related industries which is SIC group 29.

f/ Includes all public utilities, transportation, and communications. Presented are SIC categories 40 through 49.

TABLE 1.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON VIRGINIA'S EASTERN SHORE (Cont'd)

g/ Includes all employment not mentioned in the above categories. SIC categories 50 through 99 are included here.

h/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional construction worker.

i/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional utility worker.

j/ Each refinery, gas processing, and petrochemical worker is expected to create two additional other manufacturing jobs.

k/ Each additional "basic industry" type worker is expected to create an additional service or "supporting" type worker.

l/ Represents one half of the east coast exploration, platform development and oil and gas production total estimated to be needed by Resource Planning Associates in order to produce 750,000 barrels of crude oil per day.

Sources: Resource Planning Associates, Inc. "Potential Onshore Effects of Oil and Gas Production on the Atlantic and Gulf of Alaska Outer Continental Shelf," December 1973; Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development - Report to the Council on Environmental Quality;" United States Department of the Interior,"Environmental Impact Statement: Deepwater Ports," April, 1974; Commonwealth of Virginia, "Off-Shore Port Facilities: Commonwealth of Virginia," February, 1974; and Tetra Tech, Inc., "The Effect of Natural Phenomena on OCS Gas and Oil Development," December, 1973.

TABLE 2.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON VIRGINIA'S HAMPTON ROADS AREA

	1972	1985				
	Actual	Base Case I[a]	Absolute Change	Base Case II[b]	Absolute Change	OCS Development[c]
Population	1,044,400	1,244,600	4,000	1,248,600	66,900	1,315,500
Labor force (including military)	514,755	617,693	6,435	624,128	46,760	670,888
Unemployment	11,346	16,953		16,953		16,953
Total employment (including military)	503,409	600,740	6,435	607,175	46,760	653,935
Construction	21,466	27,600	585	28,770[i]	4,300	33,070[i]
Mining						
Oil and gas extraction	-	-			1,880	1,880[m]
Other[d]	57	60		60		60
Agriculture	3,898	2,868		2,686		2,868
Manufacturing						
Petroleum refining, gas processing, and petrochemicals	225	715	585	1,300[h]	4,300	5,600[k]
Other[e]	59,914	83,926	1,170	85,096[k]	8,600	93,696[k]
Utilities[f]	20,749	25,200	585	25,785[i]	4,300	30,085[i]
Federal government	170,520	154,000		154,000		154,000
Services[g]	226,580	306,371	2,925	309,296[l]	23,380	332,676[l]
Labor force as a percent of population	49.3	49.6		50.0		51.0

a/ Base case one assumes that refinery capacity at the Yorktown refinery will increase by 60 percent to 80,000 barrels per day and that the Suffolk refinery will be built with production of 184,000 barrels per day. Under the base case I assumption, Virginia would have total refinery capacity of 264,000 barrels per day by 1985.

b/ Base case two assumes that refinery capacity at the Yorktown refinery will increase by 100 percent to 100,000 barrels per day and that the Suffolk refinery will be built as outlined in base case I. In addition the Transco refinery in Portsmouth is assumed to be operational with a 200,000 barrel refinery capacity. In base case II an off-shore port facility would be built off the coast of Virginia. Under the base case II assumption, Virginia would have total refinery capacity of 484,000 barrels per day by 1985.

c/ Under the third option, development of Virginia outer continental shelf is assumed. Total refinery production would reach 750,000 barrels per day. In addition to the assumptions made in base case I and base case II, it is assumed that the Yorktown refinery will increast capacity to 150,000 barrels per day, the Suffolk refinery will increase capacity to 300,000 barrels per day and that the Motor Gas, Oil and Refining Corporation will build its Portsmouth facility with a 100,000 barrel per day capacity.

d/ Includes all mining except oil and gas extraction, which is SIC group 13.

e/ Includes all manufacturing except petroleum refining and related industries which is SIC group 29.

f/ Includes all public utilities, transportation, and communications. Presented are SIC categories 40 through 49.

TABLE 2.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON VIRGINIA'S HAMPTON ROADS AREA (Cont'd)

g/ Includes all employment not mentioned in the above categories. SIC categories 50 through 99 are included here.

h/ It is assumed that 135 refinery workers are required for each 50,000 barrels per day refinery capacity. Thus, with refinery capacity of 484,000 barrels, 1,300 workers would be needed.

i/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional construction worker.

j/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional utility worker.

k/ Each refinery, gas processing, and petrochemical worker is expected to create two additional other manufacturing jobs.

l/ Each additional "basic industry" type worker is expected to create an additional service or "supporting" type worker.

m/ Represents one fourth of the east coast exploration, platform development and oil and gas production total estimated to be needed by Resource Planning Associates in order to produce 750,000 barrels of crude oil per day.

Sources: Resource Planning Associates, Inc. "Potential Onshore Effects of Oil and Gas Production on the Atlantic and Gulf of Alaska Outer Continental Shelf," December 1973; Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development - Report to the Council on Environmental Quality;" United States Department of the Interior, "Environmental Impact Statement: Deepwater Ports," April, 1974; Commonwealth of Virginia, "Off-Shore Port Facilities: Commonwealth of Virginia," February, 1974; and Tetra Tech, Inc., "The Effect of Natural Phenomena on OCS Gas and Oil Development," December, 1973.

TABLE 3.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON ONSHORE VIRGINIA

	1972	1985				
	Actual	Base Case I[a/]	Absolute Change	Base Case II[b/]	Absolute Change	OCS Development[c/]
Population	4,764,000	5,650,000	4,000	5,654,000	72,600	5,726,600
Labor force (including military)	1,913,300	2,440,000	6,435	2,446,435	54,120	2,500,555
Unemployment	51,700	64,000		64,000		63,600
Total employment (including military)	1,860,000	2,376,000	6,435	2,382,435	54,120	2,436,555
Construction	99,400	126,000	1,170	127,170[i/]	4,400	131,570[i/]
Mining						
Oil and gas extraction	10	25		25	3,760	3,785[m/]
Other[d/]	15,690	19,975		19,975		19,975
Agriculture	73,300	40,000		40,000		40,000
Manufacturing						
Petroleum refining, gas processing and petrochemicals	225	715		1,300[h/]	4,400	5,700[k/]
Other[e/]	375,175	514,285	1,170	515,455[k/]	10,100	525,555[k/]
Utilities[f/]	98,900	125,000	585	125,585	4,400	129,985[j/]
Services[g/]	1,197,300	1,550,000	2,925	1,552,925[l/]	27,060	1,579,985[l/]
Labor force as a percent of population	40.2	43.2		43.3		43.7

a/ Base case one assumes that refinery capacity at the Yorktown refinery will increase by 60 percent to 80,000 barrels per day and that the Suffolk refinery will be built with production of 184,000 barrels per day. Under the base case I assumption, Virginia would have total refinery capacity of 264,000 barrels per day by 1985.

b/ Base case two assumes that refinery capacity at the Yorktown refinery will increase by 100 percent to 100,000 barrels per day and that the Suffolk refinery will be built as outlined in base case I. In addition the Transco refinery in Portsmouth is assumed to be operational with a 200,000 barrel refinery capacity. In base case II an off-shore port facility would be built off the coast of Virginia. Under the base case II assumption, Virginia would have total refinery capacity of 484,000 barrels per day by 1985.

c/ Under the third option, development of Virginia outer continental shelf is assumed. Total refinery production would reach 750,000 barrels per day. In addition to the assumptions made in base case I and base case II, it is assumed that the Yorktown refinery will increase capacity to 150,000 barrels per day, the Suffolk refinery will increase capacity to 300,000 barrels per day and that the Motor Gas, Oil and Refining Corporation will build its Portsmouth facility with a 100,000 barrel per day capacity.

d/ Includes all mining except oil and gas extraction, which is SIC group 13.

e/ Includes all manufacturing except petroleum refining and related industries which is SIC group 29.

f/ Includes all public utilities, transportation, and communications. Presented are SIC categories 40 through 49.

TABLE 3.--POSSIBLE HIGH DEVELOPMENT IMPACT OF THE ATLANTIC OUTER CONTINENTAL SHELF ON ONSHORE VIRGINIA (Con'd)

g/ Includes all employment not mentioned in the above categories. SIC categories 50 through 99 are included here.

h/ It is assumed that 135 refinery workers are required for each 50,000 barrels per day refinery capacity. Thus, with refinery capacity of 484,000 barrels, 1,300 workers would be needed.

i/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional construction worker.

j/ Each refinery, gas processing, and petrochemical worker is expected to create employment for one additional utility worker.

k/ Each refinery, gas processing, and petrochemical worker is expected to create two additional other manufacturing jobs.

l/ Each additional "basic industry" type worker is expected to create an additional service or "supporting" type worker.

m/ Represents one half of the east coast exploration, platform development and oil and gas production total estimated to be needed by Resource Planning Associates in order to produce 750,000 barrels of crude oil per day.

Sources: Resource Planning Associates, Inc. "Potential Onshore Effects of Oil and Gas Production on the Atlantic and Gulf of Alaska Outer Continental Shelf," December 1973; Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development - Report to the Council on Environmental Quality;" United States Department of the Interior, "Environmental Impact Statement: Deepwater Ports," April, 1974; Commonwealth of Virginia, "Off-Shore Port Facilities: Commonwealth of Virginia," February, 1974; and Tetra Tech, Inc., "The Effect of Natural Phenomena on OCS Gas and Oil Development," December, 1973.

TABLE 4.--POSSIBLE 1985 HIGH OCS DEVELOPMENT IMPACTS ON SOCIAL AND PHYSICAL SYSTEMS: VIRGINIA, HAMPTON ROADS, AND EASTERN SHORE

	Virginia	Hampton Roads	Eastern Shore
Population (absolute change over Base Case II)	72,600	66,900	5,700
Social Systems[a/]			
School enrollment[b/]	19,058	17,561	1,496
Hospital beds[c/]	265	244	21
Police manpower[d/]	112	103	9
Government overhead[e/]	$546,678	$503,757	$42,921
Government employees[f/]	2,178	2,007	171
Physical Systems			
Water demands (million gallons per day)[g/]			
domestic	7.26	6.69	.57
petroleum related industry[h/]	78+	78	.03
Sewage - domestic (million gallons per day)	7.26	6.69	.57
Solid waste (tons per day)[i/]	218+	201	17
Residential structures[j/]	24,200	22,300	1,900
Commercial structures (square feet)[k/]	1,778,700	1,639,050	139,650

a/ Ratios used to generate figures for the ten social and physical system indicators from 1985 population figures are in some cases the averages of similar ratios for four east coast hypothetical case studies done by Resource Planning Associates for the Council on Environmental Quality. These case study locations are Bristol County, Massachusetts, Cumberland/Cape May Counties, New Jersey, Charleston, South Caroline, and Jacksonville, Florida. Other ratios are commonly accepted ones for Virginia supplied by the State Water Control Board and the Division of State Planning and Community Affairs where significantly different from RPA figures.

b/ School enrollment is assumed to be .2625 the total population, based on RPA figures.

c/ Demand for hospital beds is assumed to be 3.64 per thousand population based on RPA figures.

d/ It is assumed that 1.54 additional police persons will be required for each 1,000 persons based on RPA figures.

e/ Local government overhead cost is estimated at $7.53 per person based on RPA figures.

f/ A ratio of 30 government employees per thousand population is assumed based on DSPCA figures for Virginia.

g/ A domestic water demand and sewage discharge of 100 gallons per person per day is assumed based on SWCB estimates for Virginia.

h/ Petroleum industry water demand figures are based on assumptions of 40 gallons per barrel for refineries, 15,000 gpd per gas processing plant, and 24 mgd per major petrochemical complex from RPA sources.

i/ Solid waste is assumed to be generated at 3 tons per thousand persons per day based on SWCB Virginia estimates.

j/ Residential structure figures are calculated at a ratio of 3.0 persons per household based on DSPCA-Virginia figures.

k/ Commercial structure requirements are assumed to be 24.5 square feet per person based on RPA figures.

Sources: Resource Planning Associates, Inc."Potential Onshore Effects of Oil and Gas Production on the Atlantic and Gulf of Alaska Outer Continental Shelf," December, 1973; Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development - Report to the Council on Environmental Quality;" United States Department of the Interior, "Environmental Impact Statement: Deepwater Ports," April, 1974; Commonwealth of Virginia, "Off-Shore Port Vacilities: Commonwealth of Virginia," February, 1974; and Tetra Tech, Inc., "The Effect of Natural Phenomena on OCS Gas and Oil Development," December, 1973.

VI

Recommendations

This section will set forth recommendations based upon the preceeding portions of this report. Their ultimate aim is to enable Virginia to derive maximum benefit from whatever resources may be discovered on the OCS, while preserving to the greatest possible extent the environment which so enhances our daily lives. In fact, given the energy requirements of the United States, we feel they will likely be developed whether or not we as Virginians desire it, regardless of the decision of the Supreme Court with respect to ownership of the offshore lands. It therefore behooves us to make arrangements to anticipate the effects of OCS development and its associated problems.

In order, therefore, to prepare for the possibility of the development of the OCS off the coast of our state, we make the following recommendations:

Overall Recommendations

(1) Virginia is currently involved in the development of a Coastal Zone Management Plan. It is recommended that this planning effort consider the possibility of OCS oil and gas exploration and exploitation, including the findings of this and any subsequent reports.

Other related reports, such as that recently completed on Offshore Port Facilities should also be considered.

It is further recommended that any planning for and regulation of OCS development be conducted consistently with and as a part of the Coastal Zone planning effort.

(2) In case the Supreme Court rules against the states federal legislation to require sharing of federal rents, bonuses and royalties received from the leasing of OCS lands should be supported. Some arrangements to pass funds from this source to the localities seems only simple justice, since it is they who bear the brunt of the onshore impacts. These impacts include not only the public services which must be furnished to the industries and people related to OCS development, but also those less easily quantified financially, such as the threat of oil spills, modifications to coastal ecology and shifts in population. Further, such legislation should consider the fact that onshore development in one state could well be related to OCS development off the coast of a neighboring state, and provisions made therefor. A joint declaration to this effect by all coastal states would be a useful means of supporting such legislation.

(3) The Atlantic Coastal States should oppose drilling on OCS lands until an oil spill cleanup association organized in the fashion of "Clean Gulf Associates" has been formed for the Atlantic area by the oil companies who desire to exploit the Atlantic OCS. This association should be capable of employing "state of the art" technology in its clean-up activities.

(4) Research problems concerning hydrocarbons and the marine environment should be jointly attacked by the Atlantic Coastal States and the Federal Government in order to prevent needless duplication. Virginia should develop an adequate offshore research and monitoring capability to support these studies. Though it is impossible to list here all of the programs which should be scientifically pursued in this regard, the following general topics are considered to be the most important:

(a) Baseline studies to establish current conditions among the biota, particularly those of the offshore area.

(b) Response of the various organisms to chronic long term releases of small amounts of petroleum.

(c) Surface and bottom current patterns in the

Virginian Sea under various meteorological conditions, including the development of a reliable predictive model.

(d) The effects of various natural phenomena on the weathering of petroleum, including rates of degradation.

(e) Effects of the various constituents of petroleum on organisms, particularly the larval stages.

(f) The physical-chemical interrelationships between sediments and the various constituents of petroleum, including the persistance of hydrocarbons in sediments.

(g) The effects of the incidental products of the exploration for and exploitation of petroleum resources upon the marine environment and biota. Included among these products are drilling mud, bleedwater, and drill cuttings.

(5) The present Outer Continental Shelf Advisory Committee, organized on an ad hoc basis by the Secretary of Commerce and Resources, should be continued. This committee now represents agencies of the Commonwealth with interests in OCS development. It should be formalized, and charged with the responsibility to act in an advisory capacity in matters relating to

the development of the OCS.

Recommendations for the Offshore Area

If Virginia should be awarded control of the offshore area, the following recommendations apply:

(1) Regulations similar to those in current use by the Federal Government should be adopted by Virginia to cover all phases of leasing, exploration, production, and inspection of the OCS lands and operations. These should include the control of drilling by-products such as bleedwater drill cuttings and drilling mud.

(2) A state agency should be assigned responsibility for the OCS lands in the Offshore area. The Virginia Marine Resources Commission would be a logical choice; however, VMRC would have to be very greatly expanded, since the magnitude of OCS activities it would oversee would be enormous. Alternatively, a new agency, properly funded, staffed and equipped could be formed and assigned the responsibility, together with the broad powers required.

In either case, close liaison should be established with other state agencies having an interest in the marine environment and its resources, notably the Virginia Institute of Marine Science, the State Water Control Board,

the Division of Mineral Resources, and, should responsibility be assigned elsewhere, the Virginia Marine Resources Commission.

Should the federal government be awarded control of the offshore area, the following recommendations apply:

(1) A state office having responsibility for coordinating all contacts between the state and the federal government and industrial organizations should be created. It would further serve as a focal point for Virginia in matters concerning the development of the OCS. Close liaison should be maintained with state agencies having an interest in the marine environment and its resources, including the Virginia Institute of Marine Science, the State Water Control Board, the Virginia Marine Resources Commission and the Division of Mineral Resources.

Recommendations for the Interface Area

(1) The Virginia Wetlands Act of 1972 should be reviewed and modified to encourage local planning for wetlands alterations as opposed to the case-by-case method currently in use. Experience in Louisiana indicates the major damage to the marine environment related to offshore oil and gas activity was the result of modifications to wetlands. Technical ad-

vice regarding massive wetlands alterations as well as surveillance of such activities should be provided local governments by appropriate state agencies such as the Virginia Institute of Marine Science and the Virginia Marine Resources Commission.

(2) Detailed criteria should be developed to be utilized in the approval of permits for the placing of structures (including pipelines) in the marine environment. Methods of construction, route selection, operational monitoring and requirements for removal upon obsolescence should be included. A detailed study should be made of problems encountered in states where offshore activity has been going on (such as Louisiana and California) and the procedures developed to handle them.

(3) Pipeline access through the Interface area should be so controlled that the numbers of pipeline corridors will be kept to a minimum.

Recommendations for the Onshore Area

(1) Local governments who are expected to bear the impact of onshore development should be encouraged with state assistance to plan for and regulate projected growth in their areas, in order that they may derive maximum benefit from such growth at the least possible expense

to their traditional values and lifestyles. Minimum state standards should be developed to guide this process.

(2) A study should be conducted by the state as to the most appropriate use of any revenues received as a result of the development of the OCS. One alternative to be considered by such a study would be the use of a portion of the funds received to assist the localities most heavily impacted in providing public services.

(3) Recognizing that production of oil and gas from the OCS can result in development on-shore of large industrial complexes such as refineries, tank farms and petrochemical plants--all of which can be considered as having an impact of regional as opposed to local scale--it is recommended that the Commonwealth act to increase its role in the planning and control of these developments. It appears appropriate to frame and enact legislation requiring the state to develop criteria and minimum standards to be used in the review and processing of the siting of these developments of greater than local impact, thus contributing to orderly development.

Appendix A

U.S. v. Maine, et al

In 1969 the State of Maine granted exclusive exploratory rights in certain tracts of offshore lands beyond the three-mile limit to King Resources. The United States thereupon brought suit against the 13 Atlantic Coastal States for a determination of rights in all the lands and natural resources of the bed of the Atlantic Ocean more than three geographical miles from the coastline. The federal action, in a word, is in the nature of a suit to quiet title.

The coastal states, in response to the complaint of the United States, denied the allegations and, by way of affirmative defense, alleged that they as successors in title to certain grantees of the Crown of England are now and - ever since the formation of the Union - have been entitled to exercise exclusive dominion and control over the exploration and development of such natural resources as may be found in, on or about the seabed and subsoil underlying the Atlantic Ocean adjacent to their coastlines. The States also asserted that such power of control is not prohibited by the Constitution, has never been delegated by the States to the federal government and that any attempt by the government to assert such power violates the provisions of the Tenth Amendment to the Constitution.

After the initial pleadings had been filed, the United States moved for judgment on the pleadings; the States,

led by Virginia, countered with a motion for reference to a Special Master, the States contending that, unlike other states in the nation, the Atlantic States preceded the nation, formed the government and, consequently, were possessed of historical documents and other forms of evidence and claims, all of which should be carefully reviewed prior to any decision by the High Court. In June, 1970, the Supreme Court granted the motion of the States and referred the case to a Special Master, a Senior United States Circuit Court Judge.

Hearings were held in Philadelphia for almost three years, during which time thousands of documents, some in medieval French, were submitted by both sides. Scholars from the country's top universities and a retired judge from the World Court were among the witnesses to the Court. Archives from Virginia to London were scoured for relevant evidence. Old maps were discovered and offered to the Court. In addition to the evidence collectively submitted by the States, Virginia offered comprehensive testimony with respect to the assertion of authority, the exercise of authority and jurisdiction and the exploitation of Virginia's natural resources by the Colony and State and its citizens.

The basic contention of the United States is that the original colonies did not separately acquire ownership of the three-mile belt in the adjacent sea or the soil under it. Such ownership was acquired by the national government after the formation of the Union and, consequently, by act of Congress in 1953, the United States confirmed to all

coastal states' ownership of the bed of the three-mile territorial sea adjacent to their coastal lines while at the same time reasserting the federal claim to resources seaward of the three-mile limit, subject to coastal states proving claims to limits beyond the three-mile limit.

The basic contentions of the defendant states are several:

(1) That under the law and practice of England prior to and during the 17th and 18th centuries, the seabed comprising the continental shelf of England and of English possessions was subject to an exclusive right of exploitation in favor of the English Crown.

(2) In that period no generally recognized principle of international law prohibited or denied that exclusive right to the English Crown.

(3) During the period 1492 to 1776, England acquired by right of discovery or conquest and the performance of symbolic acts of sovereignty over the territories now comprising the defendant states and the adjacent continental shelf. During that period the Crown granted its right of exploitation over part or all of that continental shelf to Colonial proprietorships and governments. For example, the States assert that the 1607 and 1609

Virginia charters to the London Company by King James I, in addition to grants of land to the North, South and West, included the sea, seabed, all islands and minerals for a distance of 100 miles, the distance Virginia and other states are claiming today.

(4) To continue, the States assert that at American Independence those rights passed individually to the successor independent states. If any portion of the continental shelf was not granted to the Colonial proprietorships and governments by the Crown prior to 1776, such portion passed individually to the independent states at independence or, at the latest, by the Peace of Paris in 1783. Virginia asserts, for example, that the 1776 Constitution of Virginia, and even the Code of Virginia today, specifically incorporate the 100 mile boundary first delineated by King James as the eastern boundary of the Commonwealth.

(5) The states contend, too, that nothing has occurred since 1783 which effectively divested the defendant states of the ownership of the continental shelf. The states preserved their respective rights when they entered into the Articles of Confederation and into the Constitution of the United States.

Thus, the legal lines are drawn in the latest and, perhaps, the last of the big offshore lands cases. Much is at stake; the case is expected to be argued in February, 1975, with a decision to be announced by June.