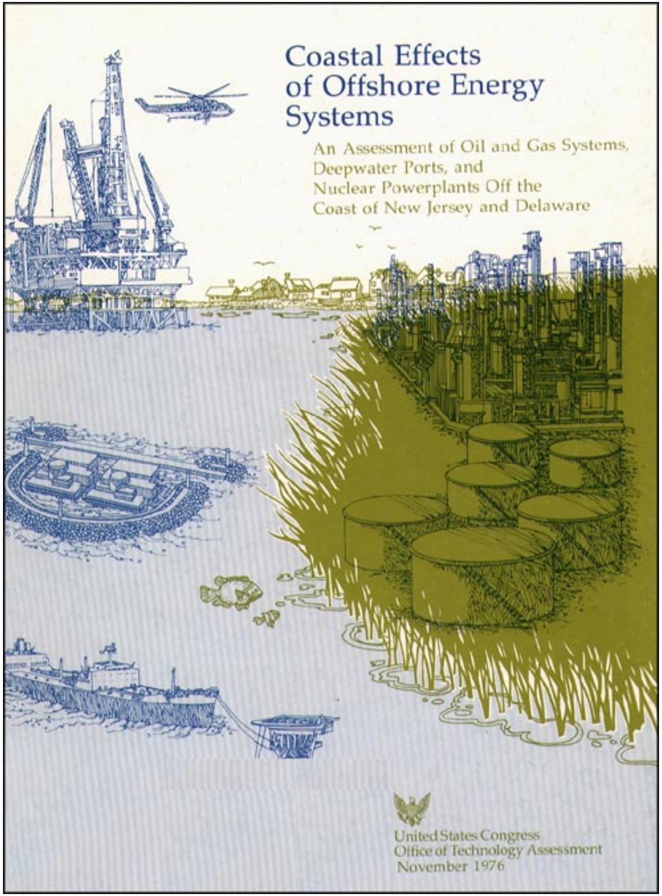
Coastal Effects of Offshore Energy Systems: An Assessment of Oil and Gas Systems, Deepwater Ports, and Nuclear Powerplants Off the Coasts of New Jersey and Delaware

November 1976

NTIS order #PB-274033



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Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, D.C. 20510

Nov 11 1976

The Honorable Ernest F. Hollings
Chairman
National Ocean Policy Study
United States Senate
Washington, D. C. 20510

Dear Mr. Chairman:

On behalf of the Board of the Office of Technology Assessment, we are forwarding to you the report Coastal Effects of Offshore Energy Systems: Oil and Gas, Deepwater Ports, and Floating Nuclear Powerplants.

The report consists of two volumes: the first covers the findings and analysis and the second provides back-up material. This report concludes OTA'S assessment of the onshore effects which may be associated with the implementation of one or a combination of the three technologies studied off the coast of New Jersey and Delaware.

This study was requested by you in your capacity as Chairman of the National Ocean Policy Study, in a letter dated January 14, 1974. The request was accepted and the study authorized by the Technology Assessment Board on July 23, 1974. A draft version of the offshore oil and gas section of this report was transmitted to NOPS in April 1976.

Sincerely,

Olin E. Teague
Chairman

Sincerely,

Clifford P. Case
Vice Chairman

Enclosure

Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, D.C. 20510

Nov 11 1976

The Honorable Olin E. Teague
Chairman of the Board
Off ice of Technology Assessment
Congress of the United States
Washington, D. C. 20515

Dear Mr. Chairman:

The enclosed report, Coastal Effects of Offshore Energy Systems: Oil and Gas, Deepwater Ports, and Floating Nuclear Powerplants, presents OTA'S analysis of the probable onshore impacts of implementing one or a combination of the three technologies studied off the coast of New Jersey and Delaware.

The assessment was requested on January 14, 1974, by Senator Ernest F. Hollings, Chairman of the National Ocean Policy Study. It was prepared by the Oceans Program Assessment staff, and has been reviewed extensively within OTA, by the Ocean Assessment Advisory Panel, and by personnel from the Federal agencies, States, and industries which will be affected by the study.

The report specifically (1) delineates the possible actions Congress may want to consider in future legislation and oversight dealing with offshore oil and gas, deepwater ports, and floating nuclear powerplants; (2) analysis past and future government actions in preparing for the three technologies off New Jersey and Delaware; (3) presents the possible economic, political, social, institutional, and legal impacts of implementing the technologies; and (4) reviews the alternatives to the technologies or the implications of not implementing the technologies in the study area.

Some of the analysis required for the overall assessment has already been made available to Congress and used by committees responsible for developing amendments to the Coastal Zone Management Act and amendments to the Outer Continental Shelf Lands Act of 1953. The assessment also resulted in the preparation and publication of three other studies desired by Congress for specific uses. Those were: "An Analysis of the Department of the Interior's Proposed Acceleration of Development of Oil and Gas on the Outer Continental Shelf," "An Analysis of the

Feasibility of Separating Exploration from Production of Oil and Gas on the Outer Continental Shelf," and "Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures."

This assessment was the first major undertaking by OTA to include a large-scale public participation program. The public participation element was an effort to bring about an exchange of information between OTA and citizens in the study region. The two-way flow of information was intended to contribute to the public's understanding of the technologies being assessed and to obtain information directly from the affected citizens about impacts of greatest public concern. The data obtained contributed to OTA'S effort to insure that these factors were adequately addressed in the study so as to assist the Congress in anticipating, understanding, and considering to the fullest extent possible, the consequences of technological application as mandated by the Technology Assessment Act of 1972. The contributions of the public participation program are detailed in the report.

This transmittal includes two volumes: the assessment report itself and working papers which are back-up material for the findings and discussions in the assessment report.

Sincerely,

EMILIO Q . DADDARIO
Director

Enclosures

ACKNOWLEDGMENTS

This report was prepared by the Office of Technology Assessment Oceans Program staff. The staff wishes to acknowledge the assistance and cooperation of the following contractors and consultants in the gathering and formulation of the background data:

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U.S. Nuclear Regulatory Commission
University of South Carolina Institute for Marine Biology and Coastal Research
Virginia Seafood Council
Watch Our Waterways
The Wilderness Society
Zero Population Growth

LIST OF WORKING PAPERS

The following working papers have been prepared by OTA and include background data, detailed analyses, and further documentation of specific subjects referenced throughout this assessment. The working papers 1 through 10 are published as volume II of this report (OTA-O-38) and maybe ordered through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock No. 052–003–00246–9.) price $11.75.

1. Federal and State Regulation of the Three Offshore Energy Technologies
2. Biological Impacts of Three Offshore Energy Technologies
3. Oil Spill Risk Assessment for OCS Oil and Gas and Deepwater Port Development
4. Air and Water Quality Impacts of Oil and Gas Processing Facilities
5. Regional Energy Supply and Demand Considerations
6. Fiscal Effects of OCS Oil and Gas and Deepwater Port Development
7. Environmental Studies for OCS Oil and Gas Development
8. Safety Analysis for Floating Nuclear Powerplants
9. Analysis of Fuel and Waste Handling and Decommissioning for Floating Nuclear Powerplants
10. Economic Considerations for Floating Nuclear Powerplants

TABLE OF CONTENTS

1 '

PAGE

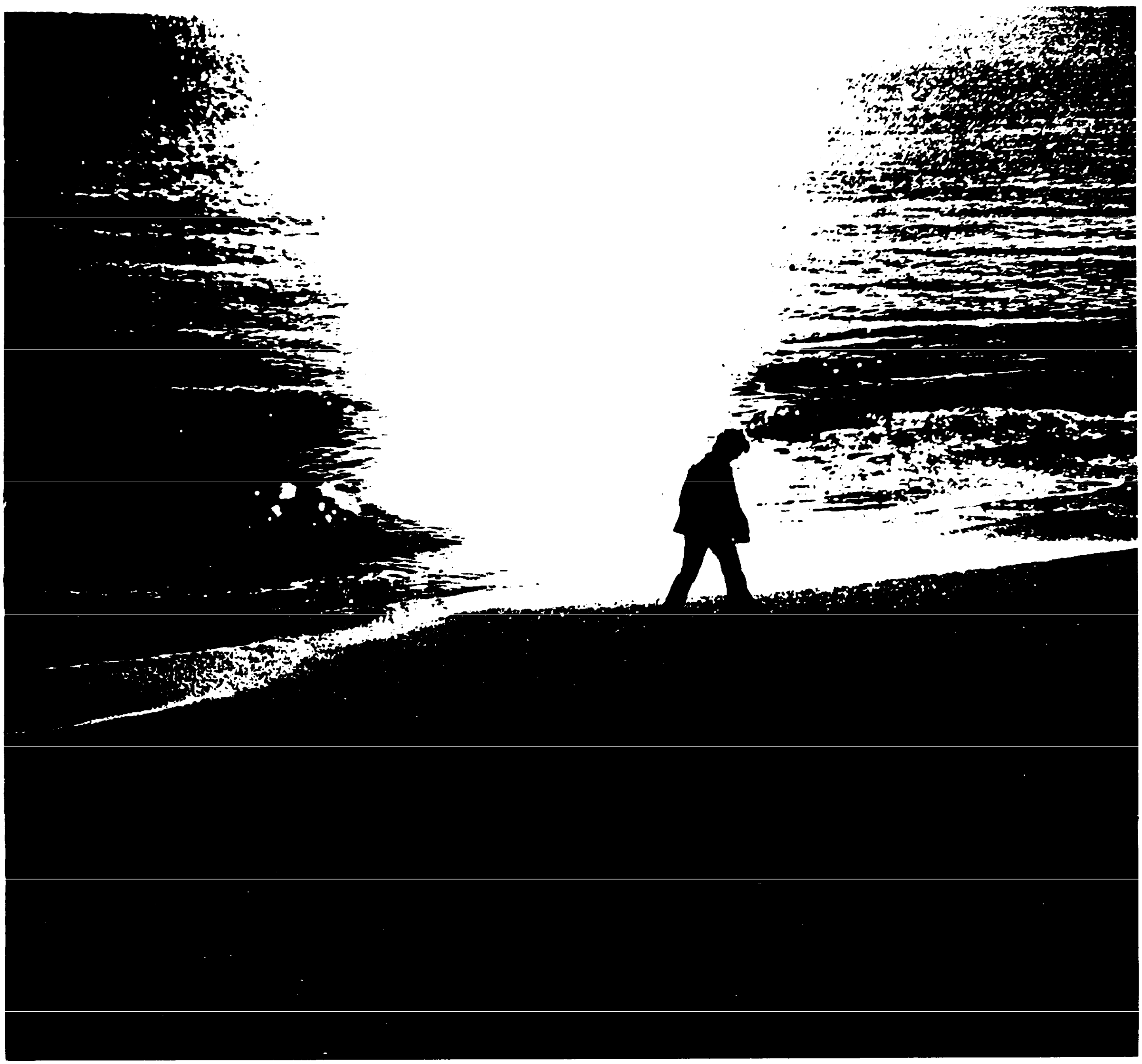
PACE

LIST OF FIGURES

FIGURE NO. *PAGE*

PAGE

PAGE



Chapter I

INTRODUCTION

BACKGROUND

About half of all Americans live and work within 50 miles of a coastline—along the Atlantic or Pacific Oceans, the Gulf of Mexico, or the Great Lakes. According to a Senate Commerce Committee study, that figure may grow to 80 percent of the total population by the turn of the century. With any such concentration of people in less than 10 percent of the Nation's land area will come intense development and competition for land for housing, industry, commerce, energy facilities, resort communities, and transportation networks.

The consequences of 25 years of accelerated dredging, filling, and construction in coastal areas are not understood at this time, So far, the growth of population in the coastal areas has proceeded with little research into the long-range implications of increased activities in those areas. It is known that marshes, estuaries, and tidal flats along the coasts of the United States are crucial to sustaining marine life, directly or indirectly. It is not known how much more development and what kinds of development can take place in coastal areas before the complex relationships between land and sea and between human life and marine life may be irreversibly disrupted. In fact, it is only since the enactment of the Coastal Zone Management Act of 1972, the principal legislation dealing with problems of the coastal zone, that these questions have been addressed in an organized fashion. (The relationship of coastal zone management and offshore energy systems is discussed in chapter IV.)

This assessment is an attempt to add to the understanding of the effects of coastal development by focusing on three energy systems which have been proposed for the waters off New Jersey and Delaware.

The objective of the study has been to trace the likely consequences of three energy systems for the ocean environment, the coastal environment, and the economics and patterns of life in both States during the next two decades.

The three systems are:

1. Oil and natural gas development on the Mid-Atlantic Outer Continental Shelf;
2. Installation of a deepwater port to accommodate supertankers in the Mid-Atlantic area; and
3. Construction of at least two floating nuclear powerplants.

The study was requested by Senator Ernest F. Hollings, chairman of the National Ocean Policy Study and sponsor of the Coastal Zone Management Act. The request was approved by the Technology Assessment Board on July 23, 1974

This report has been prepared by the Oceans Program of OTA with the assistance of an advisory panel of 11 members from industry, Government, and academia, who have reviewed draft material for each section of the report and met periodically to comment on the course of the study and to provide guidance to the staff. The Advisory Panel provided advice and critique throughout the assessment, but does not necessarily approve, disapprove, or endorse the report, for which OTA assumes full responsibility.

The Technology Assessment Board approves the release of this report, which identifies a range of viewpoints on a significant issue facing the U.S. Congress. The views expressed in this report are not necessarily those of the Board nor of individual members thereof.

OFFICE OF TECHNOLOGY ASSESSMENT

The Office of Technology Assessment (OTA) was created in 1972 as an advisory arm of Congress. OTA'S basic function is to help legislative policy makers anticipate and plan for the consequences of technological changes and to examine the many ways, expected and unexpected, in which technology affects people's lives. The assessment of technology calls for exploration of the physical, biological, economic, social, and political impacts which can result from applications of scientific knowledge. OTA provides Congress with independent and timely information about the potential effects—both beneficial and harmful-of technological applications.

Requests for studies are made by chairmen of standing committees of the House of Representatives or Senate; by the Technology Assessment Board, the governing body of OTA; or by the Director of OTA in consultation with the Board.

The Technology Assessment Board is composed of six members of the House, six members of the Senate, and the OTA Director, who is a non-voting member.

OTA currently has underway studies in eight general areas-energy, food, health, materials, oceans, transportation, international trade, and policies and priorities for research and development programs.

STUDY AREA AND APPROACH

This study concentrated on proposed developments off the coast of New Jersey and Delaware for several reasons, one being that plans to deploy energy facilities off the coasts of those States are actual rather than hypothetical proposals.

The Department of the Interior accepted bids in August 1976 for leases on 154 tracts on the Outer Continental Shelf off the New Jersey and Delaware coasts and it was expected that oil companies could begin exploratory drilling within 6 months after the sale of leases.

In the summer of 1976, the Nuclear Regulatory Commission (NRC) was well along in its technical evaluation of, and hearings on, proposals to moor two floating nuclear powerplants inside a breakwater off the New Jersey coast.

Plans to build a deepwater port in the area have been in suspension since the early 1970's, when changes in the world oil situation reduced the economic incentives for such a port. But the Delaware Bay area would be a logical candidate for siting a deepwater port if future changes in the oil distribution system revived interest in a port.

In addition, New Jersey and Delaware share some characteristics with other coastal States. Both depend on expanded industrial activity to create new jobs and sustain economic growth. Expanded industry means expanded energy resources and both States depend on other regions of the United States or on foreign suppliers for all of their oil and natural gas. Both States also depend heavily on tourist income which, in turn, depends on the attractiveness of beach areas which would be vulnerable to damage from accidents during the operation of any of the three energy systems.

Finally, planning for the offshore energy systems has been proceeding faster than planning for effective management of coastal areas under the Coastal Zone Management Act.

Because many States share these characteristics to some degree, the findings of this study can be applied to other States if adjustments for differing conditions and levels of resources are made that might be anticipated in other areas.

The study area is described in more detail in chapter IV.

The study approach was basically the same for each energy system. A foundation of data was developed to provide a framework for analyzing issues for congressional consideration.

The first step in assessing each system involved a detailed examination of each technology and how it most likely would be deployed. This phase of the study considered only those technologies and systems in their most likely configurations in waters off New Jersey and Delaware and drew largely on published reports. The reports were supplemented by analysis in areas where published data did not provide enough detailed information for full development of issues and options.

The next step in the study was to identify and evaluate the probable impacts of the energy systems on the ocean and coastal environments either as a result of routine operations or as a result of malfunctions which experience with similar technology in other areas has shown are likely to occur. In the case of floating nuclear powerplants, which have not been installed anywhere, the projections of impact were based on land-based nuclear-plant experience adjusted to reflect operation in an ocean environment.

Finally, the study produced estimates of the effect that each energy system would have on New Jersey and Delaware. These included changes in employment in the region, in the cost and reliability of energy supply, the impact on air and water quality, on road and rail networks, on land that would be diverted from other possible uses to support the proposed systems, and on general patterns of life within each State.

SELECTION OF ISSUES

In the course of the study, areas of possible conflict emerged between technology and the environment or among institutions that would share responsibility for the systems. Potential or actual conflicts which appeared to be amenable to policy consideration by Congress or by State governments or private groups were identified. These conflicts are discussed in chapter 111 as issues with options for congressional consideration. In most cases, the issues evolved from analysis of the likely consequences of deployment of a technology under existing legal and institutional frameworks and comparison of those consequences with changes in law or custom.

The nature of the issues differs from system to system.

In the case of oil and natural gas development, the major issues are concerned less with individual technology than with the system as a whole and particularly with the institutional framework in which the system operates. In the case of deepwater ports and floating nuclear powerplants, the issues stem largely from the technology, from questions about its reliability, and from avenues that offer promise of reducing risk by changing design or by more careful analysis of risks inherent in the technology.

The changing events that are natural with technologies in active planning required flexibility in the execution of this assessment. Pertinent new or revised information became available to the study team at every stage. Some of the analysis required for the overall assessment had timely congressional utility and was published in special documents or released in draft form by the Technology Assessment Board.

These publications include the following reports:

- Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures.
- An Analysis of the Feasibility of Separating Exploration From Production of Oil and Gas on the Outer Continental Shelf.
- An Analysis of the Department of the Interior’s Proposed Acceleration of Development of Oil and Gas on the Outer Continental Shelf.
- Coastal Effects of Offshore Energy Development: Oil and Gas Systems.

These documents and drafts were of particular help to congressional committees responsible for developing amendments to the Coastal Zone Management Act and amendments to the Outer Continental Shelf Lands Act of 1953.

DATA SOURCES

Basic data used in the study have been subjected to critical analysis by the OTA staff to develop projections of development patterns and impacts.

The estimates of resources in the Baltimore Canyon Trough which were used to project impacts were drawn from U.S. Geological Survey estimates. During the course of the study, U.S. Geological Survey changed its estimate of resources from 8 billion barrels of oil to 1.8 billion barrels and the study was modified to reflect the reduction.

Resource projections are discussed along with the history, current status, and possible future development of each technology in chapter IV. Alternatives to these technologies, based on projections of energy supply and demand, also are discussed in chapter IV.

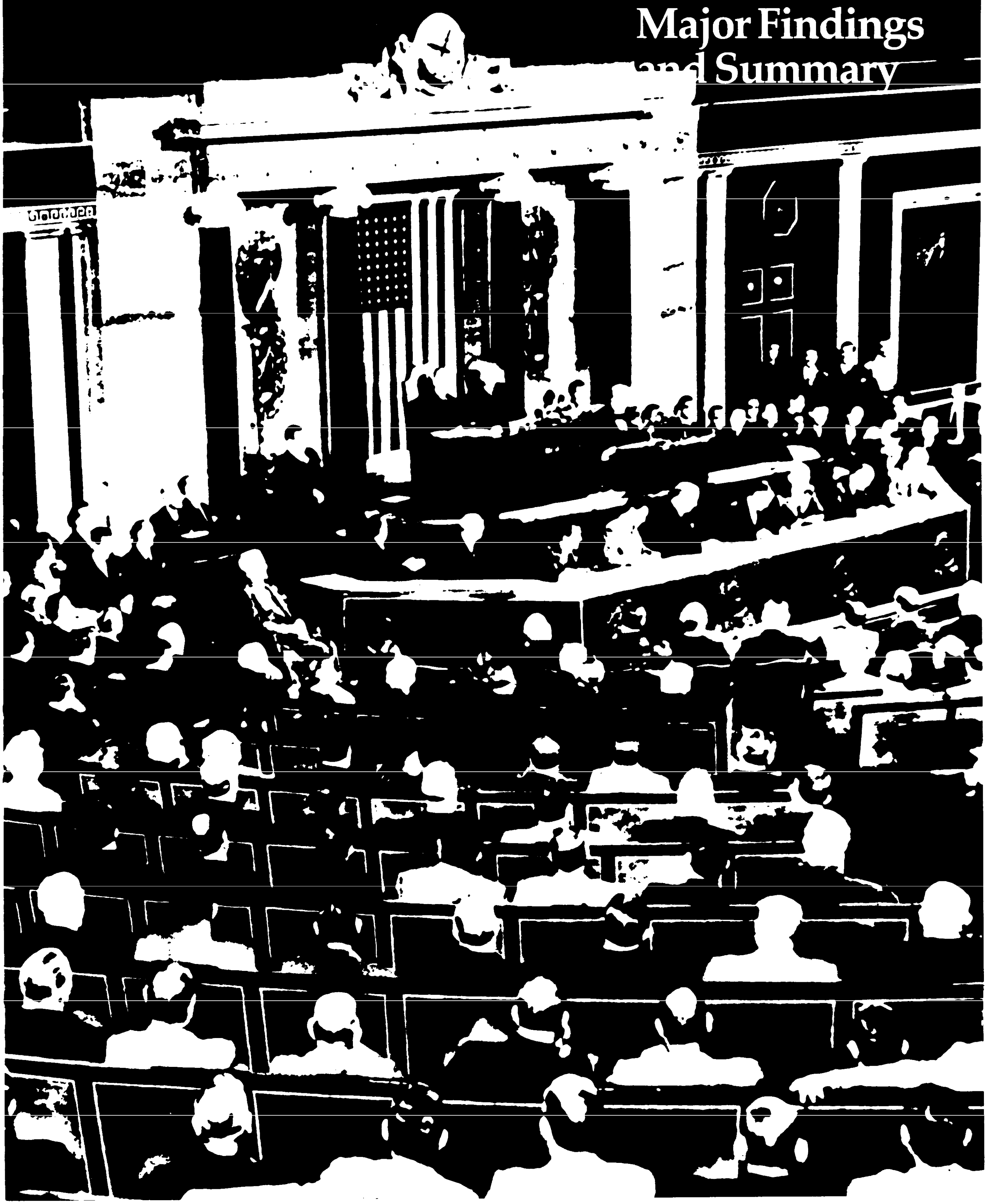
PUBLIC PARTICIPATION

To broaden the information base for this study and to make certain that public attitudes toward the three energy systems were taken fully into account, OTA conducted a public participation program as part of the assessment.

Workshops were held in New Jersey and informal meetings with groups of private citizens as well as representatives of interest groups were held in Delaware to explore citizen attitudes. About 15,000 brochures explaining the technology assessment process and asking for views on all three technologies were distributed in both States. About 1,000 persons responded to a questionnaire that was included in the brochure and an analysis of the responses is included as an integral part of this report in chapter V.

CHAPTER II

Major Findings and Summary



Chapter II

MAJOR FINDINGS AND SUMMARY

The following are the major findings of this assessment of the three energy systems which have been proposed for deployment off the coast of New Jersey and Delaware. A summary of the assessment of each of the technologies is included after the findings.

- **No significant damage to the environment or changes in patterns of life in either New Jersey or Delaware is anticipated during operation of the three systems at** presently projected levels. However, careful planning, engineering, and strict operational monitoring are required for each of these complex systems. To a large extent, such planning and monitoring will depend on the quality of oversight by the responsible Federal agency.
- Future deployment of ocean technologies on a scale larger than that anticipated at the present time could create serious conflicts among users and impose excessive burdens on ocean and coastal environments. No formal mechanism exists or is planned for resolving conflicts or directing research to discover the cumulative social and environmental consequences of vastly expanded uses of the oceans.
- Changes in Federal practices are necessary to reduce delays in determining offshore oil and gas resources, to provide full attention to State and local needs and potential impacts, and to assure strict enforcement of operating standards to minimize ocean and coastal pollution. Consolidation of authority within the Department of the Interior is essential to supervision of offshore development and the coordination of operations with State and local governments.
- While floating nuclear powerplants may offer economic and environmental advantages over land-based nuclear plants, the siting of nuclear plants on water may present unique accident risks which have not yet been comprehensively assessed by the Nuclear Regulatory Commission.
- Tankers that would use deepwater ports off New Jersey and Delaware pose a greater pollution and safety threat than the ports themselves. Confining tanker operations to a port several miles from the coast may offer environmental and safety advantages, provided that the tankers using the facility are strictly regulated.

- There are specific alternatives which, if substituted for each of the proposed offshore projects, could supply equivalent amounts of energy to the Mid-Atlantic region. None, however, offers clear social, environmental, or economic advantages. Increased imports are an alternative to offshore oil and gas development. Onshore nuclear plants and coal-fired plants are alternatives to floating nuclear powerplants. Greater reliance on small tankers is an alternative to deepwater ports. Reduction of energy consumption could offer long-term advantages, but there are no specific plans at the State or national level for an energy conservation program that might eliminate the need for the energy supplies which would come from one or more of the proposed offshore systems.

A principal product of this assessment is the development of public policy issues associated with the deployment of each offshore technology and the identification of congressional options for addressing those issues.

Chapter III contains a complete presentation of the issues and options.

OFFSHORE OIL AND GAS SYSTEMS—SUMMARY

The submerged Outer Continental Shelf (OCS) lands of the Mid-Atlantic were classified by geologists as a potential source of oil and natural gas in the late 1950's, but they did not become a priority target for development until the 1970's.

Following the oil embargo imposed by the Organization of Petroleum Exporting Countries in October 1973, accelerated leasing and development of the Mid-Atlantic OCS was made a high priority item in the Administration's plan for lessening U.S. dependence on foreign sources of oil.

In 1974, studies by the U.S. Geological Survey estimated that as much as one-third of the U.S. oil reserves for the future were most likely to be discovered in the OCS regions. In the Mid-Atlantic, estimates were that oil production could be as much as 7 percent of the 1973 national production level and gas production could be as much as 8 percent of the 1975 national production level.

As first announced, accelerated OCS development called for leasing a total of 10 million acres in a single year, an amount equal to what had been leased during the previous 21 years.

Although the Bureau of Land Management (BLM), Interior's lead agency in leasing, had been examining the possibility of an accelerated program for 2 years before the 1973 decision was made, it was not prepared for a sudden change of this magnitude. In the period since the acceleration program was announced, BLM has been chronically short of staff, particularly the specialists required for analyzing coastal and onshore impacts in frontier States. BLM was also unprepared for the adverse reaction of Atlantic Coastal States to the 1973 accelerated leasing decision.

The Governors of both New Jersey and Delaware publicly favor early exploration of the Mid-Atlantic OCS for oil and natural gas, but their support is qualified. Both have argued for changes in Federal OCS policy as a condition of their full support.

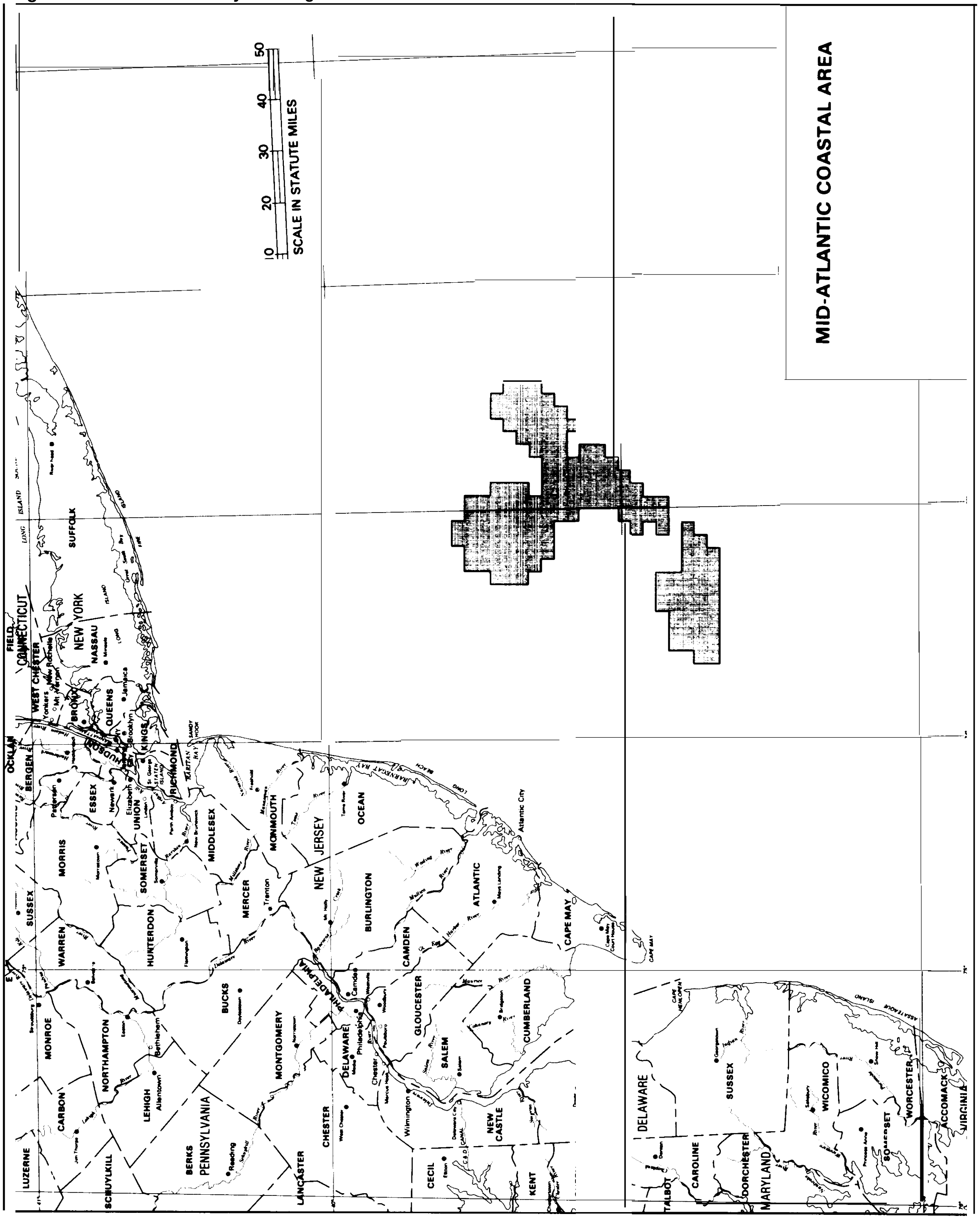
The desire for change stems from several factors. One involves basic uncertainties about environmental and economic impacts of a technology which is alien to the Mid-Atlantic even though it is familiar to the Gulf of Mexico. Another involves a series of lapses in communication and coordination between the States and the Interior Department which have raised doubts among State officials about the capability of the Federal Government in planning for operation of offshore oil and gas systems.

The Mid-Atlantic OCS program intensified pressure on the State governments, particularly from residents along the coast, to protect their beaches. Because existing law restricts major decisions about OCS development to the Federal Government, State officials have argued for a role as active participants, rather than observers, in three general areas. They are:

- Drafting of oil and gas regulations and enforcement plans which could affect the quantities of oil that may be spilled during offshore development;
- Selection of areas to be leased which will affect locations of such facilities as onshore staging areas, pipeline landfalls, tank farms, and gas processing plants; and
- Approval of development plans which set a pattern of deployment of technology that would prevail in the area during the life of a Mid-Atlantic oil and gas field.

State officials also desire more centralization of responsibilities and authority within

Figure 11-1. Baltimore Canyon Trough lease sale area



Source Office of Technology Assessment and U S Department of the Interior

the Interior Department to facilitate the flow of information to the States.

This report contains detailed descriptions of each of the component elements in a typical offshore oil and gas system, starting with geophysical survey ships which are used to gather preliminary data on resources and continuing through technology used for exploration drilling, production drilling, transportation, storage, and processing. Deployment of technology is traced over time for two assumptions-one in which 1.8 billion barrels of oil and 5.3 trillion cubic feet of gas are discovered and recovered and another for 4.6 billion barrels of oil and 14.2 trillion cubic feet of natural gas.

It is estimated that 25 platforms could be installed offshore, each with 24 producing wells, within 14 years after the initial lease sale to produce the 1.8 billion barrels of oil at an average peak rate of 313,000 barrels per day. Under the 4.6 billion barrel assumption, there could be 52 platforms, each with 24 producing wells within 15 years after a lease sale. Peak daily rate for this assumption would be 650,000 barrels.

Onshore, the oil and gas distribution network, averaging both assumptions, would cover about 3-square miles with pipeline rights-of-way, staging areas (of up to 170 acres), tank farms (covering 50 to 75 acres each), and gas processing plants (on sites of about 100 acres each). If drilling platforms were fabricated in either State, land needs would increase by about 1,000 acres.

Five areas in the New Jersey–Delaware region could serve as staging areas for offshore development, three coastal sites and the port complexes of New York City and Philadelphia–Camden. All three coastal sites—Atlantic City and Cape May, N.J., and Lewes, Del.—would meet such staging area requirements as availability of harbors for supply boats, accessibility by rail, proximity to lease sites, and availability of land for storage and service facilities. Service firms under contract to oil companies would choose staging areas on the basis of lowest overall operating costs.

Earlier studies by the Council on Environmental Quality, the American Petroleum Institute, and the Department of the Interior have produced varying projections of the physical, biological, and social changes that would result from offshore development in the Mid-Atlantic OCS. The earlier studies used different assumptions about the amounts of oil and gas that may be recovered and different State and/or regional boundaries for consideration. When these projections are adjusted to a common base, however, they fall within the same general range of effects that are estimated in the OTA study.

It is concluded that, if a major spill occurred at a drilling or production platform 50 miles at sea, the odds are one in ten that an oil slick would reach the beaches of New Jersey and Delaware.

The danger of oil striking a beach would increase if a spill occurred as a result of a pipeline rupture nearer to shore. The danger would decrease if a spill occurred at structures farther than 50 miles from shore. The platforms expected as a result of the first Mid-Atlantic lease sale will be located approximately 54 to 100 miles from shore. The distance lowers the risk of oil striking the beach and also makes the structures invisible from shore.

One element of the offshore oil system that would require particularly careful planning is the placement of pipelines in coastal areas. There is general agreement that pipelines should be routed to avoid marshlands, a design that would be difficult to achieve along the New Jersey or Delaware coast, virtually all of which is backed by marshlands,

Direct employment in New Jersey and Delaware would peak at about 9,000 workers if the high estimate of 4.6 billion barrels of recoverable oil is correct and at about 4,500 workers if the median estimate of 1,8 billion barrels is correct. Capital expenditures would total between $2 billion and $4 billion. Peak land requirements for the high estimate would be about 1,645 acres in the New Jersey–Delaware region. Of that, 320 acres could be coastal land around coastal harbors and the remainder would be inland. Seven hundred acres would be required for pipeline rights-of-way that probably would parallel existing railroad lines or highways.

Analysis of the tax systems of a variety of coastal States, including New Jersey and Delaware, indicates that per capita tax revenue from OCS-related installations onshore would be significantly higher than the statewide average per capita revenues from other sources, except during the first 2 or 3 years of development. The principal reason is that the major onshore installations, such as tank farms and pipelines, are capital intensive, and therefore produce substantial sales and property tax revenues. However, this estimate is for statewide revenues only. It is quite possible that particular localities within a State will experience net adverse budgetary impacts during the course of OCS development, since there is little reason to expect that the tax revenue-producing onshore facilities would be located in the tax jurisdiction of the communities that must provide public services and facilities for the population supporting offshore exploration and development. This problem may also occur between States if the oil and gas are not landed in the same State in which the main support bases are located. It is also possible that a locality could experience a net negative fiscal impact if extraordinary expenditures for public facilities such as roads are required to support OCS development.

The major source of potential impacts on air and water quality onshore would be any new refinery capacity that might result from OCS development. Ambient air quality standards, particularly those related to oxidant levels, could be a significant constraint on new or expanded refinery capacity. Concentrations of waterborne pollutants in refinery effluent are relatively small and probably would not significantly affect the quality of a receiving stream. Refinery cooling, however, could produce thermal pollution problems in Delaware Bay or Newark Bay, both of which are already very close to the maximum permissible load.

Dramatic changes in regional energy prices should not be expected to follow OCS development. Lower transportation costs might give New Jersey and Delaware a price advantage compared with some other regions of the country. But future prices would depend, in part, on oil and gas price control policies.

As a result of its study, OTA has identified the Federal-State conflicts as the major issues. Eight specific OCS issues are treated in this report. They are:

Federal Management System .—Federal management of the offshore oil and gas program is fragmented within the Department of the Interior and coordination with other Federal agencies which share jurisdiction is ineffective. (See pages 43–46.)

Regulation and Enforcement.—Inadequate regulation and enforcement of offshore oil and gas technology could result in more accidents and more oil spills than would occur if a more effective system were implemented. (See pages *47–50.)*

Oil Spill Liability and Compensation.—Existing laws are not adequate either to assign liability or compensate individuals or institutions for damages from oil spills resulting from exploration, development, or production in the Baltimore Canyon Trough area. (See pages 51 –56.)

Oil Spill Containment and Cleanup.—There is no assurance that the technology utilized in the Baltimore Canyon Trough or in any other OCS frontier region would be adequate for oil spill surveillance, containment, and cleanup. (See pages 57–59.)

Environmental Studies.—Environmental research and baseline studies are not formally coordinated with the Interior Department's leasing schedule and there is no requirement that information gathered be used in the decisionmaking process for sale of offshore lands and subsequent operation. (See pages 60-62.)

State Role.—The limited role of State governments in the decisionmaking process for OCS development under existing laws and practices may lead to unnecessary delays and improper planning for such development. (See pages 63–66.)

Pollution Research.—The effects of pollutants which may be discharged during OCS operations cannot presently be determined with any accuracy and recent research efforts have not clarified conflicting claims by oil companies and environmental groups regarding the amount and consequences of marine pollution. (See pages 67–69,)

Conflicting Ocean Uses.—There are potential conflicts between OCS oil and gas activities and vessel traffic engaged in commercial shipping and fishing activities. However, there has been no comprehensive study and analysis to identify all conflicts and to find ways of resolving them. (See pages 70–75.)

OFFSHORE OIL AND GAS SYSTEMS—FINDINGS

Effects of OCS Development

Oil and natural gas can be produced in the amounts presently projected off the Mid-Atlantic coast without significant ***damage to*** the environment or disruption of patterns of life in New Jersey or Delaware if operations are carefully designed, planned, and monitored. However, careful planning, engineering, and strict operational monitoring are required for each of these complex systems. To a large extent, such planning and monitoring will depend on the quality of oversight by the responsible Federal agencies. (See pages 150– 160.)

Changes in lines of authority within the Department of the Interior would improve the Department's ability to supervise offshore development and to coordinate operations with State and local governments. (See pages *43–46*, 1 30–131 .)

Federal-State Relations

States cannot participate in a meaningful way in the process that leads to major leasing and OCS decisions under present policies. The State role at present is little more than that of commentator. (See pages 131–140, 155- 156.)

Existing laws and regulations do not clearly specify the information about OCS activities to which States are entitled, a lapse that encourages disputes over rights to data between State and Federal officials. (See pages 63–66, 125, 138–140, 147–150.)

Federal efforts to deal with State concerns are fragmented among many departments and agencies and seldom reflect a sense of need for coordination, clear lines of communication, and close working ties. (See pages 43–46, 130, 152–155, 161 –165.)

The Interior Department's relations with

79-188 O - 76 - 3

State governments are improving but relations still depend more on individual judgments by Interior Department officials than on formal administrative procedures on which the States can rely. (See pages 139-140.)

- Changes in Federal OCS policies and practices have lagged behind changes in the social and political climate in the Mid-Atlantic in which offshore development will occur. The lag is particularly important with respect to environmental concerns and a desire among States for greater access to Federal information and decision making. (See pages 63-66, 127–1 31.)
- As of mid-1976, the Office of Coastal Zone Management had not asserted itself as coordinator of State and Federal activities involving the effects of offshore development on the coastal zone. (See pages 43–46, 136-138.)
- Concerns of New Jersey and Delaware officials over environmental and social impacts of offshore development are compounded by their doubts about the quality of Federal management of the leasing program and doubts about the effectiveness of the enforcement of OCS regulations. (See pages 63–66.)
- Neither Delaware or New Jersey wants to delay offshore development unnecessarily, but both are prepared to seek legal remedies if development in the Mid-Atlantic proceeds without what they consider adequate State participation in decisions. (See pages 159–160.)

Planning

- Federal requirements under the Coastal Zone Management Act that Federal activities be consistent with a State's coastal zone management plan have played no role as yet in Mid-Atlantic OCS activities because neither New Jersey or Delaware has completed coastal zone management plans. (See pages 136–138.)
- The exact location of OCS facilities and the magnitude of development impacts will not be known until Outer Continental Shelf "frontier areas" have been explored and the size and location of petroleum resources have been determined. (See pages 133, 143-144, 146– 172.)

Regulation, Safety, and Pollution

- The regulation of offshore technology by the U.S. Geological Survey (USGS) is based on general guidelines to the industry with minimal inspection and enforcement, USGS regulations are more concerned with specific pieces of equipment than with the total oil and gas production system. (See pages 47-50, 130, 146, 152–155, 161–163.)
- Techniques exist, but are not always used, for setting design standards and installation practices and for testing all major items of equipment involved in OCS operations. (See pages 47–50, 152–155, 161 –163.)
- Federal regulations are not sufficiently precise with regard to standards for construction of offshore platforms or pipelines. (See pages 47–50, 152- 155.)
- The purpose of the Interior Department's OCS environmental studies program and its role in the management of OCS activities is not clearly defined. In their present form, environmental surveys conducted under the auspices of this program are not useful either in writing environmental impact statements or in making OCS leasing decisions. (See pages 60–62, 134–135.)

- Federal pollution research efforts are not as well coordinated as are those sponsored by private industry. (See pages 67–69, 167–169.)

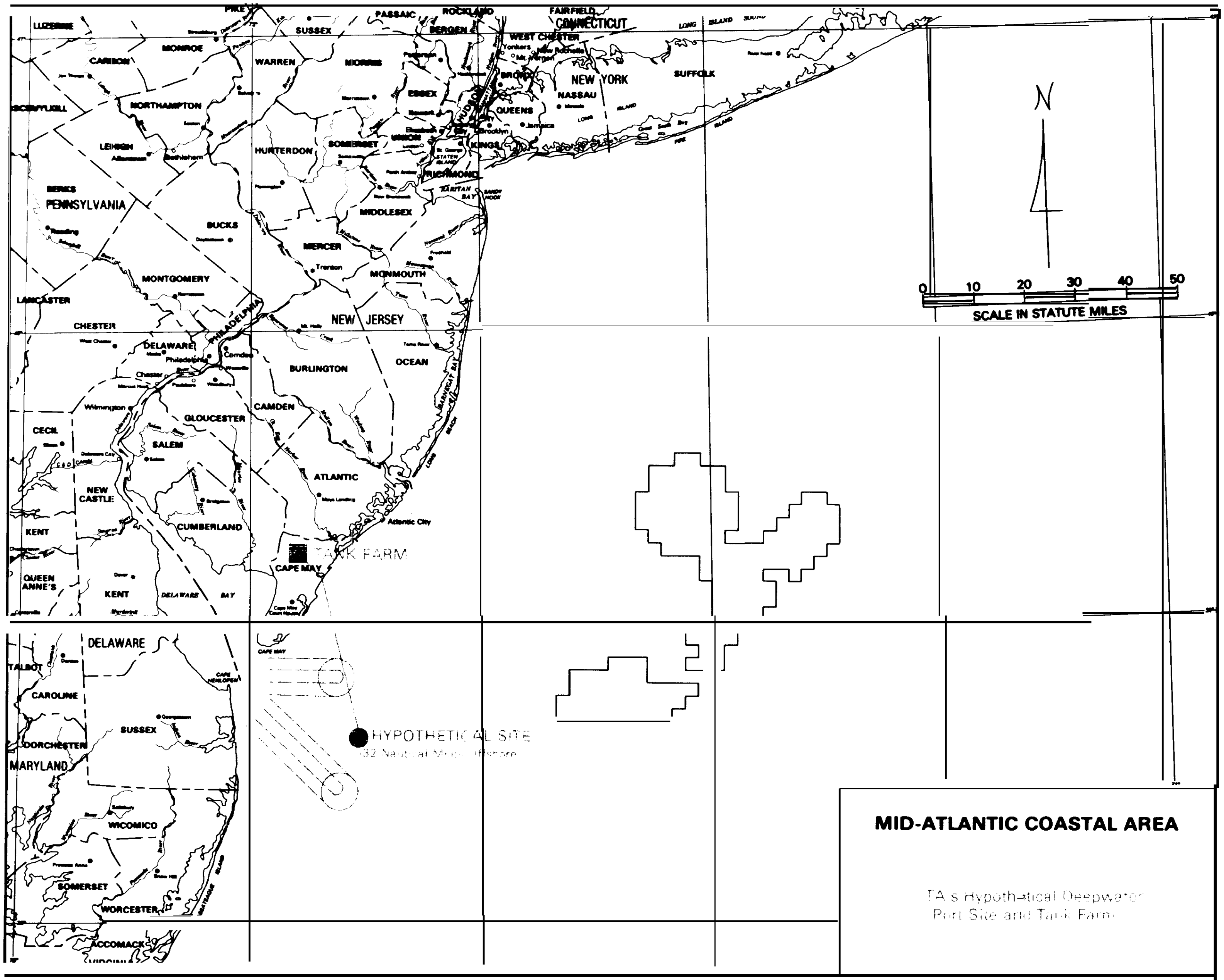
Oil Spills

- Under some weather conditions, oil spills from a platform as far as 50 miles at sea could reach the New Jersey and Delaware coasts but it is not possible to predict the point of impact. (See pages 165–166.)
- Weather, wind, and ocean currents will affect the dispersion, trajectory, chemical composition, and ultimate disposition of oil spills. These conditions vary from season to season, and even from day to day, but research on ocean conditions in OCS areas has a low budget priority. (See pages 165–166.)
- The Federal Government does not set definitive standards for the industry to follow in carrying out its responsibility to provide cleanup equipment in the event of a major oil spill. USGS does not inspect cleanup equipment but relies on industry to make its own inspections. (See pages 57-59, 166- 167.)
- USGS procedures for monitoring discharges of oil and other pollutants during OCS operations are inadequate and the agency does not use monitoring equipment that is available and in use by other Government agencies. (See pages 57–59, 166–169.)
- Under existing Federal practices there are no standards that cleanup and containment equipment, which would be available in the Mid-Atlantic, must meet, and no assurance that a major oil spill actually could be confined and removed from the water even if the best equipment is available. (See pages 57–59, 166– 169.)
- At the present time, the laws of an adjacent State would be used to determine a lessee's liability for oil spill damages but neither New Jersey or Delaware laws provide for compensation to injured parties. (See pages 51–56.)

Impacts

- Drastic changes in regional energy prices will not result from offshore development in the Mid-Atlantic. (See pages 171–172.)
- A net fiscal benefit to Mid-Atlantic State governments probably will result from onshore facilities related to offshore development but there may be localized fiscal problems and the advantage would not occur until after the first 3 years of offshore activity. (See pages 157– 159.)
- Discovery of offshore oil would not necessarily lead to construction of new refineries in the Mid-Atlantic. In fact, existing air quality regulations might prevent construction of new refineries in New Jersey and Delaware. (See pages 169–170.)
- The major impacts on air and water quality in the region would result from expanded refineries and from gas processing plants. (See pages 170– 1 71.)
- There is no formal mechansim for resolving conflicts among the many users of the ocean or for directing research to discover the cumulative environmental consequences of expanding the use of the ocean for energy development and other purposes. (See pages 37-42, 70-75, 155–156.)

Figure II-2. Hypothetical deepwater port site offshore New Jersey coast



Source: Office of Technology Assessment

DEEPWATER PORTS — SUMMARY

In the late 1960's, energy supply patterns and environmental concerns seemed to justify construction of at least one deepwater port for supertankers off the coast of New Jersey and Delaware.

By 1976, that was no longer the case. A series of changes in State laws and Federal policies, capped by the inflation and uncertainty of supplies that followed sharp increases in world oil prices, had changed the region's petroleum distribution system dramatically.

Plans for expanding old refineries and building new ones were on the shelf. Increases in demand for petroleum products were being met by Gulf Coast and Caribbean refineries. Inflation had doubled original estimates of the cost of a deepwater port.

Extensive interviews with industry officials and analysis of feasibility studies disclose that—barring future changes as drastic as those of the early 1970's—the oil industry will not revive Mid-Atlantic deepwater port plans for at least 10 years.

New tax policies, changes in environmental laws, changes in oil prices or sharp increases in Mid-Atlantic demand for imports could change the picture again. It also is possible that environmental or political goals could prompt States to build a deepwater port even if it were not attractive on purely economic grounds.

In the meantime, the oil industry is moving ahead with plans to build two deepwater ports off the shores of Texas and Louisiana that eventually can handle 10 million barrels of oil a day. A program of refinery construction and expansion is underway in both Texas and Louisiana to handle imports of crude oil.

During the period of strong Government and industry interest in Mid-Atlantic deepwater ports, several sites and types of terminals were studied, including a sea pier located inside Delaware Bay. Of these, the technology most likely to be placed in waters under Federal jurisdiction is a large monobuoy complex located far enough from the coast to serve the largest supertankers in the world fleet. These are 480,000 deadweight ton (dwt) ships, a quarter-of-a-mile long, that carry up to 3.7 million barrels of oil and require 110 feet of water depth for maneuvering. One site that could accommodate the largest tankers is 32 miles off southern New Jersey where waters are 110 to 115 feet deep.

Oil could be pumped from the site through underwater and overland pipelines to the Delaware River refinery complex which includes seven refineries with a total capacity of 890,000 barrels of petroleum product per day. The capacity of the refineries could be nearly doubled without acquiring additional land.

During the course of this study, several bulk-oil terminal designs were analyzed. The monobuoy was selected for detailed study because it is a proven technology, already in operation in more than 100 deepwater ports around the world, and because it is less expensive, safer, and more accessible in rough weather than other designs.

A monobuoy is a floating steel drum, 30 feet to 50 feet in diameter, which is anchored over a buried pipeline leading to shore. Tankers tie up to the buoy, connect the buoy's floating rubber hoses to their cargo compartments and pump oil through the hoses and into the pipeline.

Under 1976 conditions, the cost of building and operating a monobuoy complex off Delaware Bay would make the price of transferring oil through the deepwater port higher than the existing system, which uses lightering barges. Another barrier is

Delaware's Coastal Zone Act which prohibits pipeline landfalls in that State. New Jersey's Coastal Area Facilities Review Act does not prohibit pipeline landfalls outright but both the present and immediate past Governors of New Jersey are on record in opposition to deepwater port development in their State.

Thus, the descriptions of technology and the likely consequences of its deployment which are discussed in this study are purely hypothetical. Basic changes in policy and the economics of oil distribution will be necessary before a deepwater port can be deployed in the region.

Given the lack of interest in a Mid-Atlantic deepwater port on the part of Government officials and the oil industry, the matter is not a major public issue at this time. The passage of the Federal Deepwater Port Act of 1974 also has reduced the number of issues of Federal concern.

However, this study has identified several potential issues. They include:

Tanker Design and Operations.—Tanker spills are the source of five to fifteen times as much oil as all offshore drilling and port operations combined; yet pollution control regulations are far less stringent for tankers than for either deepwater ports or offshore oil and gas operations. (See pages 76–79.)

Oil Spill Containment and Cleanup at Deepwater Ports.—The use of offshore deepwater ports may reduce the risk of certain oil spills and environmental damage below that of transporting crude oil by smaller tankers into the congested New York Harbor and Delaware Bay. Even the very small risk of a catastrophic spill from a supertanker, however, dictates that stringent pollution control and cleanup systems be used. (See pages 80–82.)

Standards in State Waters.—Under existing Federal law, operators of deepwater ports in State waters could ignore the safety and environmental pollution standards that apply to ports outside the 3-mile limit. (See pages 83-85.)

Adjacent Coastal State Status.—Differing interpretations of statutory criteria for determining adjacent coastal State status make it difficult to predict which States could qualify for that status in the future and whether some States may be deprived of the benefits of such status. (See pages 86–89.)

DEEPWATER PORTS—FINDINGS

Construction

- A deepwater port is not likely to be built to serve the Mid-Atlantic during the next 10 years. (See pages 186–188.)
- Industry is not likely to abandon its existing marine transportation system for supplying the Mid-Atlantic with oil products as long as there is no clear cost advantage. (See pages 173-178, 186–188.)
- Expanded or new refinery capacity would be necessary to make a deepwater port economically feasible, But existing Federal and State air quality regulations make construction of new refineries along the Delaware River and Bay unlikely in the foreseeable future, although existing refineries may be expanded without exceeding pollution standards. (See pages 186– 188.)

Environment

- Because a decision to build a deepwater port would logically follow—not force—

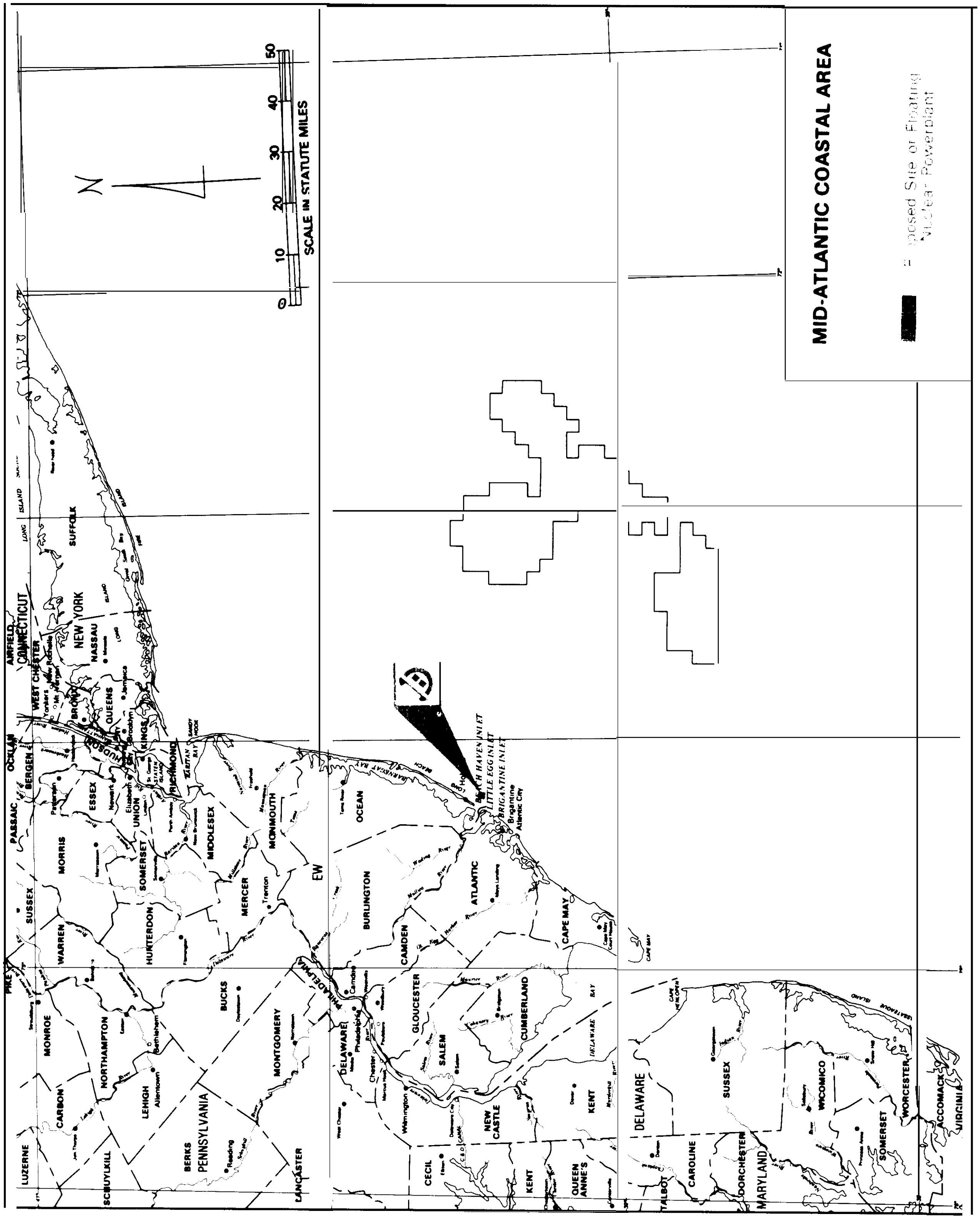
a decision to build new refineries, a port is likely to be postponed at least until, and if, refinery capacity in the Mid-Atlantic expands significantly. (See pages 186–188.)

- A deepwater port system would offer environmental advantages over small tankers operating in existing ports. Presently, small tankers spill twice as much oil that can damage the coastal zone as would be spilled in a deepwater port system. (See pages 193–194.)
- The most serious threat of oil spills as a result of a deepwater port system comes from the tankers using the port. Yet, tanker regulations are less strict than port regulations. (See pages 76–79, 195– 196.)
- Because of the serious design limitations of containment and cleanup equipment, even the most advanced equipment will be effective only about 55 percent of the time in winter seas off the Mid-Atlantic coast. These facts emphasize the importance of preventing spills rather than regulating cleanup equipment. (See pages 80–83, 193–194.)

Planning and Procedures

- Coast Guard Vessel Traffic Surveillance Systems are not required for deepwater ports in State waters and budget priorities in the Coast Guard could delay installation of these systems for the ports. (See pages 83-85, 185- 186.)
- There is disagreement among Federal officials, State governments, and other interested parties as to statutory criteria for determining which States near a deepwater port are eligible for economic assistance and regulatory powers of the Deepwater Port Act. (See pages 86–89, 195.)
- Applications for the construction and operation of deepwater ports in State or territorial waters are not under the jurisdiction of the Deepwater Port Act and there is minimal coordination between the two agencies which do have jurisdiction —the Army Corps of Engineers and the Department of Transportation. (See pages 83-85, 185–1 86.)

Figure II-3. Proposed site of the floating nuclear powerplant



Source Off Ice of Technology Assessment and Public Service Electric &I Gas C o

FLOATING NUCLEAR POWERPLANTS—SUMMARY

Late in 1972, New Jersey's largest public utility company concluded that floating nuclear powerplants moored off the coast would solve a major problem faced with all large-scale generators—access to cooling water. The company, Public Service Electric & Gas Co., which generates more than 60 percent of the State's power, also concluded they could be built for less money and be less environmentally damaging than land-based plants. Access to cooling water was crucial to the company's future plans. At the time its customers were using electricity at rates that meant doubling Public Service's generating capacity every 8 years—a rate of growth well above the national average—and the number of sites for new plants that could be built without cooling towers was severely limited.

During the period of steep growth in demand in the late 1960's and early 1970's, the offshore plant was a critical element in Public Service's long-range plans for providing new generation facilities. Its construction schedule called for having large amounts of new generating capacity in place by the early 1980's. Two land-based nuclear plants near Salem, N. J., were running 5 years behind schedule. Construction of two more nuclear units was delayed when objections to the use of Newbold Island in the Delaware River forced Public Service to relocate the project to Hope Creek, just north of the Salem plants. Lead times for land-based plants elsewhere in the State were running between 8 and 12 years.

In September 1972, after conducting its own site surveys off the New Jersey coast, Public Service contracted to buy the first two floating plants to be produced by Offshore Power Systems, Inc. In 1973, Public Service signed a contract for two more floating plants.

Today, after 3 years of analyzing the offshore power concept, staff members of the Nuclear Regulatory Commission (NRC), and some other Federal agencies have come to the same general conclusion about the cost and environmental impact of floating nuclear powerplants. These staff judgments are tentative and are not in any sense formal endorsements of the concept or the construction plans. The Public Service proposal still must work its way through a series of reviews, public hearings, and decisions by Federal and State agencies and meet challenges from environmental groups, New Jersey beach communities, and some nuclear scientists and engineers who say that the systems are unnecessary, and may be unworkable or unsafe. Before an offshore nuclear plant can start generating power it must clear three separate stages of licensing. The first of these probably will not be completed before 1977.

The preliminary NRC staff reviews nevertheless have provided enough encouragement to the companies involved in the floating nuclear powerplants—the Atlantic Generating Station Units 1 and 2—that they have spent more than $120 million thus far for plans, environmental studies, and in tooling up for production.

Public Service plans to have the first plant operational in 1985 and the second in 1987.

Each plant is designed to generate 1,150 megawatts (MWe) of power, a supply that Public Service estimates will provide about one-third of the additional power it plans to be generating by 1987. The plants are designed to generate power for 40 years, after which they will be shut down and decommissioned.

Several advantages of supplying electricity from offshore stations have been advanced in recent years by supporters and some analysts of the concept. Promoters of offshore plants take the position that:

- Unlimited supplies of cooling water are available at ocean sites and the environmental consequences of discharging heated water into the ocean will be minimal compared with the consequences of discharging heated water into rivers, lakes and bays.
- Offshore construction eliminates the disruption of coastal marshlands and estuaries to a great extent.
- The floating power concept moves in the direction of standardized nuclear plant designs, a goal the Nuclear Regulatory Commission (then the Atomic Energy Commission) set in 1972.
- Shipyard construction of plants will shorten the time required to put a nuclear plant in operation after a decision is made to build it.
- Volume production can cut costs and improve quality control.

Federal and State agencies have been reviewing the offshore powerplant proposal informally since late 1971 and formally since July 1973, when the Atomic Energy Commission docketed an Offshore Power Systems application for a permit to build eight floating nuclear powerplants.

During that time, the Atlantic Generating Station has received encouragement from the staff of the Council on Environmental Quality, which views the proposal with "guarded optimism." The Nuclear Regulatory Commission's Office of Nuclear Reactor Regulation has declared the project "generally acceptable" as to environmental impact and risk. The same office concluded in a Safety Evaluation Report published in September 1975 that with some modifications in design "there is reasonable assurance that . . . [the reactors could be installed] without undue risk to the health and safety of the public."

During preheating conferences on the Offshore Power Systems application for a manufacturing permit, interveners have challenged many of these claims, questioned design features, raised doubts about the need for any new generating capacity in the area, and argued that the technology is unproven and should not be tested near New Jersey communities.

The State of New Jersey, which has not sought official intervener status, has complained to the Nuclear Regulatory Commission that neither of two environmental impact statements NRC has published "faces up fully to all the risks [of floating plants] about which you owe the public your professional advice."

In a May 4, 1976, letter to NRC, David J. Bardin, New Jersey Commissioner of Environmental Protection, wrote that the most important lapse was in not addressing the possible consequences of a major accident "on the ground that such failures were unlikely to occur."

Some of the major points that interveners have argued in preheating conferences since 1974 are:

- The plant will be vulnerable to external hazards such as ship collisions, airplane crashes, and severe storms. Damage to the plant could result in dispersal of radioactive materials injurious to human health and aquatic life.
- Transportation and handling of radioactive fuel and wastes involve risks to human safety and health and to the marine and coastal environment.
- Evacuation in case of an accident will be difficult, especially in summer months, and there are no adequate plans or procedures for such emergencies.
- Fear of nuclear accidents will reduce the appeal of the area for recreational uses

and have a detrimental effect on the region's tourist -based economy,

- Other impacts that could be adverse include industrialization of the ocean around the site, onshore support facilities, dredging, and defects in underwater electrical transmission lines.

- NRC should prepare a comprehensive, programmatic EIS on the construction of floating nuclear powerplants located offshore.

More than 15,000 New Jersey and Delaware residents were contacted by OTA as part of the public participation program of this study. From these participants, more than 1,000 responses dealing specifically with the floating nuclear plant were selected for analysis. The analysis showed that the public was generally well aware that advantages and disadvantages must be weighed in deciding whether to build a floating nuclear plant. The analysis, along with press reports and statements at public hearings, also showed that the public sees the disadvantages as involving questions of safety, environmental degradation and high construction costs. The advantages include increased energy supplies with resulting economic expansion and cheaper power than would be possible with continued use of oil-fired generating plants.

Specific concerns about safety involve possibilities of accidents, leakage of radioactive waste and unresolved questions about the permanent disposal of nuclear waste. There was a perception among those who answered the OTA questionnaire that floating nuclear powerplants are experimental and that there is no experience on which to base estimates of risk and reliability.

One of the advantages cited in questionnaires and workshops is that nuclear powerplants are less polluting generally than fossil-fueled plants. In turn, participants saw advantages in floating plants over land-based plants in their distance from shore and the elimination of pressures on New Jersey water supplies for cooling water.

In this study, OTA has analyzed available information on costs, benefits, environmental impact, safety, waste disposal systems, transportation, transmission cables, and decommissioning activities associated with the floating plants. The study does not attempt to evaluate controversies about the safety and performance of nuclear plants in general; these are beyond the scope of the coastal effects analysis, It concentrates, instead, on exploring differences between the designs of floating and land-based plants and comparing the advantages and disadvantages of each,

The major issues identified by OTA in its study of the floating nuclear plant are:

Risks From Major Accidents.—The Nuclear Regulatory Commission (NRC) is not evaluating the risks from accidents in floating nuclear plants comprehensively enough to permit either a generic comparison of the relative risks from land based and floating nuclear plants, or an assessment of the specific risks from deploying floating plants off New Jersey. (See pages 90–98.)

Deployment in Volume.—As many as 59 floating nuclear powerplants could be built by a single manufacturer by the year 2000 but no policy analysis of the impacts of deploying that many plants in U.S. coastal waters has been done or is contemplated. (See pages 90-101.)

Technical Uncertainties.—Several technical aspects of the deployment, operation, and decommissioning of floating nuclear powerplants have not been analyzed thoroughly enough to permit judgments about the relative risks of the overall system. (See pages 102–105.)

Siting of Floating Powerplants Outside U.S. Territorial Limits.—Because there is no physical barrier to location floating nuclear powerplants more than 3 miles offshore, proposals for siting plants outside territorial limits are possible. However, U.S. authority to regulate floating nuclear powerplants outside U.S. territory is not clear under existing international law. (See pages 106–111.)

FLOATING NUCLEAR POWERPLANTS—FINDINGS

Energy Supply

- The two 1150 megawatt floating nuclear plants proposed to be located offshore New Jersey could produce about 10 percent of the State's electrical needs projected for 1990. (See pages 197–200.)

Planning and Procedures.

- No detailed procedure or design standards have been developed for transporting fuel to a floating plant or for carrying irradiated fuel and other radioactive wastes to shore. (See pages 102–105, 214–218.)
- Offshore sites for nuclear powerplants offer advantages over shore-based sites in terms of impacts on the marine environment. (See pages 106-111, 200–201, 222, 229.)
- The floating nuclear powerplant concept of standardizing design may provide a method for controlling escalating costs of nuclear power plants. (See pages 200–201, 225–228.)
- There are several decommissioning options for the floating nuclear plant, but only the one of dismantling the radioactive internals at the plant site and disposing of them appears to be technically and economically feasible. (See pages 102–105, 219–222.)
- Existing international law does not specifically settle the question of jurisdiction over a floating nuclear powerplant located beyond national territorial limits, and the Nuclear Regulatory Commission appears not to have authority under present law to approve siting of a U.S. nuclear powerplant in waters outside of U.S. jurisdiction. (See pages 106–111.)
- Federal licensing of floating nuclear plants is confined to rather narrow technical and administrative questions related to building eight plants and deploying two of those plants off the coast of New Jersey. It does not consider the implications of approving the larger scale deployment of floating nuclear powerplants. (See pages 99–101.)
- The one U.S. company now developing a capacity to build floating nuclear powerplants intends to build and market four such plants a year after 1985. Operating at peak capacity beginning in 1977, this company could produce 59 floating nuclear plants by the year 2000. (See pages 99-101.)

Safety

- The nuclear reactor and floating barge are proven technologies but the combination of the two as a system is not, (See page 203.)
- A critical review of completed studies discloses little foundation for concluding that either construction or routine operations of the two plants at the Atlantic Generating Station would endanger public health or environment. (See pages 224–229.)
- In the unlikely event of a core-melt acci-

dent in a floating plant, the molten core eventually would melt through the bottom of any barge and release radioactive materials directly into the ocean where they could contaminate beaches and be absorbed in the food chain. (See pages 90–98, 232–236.)

- The probability of a core-meltdown accident in a floating nuclear powerplant is comparable to the probability calculated in WASH–1400, commonly known as the Rasmussen Report, for land-based plants. However, the expected consequences of releases of radioactive materials as a result of a core-melt at a floating plant could be significantly different. (See pages 90–98, 230–237.)
- The probability of an atmospheric release of radioactive materials may be as much as seven times greater for a core-melt at a floating plant than for a core-melt at the land-based plant, as calculated in WASH–1400. However, the amount and consequences of the release may be reduced by design features and offshore siting of the plant. (See pages 90–98, 230–237.)
- The Liquid Pathways Generic Study being prepared by the Nuclear Regulatory Commission and Offshore Power Systems comparing the radiological consequences of accidental release of radioactive materials into water at floating plants and land-based plants is not as comprehensive as WASH – 1400's analysis of the consequences of accidents, partly because it does not consider economic impacts. (See pages 90-98, 233–236.)

ALTERNATIVES TO OFFSHORE TECHNOLOGIES—SUMMARY

New Jersey and Delaware would have a limited number of alternatives over at least the next two decades if any or all of the proposed offshore energy systems were not deployed.

Without strong national leadership in conservation and energy supply programs, the most likely course for the Mid-Atlantic region during the next 20 years is to extend the energy system that already is planned or in place.

ALTERNATIVES TO OFFSHORE TECHNOLOGIES—FINDINGS

- There are specific alternatives which, if substituted for each of the proposed offshore energy projects, could supply equivalent amounts of energy. Increased imports are an alternative to offshore oil and gas development. Onshore nuclear plants and coal-fired plants are alternatives to floating nuclear plants. Greater reliance on small tankers is an alternative to deepwater ports. None of the specific near-term alternatives offer clear social, economic, or environmental advantages. (See pages 238-246.)
- Reduction of energy consumption could offer longer term advantages but there are no specific plans at the State or national level for an energy conservation program that might eliminate the need for energy supplies that would come from one or more of the proposed offshore systems. (See pages 240–244.)
- Utility managers will choose existing and tested technologies that are most apt to match the consumption levels in their forecasts and will assign reliability of power supply a higher priority than cost. (See pages 239-240.)
- The most promising alternatives for stretching out supplies of fossil fuels are programs to improve insulation of homes and offices, changes in automobile design to increase mileage, and use of existing technologies to increase the amount of power generated per unit of fuel. (See pages 240–242.)
- Coal is a potential substitute for every basic fuel in the United States and supplies could last for more than a century even if consumption were to quadruple. However, massive conversion to use of coal would entail major changes in transportation networks, in air quality standards, new mining techniques, and new miner-training and safety programs. (See pages 243-244.)
- Utility companies and other energy suppliers in Mid-Atlantic States will not factor supplies of oil and natural gas from the Baltimore Canyon Trough into their future plans until exploration establishes likely production levels. (See pages 238–239.)
- No single new technology or change in the way existing technologies are used is likely to provide more than a small percentage of total energy requirements before the end of the century. Solutions to energy problems will be found in putting together many relatively small conservation and supply programs. (See pages 240–246.)
- Given existing laws, regulations, fuel

supplies, and technologies, New Jersey utilities report that they would replace floating nuclear powerplants with shoreline floating plants, land-based nuclear plants, and coal-fired plants, in that order of preference. (See pages 238–240.)

- Solar energy will not contribute much to energy supplies before the end of the century unless Federal programs to cut solar installation costs and private plans to market solar products are given higher priorities than they now enjoy. (See page 241.)

Chapter III

ISSUES AND OPTIONS

INTRODUCTION

This study has assessed the social, political, institutional, environmental, and economic effects of offshore oil and gas, deepwater ports, and floating nuclear powerplant technology on the coastal zone of New Jersey and Delaware. The potential effects in this one region have been used to illustrate those public policy issues which are of significant concern to Congress and the Nation.

OTA found that each of the three technologies studied posed different problems and benefits for the area and that little cumulative effect could be expected even if all three were to be deployed simultaneously.

There was, however, one issue which was raised by all three of the technologies: the possibility of increasing and diversified use of the oceans in the future without any formal mechanism for planning development, identifying priority ocean uses, and resolving conflicts among an increasing number of users.

This chapter discusses this common issue, eight issues pertaining to the development of oil and gas resources, four pertaining to deepwater ports, and four pertaining to floating nuclear powerplants. Analyses of these issues have been used to develop policy options which Congress may wish to consider for resolving some of the problems identified. These policy options have been reviewed by industry and pertinent government agencies and their comments have been considered prior to preparation of this final report.

The comments quoted in the margins of the Issues discussions reflect the view of citizens who joined in the public participation segment of this study and the views of State and Federal officials who reviewed the work for OTA.

ISSUE 1

Offshore Priorities and Planning

Future deployment of ocean technologies on a large scale could create serious conflicts among users and impose excessive burdens on ocean and coastal environments unless a system for setting priorities of use and for zoning ocean areas, much as land areas now are zoned, is established.

FINDINGS

1. Decisions about the most appropriate uses of the oceans now are left to the individual judgments of private citizens and companies and the several Federal agencies that have jurisdiction over some phase of ocean activities.

2. There is no formal mechanism for resolving conflicts among the many users of the ocean or for directing research to discover the cumulative environmental consequences of expanding use of the oceans.

DISCUSSION OF THE ISSUE

In normal operation, none of the three offshore energy systems addressed in this study is likely to impose intolerable burdens on either the ocean or coastal environment, singly or in combination. Conflicts between these new systems and traditional users of waters off New Jersey and Delaware probably can be resolved with appropriate vessel traffic control systems and methods of coordinating oil development and fishing operations.

If such offshore programs as floating nuclear powerplants prove workable, they could lead to deployment of more floating powerplants and other offshore technologies on a major scale.

No priorities now exist for uses of the oceans. No structure, legal or administrative, exists for resolving conflicts among users or for performing research on the long-range and cumulative impacts of expanded ocean use.

Environmental impact statements and public hearings which are required for most ocean licensing provide a forum for identifying some conflicts among ocean uses,

Overall Concern

Public Participation Comments

but they seldom identify hard choices among limited ocean resources and ocean uses.

The region’s ocean waters have been used for fishing, military operations, and commercial shipping since colonial days. More recently, the ocean has been used for recreation, dump sites, communication lines, and weather stations.

Several other ocean uses have been proposed, either for the near or distant future. One proposal would install wind- or wave-powered generators at sea to generate electrical power. Research and development is underway on methods of using the ocean for controlled development of biological resources as a method to generate increased food and energy supplies. Mining of the Outer Continental Shelf for sand, gravel, and minerals is an existing activity that could be expanded. Several proposals exist for creating artificial islands for heavy industries that, on land, are regarded as “bad neighbors. ”

Meanwhile, use of the ocean and its beaches for recreation continues to grow, as do marine research, archeological exploration, and salvage operations.

Many conflicts in ocean use are not confined to U.S. territorial waters. Commercial fishing, shipping, and mining, for example, are international activities that often involve U.S. waters. The Third International Law of the Sea Conference is addressing many marine problems, although its primary mission is to resolve conflicts among nations rather than conflicts among individual users. Some industry organizations and a few international organizations, such as the Intergovernmental Maritime Consultative Organization (IMCO), were created to solve problems between specific ocean activities and other uses that conflict with those activities. IMCO deals primarily with commercial shipping activities. However, no single international group is responsible for an overall view of the potential for future problems.

The following summary of the major historic and future uses of the ocean off Delaware and New Jersey suggests in more specific terms the potential conflicts among ocean users, both domestic and foreign.

COMMERCIAL FISHING

The Delaware and New Jersey fishing grounds are at the southernmost tip of the North Atlantic fisheries. In the North Atlantic's broad expanse of offshore waters—which includes the Continental Shelf from Cape Cod to Cape Hatteras—U.S. fishermen caught 1.5 billion pounds of commercial fish and shellfish in 1975, which is almost one third of the total U.S. catch.

Preliminary figures collected by the National Fisheries Service show that commercial fishermen in Delaware and New Jersey grossed $20 million in 1975, with a catch of more than 150 million pounds.

According to the National Fisheries Service, more than 2,000 New Jersey and Delaware fishing boats provided full- or part-time employment to more than 3,500 persons.

In the Mid-Atlantic, foreign vessels, operating primarily outside the 12-mile national limit, have traditionally caught large quantities of fish. The vessels came from the Soviet Union, Poland, Japan, Spain, Italy, and East and West Germany. Even though the United States has recently enacted a 200-mile fisheries zone, provisions for licensing foreign fishing within this zone are still in the future.

Commercial fishing in this region by both U.S. and foreign fishermen, is likely to continue at the present level without major increases in the future because many of the resources are already utilized to their maximum limit. There will probably be additional activity to restore depleted stocks, to regulate and enforce new management systems for fisheries, and to find new ways to increase productivity of certain species. All of these activities will require the use of more ocean surface and bottom space in areas that might be sought for other uses such as oil drilling or siting of platforms. In addition, surface traffic of fishing vessels, enforcement vessels, and research vessels which tend to stay at sea for longer periods of time could conflict with other surface traffic.[1]

SPORT FISHING

In 1970, an estimated 1.7 million salt-water sport fishermen in the Mid-Atlantic region generated about $300 million of business activity, according to a 1970 National Survey of Fishing and Hunting. Sport boats take anglers to search for barracuda, shark, mackerel, bluefish, butterfish, bass, trout, flounder, and croakers in the Continental Shelf waters and beyond for tuna, dolphin, mackerel, and albacore.

Between Atlantic City, N.J., and Ocean City, Md., the ocean yields white marlin and tuna for sport fishermen.

Based on past trends, interest in sport fishing probably will increase in coming years at a rate higher than actual population growth. Boat traffic will increasingly cause conflicts, especially at the coastal harbors that may also be used for supply boats to support offshore technologies. In addition, land-use pressures may increase in spawning and nursery grounds in the coastal zones, which are utilized by 75 percent of the sport fish at some time in their life cycle. z

MERCHANT SHIPPING

The shipping lanes off Delaware and New Jersey are ocean versions of interstate highways that link Mid-Atlantic metropolitan areas. There are two major two-way traffic lanes into the Delaware Bay, second in the region only to New York Harbor in total cargo handled.

One route is designated by the International Maritime Consultative Organization of the United Nations as the recommended lane for traffic in and out of Delaware Bay, However, only U.S. flag ships are forced by the U.S. Coast Guard to comply with the recommendation and less than half of the ships that call at Delaware Bay are U.S. flag ships. The other route is not recognized by IMCO, but is a well-established traffic land used heavily by foreign and domestic ships. Many other lanes intersect the recognized lanes.

The ports on the Delaware River and New York Harbor together are probably the most heavily utilized in the United States. They handle over one-third of all imported and domestic oil carried by tankers. Nearly 3,000 major tankers enter and leave each port per year. Total major ship traffic into Delaware Bay is more than 5,000 ships per year and into New York Harbor more than 8,000 per year. Almost 150 steamship liners operate out of the Port of New York alone. Many of these ships are foreign flag (almost all of the tankers carrying imported oil) and traffic problems will undoubtedly increase as other offshore users enter the region. The conflicts are clear between offshore platforms in the Baltimore Canyon, which could be located near some traditional shipping lanes if oil is discovered.[3]

OFFSHORE OIL AND GAS

The scheduled sale of oil and gas leases in the Mid-Atlantic could cause a sharp increase in the number of structures and amount of ship traffic in the ocean off Delaware and New Jersey.

As many as 10 exploratory rigs and 50 production platforms may be working off the Mid-Atlantic coast at one time, along with vessels engaged in exploration, crew transport, supply, platform and pipeline construction. As many as 30 vessels-supply boats, tugs, and crew boats—could be operating in the Baltimore Canyon region by 1980 in direct support of exploration rigs. When and if Baltimore Canyon oil and gas is discovered and activities hit their peak, the number of operating support vessels could increase to over 200 and include construction barges, pipelaying barges, and other varieties of workboats. These uses and resulting traffic will conflict with shipping, fishing, research, recreation, and other surface uses not only offshore, but in the already limited coastal harbors. Oil could be tankered to shore from Outer Continental Shelf production rigs.[4]

MILITARY

A large portion of the Mid-Atlantic Continental Shelf is used by the military for acknowledged and for classified activities. Unclassified military operations in the area include submarine missions, air exercises, gunnery practice, missile and rocket testing, search and rescue drills, oceanographic research, and ocean surveillance. There are also several deepwater dumping grounds for explosives and nuclear waste,

Naval ships and planes, which are most likely to conflict with surface ship traffic, use the area 18 hours a day on weekends. Potential air traffic conflicts are also possible with helicopters that are used to transport crews to offshore platforms.

INSTALLATION AND FACILITIES

The cities of Philadelphia, Pa,, and Camden, N.J., and E.I. Du Pont de Nemours and Co. of Edge Moor, Del., dump municipal and industrial waste in two deepwater sites 50 miles southeast of Delaware Bay. The dump sites are designated and monitored by the Environmental Protection Agency.

In 1974, barges made 222 trips from Delaware Bay to the dump sites. Since then, the Environmental Protection Agency has reduced the number of dump permits for the area. Philadelphia, which dumps the largest volume of waste, has been ordered to phase out its dumping by 1980. Because of public opposition to ocean dumping off the resort areas of Atlantic City, N.J., Rehoboth Beach, Del., and Ocean City, Md., it is unlikely that any new major dumping permits will be issued.

Three major transoceanic telephone cables are buried directly east of the New Jersey shore, The cables are buried about 10 feet deep along most of the Continental Shelf. Many conflicts between scallop fishermen, who run dredges over the bottom near the cables, and the telephone company have arisen in the past. New conflicts are possible if and when oil pipelines are added to the seafloor network.

CONGRESSIONAL OPTIONS

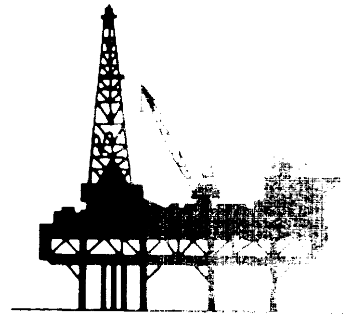
Congress may wish to deal with problems arising from conflicting ocean uses on any of a number of policy levels. It could:

1. Mandate a detailed study of conflicting ocean uses to assemble a data base on present and future uses and suggest priorities for development and control. Such a study could also assess present Federal organizational capabilities to deal with such conflicts and, if appropriate, propose changes, if any, required in the Federal structure.
2. Provide one ocean-related agency with authority to resolve ocean-use conflicts that result from increased offshore activities, Any such delegation of authority probably would have to specify arbitration, public or private, as an avenue for resolving some conflicts.
3. Require joint planning for offshore uses by conflicting parties, public and private, domestic and foreign.

ISSUE 2

Federal Management System

Federal management of the offshore oil and gas program is fragmented within the Department of the interior and coordination with other Federal agencies which share jurisdiction is ineffective.



Oil and Gas

FINDINGS

1. The Department of the Interior, in its OCS management role, must coordinate elements of development which involve 4 cabinet-level departments, 15 subcabinet and independent agencies, 22 State governments, and public and private interest groups.

2. There is no top-level coordination of OCS management, practices, and studies initiated by the Department of the Interior. Line responsibilities for OCS activities are divided within the Department of the interior between two of its bureaus, both of which have a wide range of other activities that overshadow their OCS responsibility.

3. Clear lines of responsibility have not been established between the Department of the Interior and the Office of Coastal Zone Management despite the fact that offshore development in the Mid-Atlantic could produce the most important impacts on coastal zones since the Coastal Zone Management Act became law.

DISCUSSION OF THE ISSUE*

Despite the urgency which the Administration attaches to expanding offshore lease sales and petroleum production, no consolidation of responsibility and accountability for the OCS program in one agency has occurred.

*This brief discussion of the issue is taken from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 124– **140.**

Public Participation Comments

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The Department of the Interior, in its OCS management role, must coordinate elements of offshore development that involve cabinet-level departments, some 15 subcabinet and independent agencies, 22 State governments, and public and private interest groups. Over the past 2 years, this coordination has been seriously questioned. Examples of this difficulty have been disputes over pipeline jurisdiction among agencies within the Interior Department itself. One Interior Department agency had been negotiating, without success, with a Transportation Department agency over pipeline jurisdiction for nearly 5 years before a memorandum of understanding was signed by the two Departments. No policy-level pressure has been brought to bear on Interior's Bureau of Land Management and the U.S. Geological Survey to solve their own jurisdictional problems about pipelines within the Interior Departmental

Many studies of offshore development have been initiated at middle and lower levels of the Department. It is not clear whether they will produce information that policy makers either at the Federal or State level actually require. There is no top-level coordination of such studies.

Line responsibility for OCS activities is divided within the Interior Department between two bureaus, both of which have a wide range of other activities that overshadow their OCS responsibilities in terms of manpower and budget. The Bureau of Land Management (BLM) is the lead agency in developing leasing programs and granting rights to offshore exploration and development. Once leases are signed, responsibility for supervising offshore activities passes to the U.S. Geological Survey (USGS), which is primarily a scientific agency with limited regulatory responsibility. The USGS drafts technical regulations for offshore equipment and operations and enforces those regulations. The regulations have been, and continue to be, more concerned with specific items of equipment than with relationships between the equipment and the total oil and gas development system.

Clear lines of responsibility have not been established between Interior officials and officials of the Office of Coastal Zone Management for OCS operations, despite the fact that offshore development in the Mid-Atlantic could produce the most important impacts on coastal zones there of any single development since the Coastal Zone Management Act became law.[2]

The Office of Coastal Zone Management (OCZM) could have a significant impact on offshore energy development when States begin to complete coastal zone plans. The Office has had a relatively minor role in offshore energy development to date. This role could change when New Jersey and Delaware submit final plans and the Office must make judgments about whether the plans make sufficient allowance for coastal zone activities that are in the "national interest" and whether, in turn, Federal activities in coastal zones are "consistent" with State plans. Neither "national interest" nor "consistent" has been formally defined by the OCZM or any Federal agency so far.

State officials have expressed a hope that once coastal plans are completed, the Office of Coastal Zone Management would function as a clearinghouse for Federal activities and plans to help States sort out various Federal programs with coastal implications. They also said they would hope the Office would assert authority, once coastal plans are completed, to force coordination among Federal programs that involve coastlines. a

In addition, long-range national policy questions which arise from accelerated leasing schedules should be considered.

For example, can the United States proceed indefinitely without (a) a formal process for determining total energy needs and (b) calculating the share of those needs that should be provided by OCS resources? That allocation, rather than the existing program for leasing maximum acreage in the minimum number of years, could become the guide for future leasing programs. It is also important to consider whether the United States can proceed indefinitely with offshore developments for oil and natural gas and other seabed resources, fisheries, and commercial activities, without a formal process for reconciling conflicts not only among the uses but between those uses and their impact on the ocean environment.

CONGRESSIONAL OPTIONS

1. Assign a single policy-level office within the

Department of the Interior the authority and responsibility for OCS policy coordination.

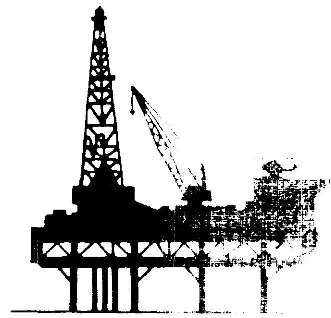
2. Assign to a single policy-level office within the Department of the Interior general responsibility for program coordination with all Federal agencies with OCS responsibilities and specific line authority and responsibility for operations of:

- those sections within the USGS which now draft and enforce technical regulations for offshore oil and natural gas activities;
- those sections within the Bureau of Land Management which now supervise offshore leasing and environmental studies programs; and
- all land uses, ocean use, economic, geological, and other planning that is now carried on independently in various sections within the interior Department that relate to OCS operations.

ISSUE 3

Regulation and Enforcement

Inadequate regulation and enforcement of offshore oil and gas technology could result in more accidents and more oil spills than would occur if a more effective system were implemented.



Oil and Gas

Public Participation Comments

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"We must not overre[illegible] Nation develop."

FINDINGS

1. The present Federal system for the regulation of offshore oil and gas development and for the enforcement of these regulations does not assure the use of adequate technology for safety and pollution prevention.

2. Many of the operating orders for the Mid-Atlantic are not issued by the Department of the Interior until after leases have already been sold.

3. Technology exists for setting design standards, installation practices, specifications, and scheduling tests and inspections for all major equipment items related to OCS operations but it has not been utilized.

DISCUSSION OF THE ISSUE*

Three principal aspects of regulating offshore oil and gas technology are in question:

1. The standards and specifications for design, construction, and installation of individual components.
2. Regulations which are issued to guide the operations and illustrate best technical practice for use of each component.
3. The enforcement system and procedures for checking, monitoring, and reporting adherence to established regulations.

A significant problem with identifying potential impacts from lapses in technology supervision is the fact

*This brief discussion of the issue is taken from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 140– 171.

that very little data or analysis is available for evaluating accidents and safety questions.

During offshore U.S. oil operations spanning the 10 years from 1967 to 1976, major spills (of more than 1,000 barrels each) were few in number but caused more than 80 percent of the pollution by volume. The two principal sources of these spills were underwater pipelines and drilling-production platforms, each contributing roughly equivalent numbers and volumes of spills.

"Safety Alert" notices, which are issued in the Gulf of Mexico to warn industry of malfunctions in equipment, provide other data on causes. Of 27 such notices reviewed, the causes of significant accidents included platform machinery malfunctions, platform construction operations failures, ship collisions, blowout-preventor malfunctions, shallow gas pockets, and severe storms.[1] There appears to be no systematic analysis of this accident data or any other for the purpose of determining where specific improvements are needed.

The U.S. Geological Survey, principally through OCS orders and other lease stipulations, regulates OCS technology and related activities. Recent studies have made recommendations for several changes, including more stringent regulation of oil spill prevention equipment and techniques, better equipment standards, and increased inspection and training. z

Few of the substantive recommendations of these studies—which included development of comprehensive standards and specifications, improved training, and improved inspection and enforcement practices—have been reflected by changes in proposed OCS orders for the Mid-Atlantic or other regions such as Alaska. The USGS, in fact, debates the need to complete orders and inspection plans prior to a lease sale. The USGS has, on the other hand, instituted a number of the procedural recommendations of these studies.[3]

The USGS decided, in the case of the 'Mid-Atlantic, orders on platforms and pipelines would not be issued until some unspecified time after the lease sale and that inspection procedures would be established only after exploration and development activities take place. The USGS has said that there is no need to issue these orders until the industry clearly intends to develop an offshore area.

The offshore oil industry has developed a good safety record with regard to oil spill accidents from platforms, especially since the Santa Barbara spill in 1969. At the same time, however, Federal regulatory agencies, principally USGS, do not appear to employ the best available system for establishing standards and enforcing regulations. There is, therefore, no assurance that the best practices and standards will be consistently followed.

Pipeline networks have not been subject to stringent regulatory standards in the United States in the past and pipeline failures, with resulting oil discharges, have occurred in the Gulf of Mexico as well as in other offshore development regions.[4]

Specific design standards, installation practice specifications, and scheduled tests and inspections could readily be adopted for pipelines in the Mid-Atlantic region, and in other OCS regions, based on existing knowledge and available technology.

New technology is available to assure pipeline safety and could be immediately incorporated in regulations prior to any lease sale. This includes standards for coating pipelines with corrosion protective materials, standards for welding and inspecting welds, specifications for pipe materials, and procedures for installing and burying pipe.

Oil production platforms are highly complex systems, subject to great uncertainties, which are designed, built, and installed by oil companies under stringent self-imposed technical guidelines. There is very little regulation of this technology. Most recognized industry standards are not required by Government regulations; the OCS order for platforms merely states that platforms shall be adequately designed and certified, Government inspections of construction, installation, and operations are not systematically planned.

The American Bureau of Shipping, a private group which sets design standards and inspects offshore equipment for insurance companies, has developed specifications and inspection procedures for offshore mobile platforms. The Bureau regularly works with the U.S. Coast Guard to certify ships and other floating equipment. Adoption of this regulation and enforcement practice to fixed production platforms by OCS regulatory agencies could increase the effectiveness of the present system immediate y.

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The U.S. Coast Guard recently developed regulations for deepwater ports which, in many cases, cover technology and hardware similar or identical to that used in OCS operations. The Coast Guard philosophy of regulation appears to be one of setting detailed, firm and comprehensive rules for designing, building, and operating, and then carefully checking adherence to those rules. On the other hand, the USGS philosophy appears to be one of asking for industry's best efforts and then making broad judgments about its adequacy.

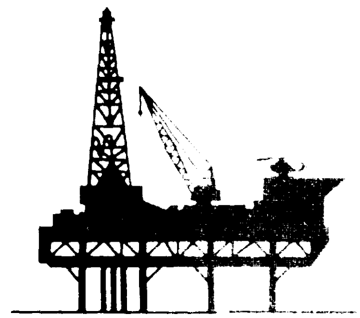
CONGRESSIONAL OPTIONS

The following options are available for making changes to the present system:

1. Require that OCS orders be completed prior to, and made part of, all lease sales. Such orders should include design standards for the complete system, along with test and inspection schedules. Require development plans to be complete and comprehensive, to utilize environmental data developed for the region, and to follow specified standards and practices for the system.
2. Transfer regulatory and enforcement authority from USGS to the U.S. Coast Guard for major OCS systems, and apply existing Coast Guard regulations on drill ships and floating platforms to other offshore technology.
3. Separate regulation and enforcement for daily OCS operations within the Federal Government by assigning these responsibilities to an agency, or department, other than Interior, while preserving Interior's OCS development responsibilities.

ISSUE 4

Oil Spill Liability and Compensation



Oil and Gas

Existing laws are not adequate either to assign liability or to compensate individuals or institutions for damages from oil spills resulting from exploration, development, or production in the Baltimore Canyon Trough area.

FINDINGS

1. Because existing law does not deal comprehensively with liability for oil spills from offshore structures in OCS activity, the law of the adjacent State is used for determining a lessee's liability for damages. The laws of Delaware and New Jersey, which are adjacent to Baltimore Canyon lease areas, do not contain explicit provisions to provide for compensation to parties injured by oil spills.

2. Under existing statutory and case law, damaged parties lack effective protection against economic losses that may result when an oil spill reaches shore.

3. There are benefits to having the States handle some aspects of liability and compensation and these benefits can be preserved by a Federal law which does not **completely preempt State laws.**

DISCUSSION OF THE ISSUE*

The possibility of a major oil spill during development in the Baltimore Canyon Trough is a potential impact that concerns the public and government officials of New Jersey and Delaware.] The concern is intensified by the fact that, under existing law, damaged parties lack protection against economic losses that may result from oil reaching shore.

The OTA oil spill risk assessment indicates that there probably would be at least one major oil spill during development of the Baltimore Canyon Trough. Under certain weather conditions and at certain times of the

*This brief discussion of the issue is taken from the full text "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 165– 167.

Public Participation Comments

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year, oil could come ashore anywhere in the New Jersey area, affecting tourist and commercial fishing incomes. z Natural resources such as estuarine areas and wildlife preserves whose values are difficult to quantify economically also could be damaged.

Most Federal liability statutes apply to spills from vessels rather than spills that may occur as a result of offshore oil and gas development. Under existing law, offshore structures such as production platforms probably would be treated as artificial islands and would not be governed by the principles of law governing the liability of vessels.[3]

Offshore structures within the territorial seas are covered in the Federal Water Pollution Control Act (FWPCA), as amended (33 USC 1321), which makes a discharger liable to the Federal Government for cleanup and removal costs up to a limit of $8 million. The discharger is liable for full costs if negligence can be shown. However, no evidence of financial responsibility such as a surety bond is required for offshore operators. A $35 million fund is established to support cleanup efforts when a discharger fails to act on his own but there is no provision for compensating parties for damages that the cleanup effort cannot prevent. Such parties must rely on the courts and the application of the common law of torts to recover losses under theories of negligence, trespass and, occasionally, nuisance. Primary responsibility for administering the liability provisions of the FWPCA rests with the U.S. Coast Guard which monitors all cleanup efforts and, when necessary, initiates Government cleanup.

Other relevant Federal statutes which deal with liability for oil pollution are the Deepwater Port Act of 1974, the Trans-Alaska Pipeline Authorization Act of 1973, and the Outer Continental Shelf Lands Act of 1953. Each of these has specific and limited application.

The Outer Continental Shelf Lands Act does not specifically establish a system for oil spill liability, although it does authorize the Secretary of the Interior to promulgate regulations to prevent waste and conserve natural resources. When read in conjunction with other related laws, such as the National Environmental Policy Act, that provision authorizes the Secretary to issue rules pertaining to pollution which are binding on the lessees.[4]

After the Santa Barbara oil spill, regulations were issued (34 FR 13547, August 22, 1969) making lessees strictly liable for all cleanup and removal costs. However, the regulations stipulated that a lessee's obligations to third parties, other than those of cleanup costs, are governed by applicable law (30 CFR 250.43).

In the absence of Federal law dealing with liability for oil spills resulting from offshore development, the applicable law for determining a lessee's liability for damages presumably is the law of the adjacent State.[5] Both New Jersey and Delaware are working on new liability laws,[6] but present laws do not seem to provide for compensation to injured parties, other than through civil action.

The objectives of a model oil spill liability law include an incentive to prevent spills and to move quickly to contain and clean up those spills that cannot be prevented; compensation for damage victims, T and assurance that a lessee would be able to assume any financial burdens resulting from damage claims.

Current laws do not meet those objectives. While rapid cleanup may be somewhat encouraged by the present system, the incentive to prevent oil spills is not as strong as it could be. Although an OCS discharger is strictly liable, and there are few defenses against damage claims, liability is limited to removal and cleanup costs except where courts apply common law to require compensation.

Other questions have to do with whether loss of opportunity for recreation or loss of navigation rights are properly recoverable injuries.

Under current laws, if a lessee escapes liability under one of the permissible defenses, and cleanup costs exceed the current $35 million fund limit under the FWPCA, there is no source of funds from which to compensate loss. This problem could be addressed in new legislation,

Because offshore operators are not required to demonstrate financial responsibility and because insurance against oil spills sometimes is difficult to obtain, it is possible that companies which could not assume current required liability expenses would be permitted to operate off New Jersey and Delaware. B

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Full liability insurance for ocean-related pollution has been generally unavailable on the commercial market to owners and operators of onshore and offshore facilities.[9] This is partly because insurers cannot accurately estimate potential damage or loss, The oil industry has established an entity to compensate victims of pollution by onshore and offshore oil structures. Oil Insurance Limited (OIL) is an insurance company set up by members of the industry to cover catastrophes, property damage, pollution, and wild-well control, both onshore and offshore. Coverage up to $100 million per member company, with a deductible of $1 million, will be provided in any one year. A company must repay OIL over a period of 10 years for all settlements through retroactive premiums.

While compensation for direct physical damages could be awarded by the courts, such an award would depend on the ability of a damaged party to underwrite protracted legal action. Indirect damages are even less likely to be recoverable.[10] Therefore, there are many potential circumstances where an injured party would not be able to obtain adequate compensation.

Property owners who are directly damaged by oil would have the best chance to recover property and business losses under existing law. However, courts generally have held that lost business profits and lowered property values of persons whose property has not been directly damaged by oil could not be foreseen by a negligent party and therefore are not grounds for damage claims. Thus, there is no recourse for such people as hotel owners whose property is not on beach frontage and therefore cannot be damaged directly, but who lose income because an oil spill keeps tourists away from a resort area. Other principles such as trespass and nuisance are even more limited in application and also provide no recourse for those who are indirectly damaged.[11]

Existing laws are not clear on the unresolved question of whether State or local governments may seek and obtain relief for loss of wildlife or natural beauty or other damage to the environment. Nor are the laws clear on whet her governments may claim damages for lost tax and licensing revenue for diminished tourism and reduced harvesting of fish.[12]

Perhaps the most controversial subject of any liability and compensation discussion is unlimited liability for all cleanup costs and damages.

There is disagreement on whether an unlimited liability provision would encourage industry to undertake the least pollution-prone operation or would discourage industry from undertaking operations with any risk at all. There is also disagreement over whether unlimited liability would encourage those responsible for spills to rapidly and completely clean up a spill or whether it would encourage laxity.

Some suggest that unlimited liability is either uninsurable, or that the rates for such insurance will be prohibitive to independent companies. However, unlimited liability already exists in such areas as crew claims and cargo damage in shipping, although potential losses in these areas are easier to calculate than are oil spill losses. Some instances of unlimited liability have been in effect for several years without any adverse effect. At the Federal level, the OCS regulation imposing unlimited liability for cleanup which followed the Santa Barbara accident has been in effect since 1969 and the participation of independents has not been endangered. At the State level, four States have unlimited liability laws, and have not noticed adverse impacts on the oil industry.[13]

Both Delaware and New Jersey are considering their own liability and compensation legislation, but because preemption of State laws is a key provision of some proposed Federal legislation, the States may be reluctant to invest considerable effort in adopting such legislation which could be nullified by Federal law.

However, in two important areas of liability plans—rapid, reasonable cleanup and equitable damage compensation—States appear to be better qualified to deal with the situation than the Federal Government. For example, experience has shown that State agencies respond faster to spills than Federal agencies.[14] A In addition, State officials may be better able to evaluate local damages and a fund administered on the State level may be more accessible to claimants.

The benefits of both State- and Federal-level regulation of oil spill liability and compensation could be preserved in a framework that would: (1) require States to accept Federal certificates of financial responsibility, thus minimizing compliance costs to industry; (2) prevent States from levying fees on oil for the purpose of creating State funds, thus minimizing product costs to consumers; and (3) permit States to impose their own liability limits and to create funds by appropriations in order to undertake cleanup operations and compensate damage victims.

CONGRESSIONAL OPTIONS

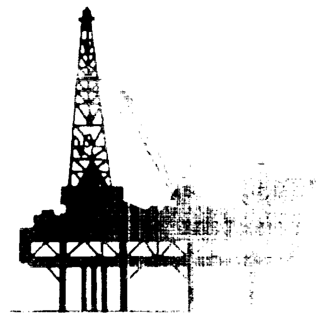
1. Congress could adopt legislation dealing with liability and compensation for damages associated with offshore oil and gas production that would be comprehensive enough to cover such problems as indirect damages, class actions, and unlimited liability.

2. Congress could adopt liability and compensation legislation that addresses only direct damages and let other issues evolve through case law.

ISSUE 5

Oil Spill Containment and Cleanup

There is no assurance that the technology utilized in the Baltimore Canyon Trough or in any other OCS frontier region would be adequate for oil spill surveillance, containment, and cleanup.



Oil and Gas

FINDINGS

1. There is confusion over who is in charge because most local officials do not know what action should be expected or who is available to take action in the event of a spill.

2. There are no definitive regulations for industry to follow regarding standards for equipment, minimum levels of manpower readiness, and responsibility for coverage on OCS oil spills.

3. Industry is making an effort to be well equipped to deal with spills in the Mid-Atlantic.

DISCUSSION OF THE ISSUE*

An estimate of the range of probable oil spills as a result of Baltimore Canyon development activities has been made, based on statistics from offshore oil operations over the past 10 years, principally in the Gulf of Mexico. A few major accidents have caused most of the oil spilled into the marine environment. None of these offshore spills to date has been contained and cleaned up on site.

OTA estimates the range of oil spilled over the projected 30-year life of the field will be from 5,000 to 860,000 barrels resulting from 1 to 40 spill incidents. The most likely amount is 40,000 barrels and 18 spill incidents.[1]

Depending on the season, the size of spill, and prevailing conditions, the shoreline could be severely impacted as a result of inadequate containment and cleanup.

*This brief discussion of the issue is taken from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 165–167.

Public Participation Comments

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The Coast Guard is responsible for the implementation of Federal pollution response functions in the coastal area as required by the National Contingency Plan. A memorandum of understanding between the Coast Guard and the Department of the Interior gives the Coast Guard the responsibility to respond to discharges in the OCS consistent with this plan, but reserves for the Department of the Interior the responsibility of controlling the discharge at the source.

The Coast Guard, in implementing the intent of the FWPCA, has structured its enforcement and response posture to foster the cleanup of polluting discharges by the responsible party. The Coast Guard on-scene coordinator, in each pollution incident, makes a determination as to the propriety of the responsible party's removal actions and initiates Federal removal actions when they are necessary.

The confusion over who is in charge should a spill occur has been evidenced by OTA'S inquiries of public and private groups in the New Jersey and Delaware region. Most local officials are unaware of the provisions of the National Contingency Plan or the Coast Guard-Department of the Interior memorandum of understanding and do not know what action would occur or who is available to take actions in the event of an oil discharge.

The key to oil spill cleanup operations is quick response. The present capability to deploy effective high seas removal equipment is limited by the availability of such equipment and the ability to deliver the equipment on scene. The Coast Guard has developed high seas containment booms and removal devices and has begun stockpiling this equipment. Towable high-speed delivery sleds have been developed by the Coast Guard and are to be available prior to development of the Mid-Atlantic OCS.

Industry, through Clean Atlantic Associates, Inc., is developing a stockpile of equipment and operational procedures for dealing with potential oil spills, but there are no firm Government requirements for most of their activities.

The Department of the Interior, under the authority of its OCS operating orders, which require lessees to maintain cleanup equipment, could monitor Clean Atlantic Associates activities, but cannot order the group to acquire equipment meeting certain standards or to train personnel for certain levels of operation.

CONGRESSIONAL OPTIONS

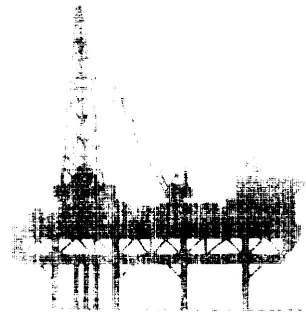
1. Provide authority and funding for the Coast Guard to patrol for oil spills and take charge immediately should a spill occur.

2. Prepare definitive regulations for industry to follow, including standards for equipment, minimum levels of manpower readiness, and responsibility for coverage on all OCS oil spills.

OTHER OPTIONS

Federal and State officials could develop a strong information program to advise local officials and the public of procedures that would be followed and parties who are responsible for actions in the event of a spill.

ISSUE 6



Oil and Gas

Public Participation Comments

Environmental Studies

Environmental research and baseline studies are not formally coordinated with the Interior Department's leasing schedule and there is no requirement that information gathered be used in the decisionmaking process for sale of offshore lands and subsequent operation.

FINDINGS

1. The purpose of Interior's environmental studies program and its role in the management of OCS development has not been clearly defined.

2. The value of the investment in environmental studies is questionable if there is little or no relationship between the studies and management decisions.

3. Environmental studies to date are not useful either for Environmental Impact Statements or in leasing decisions because they are not completed in time to be used.

4. Some important elements are missing from the Mid-Atlantic and other regional studies now underway, including nearshore investigations, climatology, physical oceanography, and shallow geologic studies.

DISCUSSION OF THE ISSUE*

The OCS environmental studies programs now underway in frontier areas are a major Federal undertaking in oceanographic investigation. The fiscal year 1976 budget for these studies is over $40 million with substantial field data collection underway in the Mid-Atlantic, Gulf of Mexico, offshore Southern California, and Alaska. Most of the programs include collection of marine biological data, measurements of hydrocarbons and trace elements in the marine environment, and analyses of physical and chemical characteristics of the marine environment. Some of the programs also include other specific biological, oceanographic, geologic, and meteorologic studies.[1]

*This brief discussion of the issue is taken from the full text "Development of Offshore Oil and Gas in the Mid-Atlantic, " chapter IV, particularly pages 131 – 1 40.

The purpose of these studies has not been fully defined, and many questions remain about how the information developed can or will be used in the decision-making process of leasing OCS lands and managing or regulating subsequent OCS activities. Presumably, the environmental studies will begin to establish a definition of the "baseline" or existing environmental conditions from which one can measure environmental impacts that might be caused by any oil and gas activities throughout the life of an offshore field. The studies would also continue in conjunction with oil development and become closely related to monitoring of any environmental changes. In addition, many biologists believe that the studies should identify environmentally sensitive areas or special hazards that would indicate which areas, if any, should be withdrawn from lease offerings.[2]

The vague relationship between these studies and any decisionmaking process, however, is a principal issue. If there is little or no relationship between the studies and management decisions, then the value of the investment in the studies is questionable. If the studies do not include environmentally sensitive regions such as nearshore waters or do not provide adequate scientific evidence, then the usefulness of the results is questionable.

Many scientists claim that the studies are not well planned since they attempt to solve too many complex problems within unrealistic time frames, and that study efforts are hopelessly fragmented. s A priority of important subjects should be established if meaningful results are to be obtained. Some important elements are missing from the Mid-Atlantic and other regional studies now underway, including nearshore investigations, climatology, physical oceanography, and shallow geologic studies.

CONGRESSIONAL OPTIONS

The following options could be employed for making such changes in the present system as may be needed:

1. Require that environmental studies be made a formal part of the lease-management process by

defining the content and timing necessary for providing data for milestone decisions.

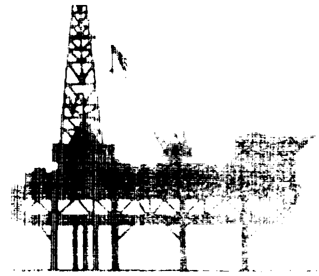
2. Require that environmental studies that would define baselines and identify sensitive or hazardous areas and conditions be completed prior to preparation of a development plan, and that the data be used in evaluating and approving development activities.

3. Separate the responsibility for environmental studies from the agency in charge of development (Interior) and put a scientific agency in charge (such as the National Oceanic and Atmospheric Administration).

ISSUE 7

State Role

The limited role of State governments in the decision-making process for OCS development under existing laws and practices may lead to unnecessary delays and improper planning for such development.



Oil and Gas

Public Participation Comments

FINDINGS

1. New Jersey and Delaware officials are not receiving information which they consider necessary to plan for dealing with the onshore impacts of offshore development and there is no description in present laws or regulations which specifies what information must be provided to the State in development plans or impact statements.

2. Top-level State officials in New Jersey and Delaware do not believe that current laws and practices for planning and administering offshore petroleum development allow for full State participation in important decisions.

3. Without meaningful State participation in decisionmaking, State and local officials may try to use ***court action to*** block or delay decisions with which they disagree.

DISCUSSION OF THE ISSUE*

The flow of information from the Federal Government to the States in the 2 years since the decision was made to accelerate offshore leasing has been slow and uncoordinated. The States are concerned about this situation because they need comprehensive and timely information in order to plan for the onshore effects of offshore development.

Offshore energy development eventually will mean the location of staging areas, pipelines, tank farms, gas processing plants, and perhaps even new refineries on

*This brief discussion of the issue is taken from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 136– 140, 146– 150.

shore to support OCS oil and gas production. The States are concerned that these onshore activities may require major investments of public funds that cannot be scheduled without considerable advance warning and some assurance that the investments actually are required, and that revenues ultimately generated by offshore activity will support the expenditures.

State officials say, by and large, that they understand the present limitations on the Interior Department in providing some types of data. They also recognize that some progress has been made in meeting State needs, but most of the steps taken by the Bureau of Land Management (BLM) to provide information are strictly administrative actions, are not guaranteed by law, and can be changed without consultation with the States.

State officials also say that there are still specific information gaps, principally in the following areas:

- Hard information on potential onshore impacts, including a quantification of potential economic losses to tourist and fishing industries.
- Detailed estimates of oil and gas reserves.
- Historic and predictive data on the incidence and effects of oil spills.
- Information on geologic and climatic conditions and shoreline characteristics that might pose dangers to offshore structures and pipelines.
- Environmental and baseline data in general, particularly data on wetlands and nearshore areas.

Once management plans have been approved by Federal officials under the Coastal Zone Management Act, both States presumably would have a legal right under the Act to "necessary information and data" about any Federal activity in their coastal zone, including activity related to offshore oil and natural gas development. However, since the Act does not specify whether the States or the Federal Government would interpret the word "necessary," it is not certain that it will solve the States' information problems. Final approval of New Jersey and Delaware coastal zone management programs is expected early in 1977.

States have also pressed for access to point-of-no-return decisions that would affect the location and magnitude of onshore activities. By law, the States' role is presently limited to not much more than that of an observer. They are allowed to comment on information and proposed actions, but there is no requirement that their comments and suggestions be acted upon.

The goal of legislation should be to create a framework for relationships between State and Federal Governments that would ensure States full participation in major OCS decisions. One way to assure State involvement in those major decisions could be to make participation a legal right of a State rather than an option of Federal decisionmakers. Thus, the right of States to a voice in policy decisions that may have significant social, economic, or environmental consequences for their citizens, would be unobstructed up to, but not including, the right to veto Federal offshore development plans.

States have the right through their riparian laws, environmental protection regulations, and zoning powers to block or delay development once it involves State lands. State officials with whom OTA researchers talked in the course of the study seemed universally to prefer continuing participation in development decisions rather than blocking actions, but officials indicate they will take legal action to block development if their concerns are not satisfied.

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Under pending legislation, a revision of the OCS Lands Act of 1953, States would be entitled to comment on development plans before they were approved by the Secretary of the Interior, to have written explanations for the Secretary's rejection of those comments, and to appeal that decision to the U.S. Circuit Court of Appeals.[1]

That same principle of arbitration could be applied to other important decision points in the development process, including the sale of leases, The Interior Department, for example, could solicit State comments on proposed lease sales and solicit State proposals for lease stipulations which States felt necessary to protect their environmental and economic interests. Interior could explain in writing why any State proposal had been rejected. States could have the same rights of appeal on lease stipulations as they would have on development plans under the pending legislation.

Enforcing agencies could also submit to the States long-range and detailed plans for enforcing lessee compliance with operating orders, evaluate State comments on the plans and either modify them or explain a failure to modify them to accommodate any State objections.

"One cannot fault the USGS if they are adhering to the letter of the law with respect to divulgence of information or State involvement in offshore energy development decisions, but that does not mean that legislation could not be enacted to remedy the situation."

Such free exchange of information and State access to decisions would not necessarily resolve all future conflicts about offshore energy development. It would, however, help clear up uncertainties about the ground rules for development which affect not only Federal and State officials but the oil industry as well.

The Department of the Interior is not bound to an ironclad schedule and slippages do occur [in the OCS sale dates]. If State members of the Advisory Board ask the Office of OCS Program Coordination, they will be told [illegible]

Codifying the rights of States to participate in decisions, object to proposals, and appeal to third parties could extend the time required to set offshore energy development in motion in frontier OCS areas. However, the existing process has its own built-in potential delays through court actions and challenges to locations of onshore facilities.

Codifying the rights of States would, at least, make it possible to anticipate delays and to know with some degee of certainty how much more time the process would take than it does under existing law.

CONGRESSIONAL OPTIONS

1. Congress could require the Department of the Interior to solicit State comments on proposed lease sales, State proposals for stipulations to be written into leases, and State comments on development plans to protect economic and environmental interests. The Department of the Interior could be required to explain in writing why any State proposal was rejected and States could have a right of appeal.

2. Congress could require enforcing agencies to submit to the States long-range and detailed plans for enforcing lessee compliance with operating orders, evaluate State comments on the plans, and modify the plans, or explain a failure to modify them, to accommodate State objections.

3. Congress could require that an impact statement be prepared to accompany each development plan and that major development plans include detailed descriptive, design, and procedural information on offshore and onshore facilities that industry wants to build.

ISSUE 8

Pollution Research

The effects of pollutants which maybe discharged during OCS operations cannot presently be determined with any accuracy and recent research efforts have not clarified conflicting claims by oil companies and environmental groups regarding the amount and consequences of marine pollution.

FINDINGS

1. Many specific environmental conditions of each OCS region which may affect the dispersion, trajectory, chemical composition, and ultimate fate of a spill are unknown.

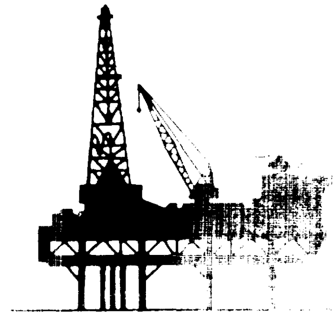
2. It appears that very little public research money is allocated to projects that address the unknowns of the effects of oil spills and other OCS pollutants.

DISCUSSION OF THE ISSUE*

Some unavoidable oil spills from accidents, chronic oil discharges from platforms, and discharges of other pollutants will occur should the Baltimore Canyon Trough be developed. It appears that future estimates of pollutant discharges from OCS operations can be based on statistical evidence from past Gulf of Mexico experience because no major changes in levels of pollution control technology are projected. Since it probably would require substantial investments to effect major reductions in pollution levels, the questions of benefit received are constantly raised. There are no reliable estimates of total environmental damages that may be caused by OCS related pollution, and it is very doubtful whether marine biological, esthetic or chemical changes caused by pollution can now be quantified.

What is not known and cannot be measured at this time is the severity of damage related to amounts and concentrations, the effects on the food chain and ultimate consumer, and the long-term effects of chronic discharges. Also unknown are many specific environmental

*This brief discussion of the issue is drawn from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic," chapter IV, particularly pages 134-135, 165-167.



Oil and Gas

Public Participation Comments

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The U.S. Coast Guard has recently evaluated its Marine Environmental Protection (MEP) program, which principally addresses oil pollution other than that related to OCS operations, but which can serve as an example of analyses of relative causes and effects of spills.

The Coast Guard oil spill data, however, includes only those OCS spills that are voluntarily reported. In this evaluation it is stated that oil exploration / production operations contributed almost a million gallons out of the 15 million gallon total discharged during 1974.

It is also stated that "the documented direct cost to society of oil pollution incidents (from all sources) in the United States is about $50 million a year or in excess of $4,500 per incident. The estimate is undoubtedly low since it includes only the costs of cleanup and the value of the product discharged. " A far greater concern than direct cost is the indirect cost to society.

The U.S. Geological Survey maintains an oil spill data base in the OCS Events Files. In this file, information is maintained on all oil spills of one barrel or more, blowouts, fires and explosions, fatalities, and miscellaneous accidents. Input for each incident includes probable cause, type of operation, date, location, and brief description of the event. The file is updated monthly and the data are analyzed by USGS for amounts and trends. It is unclear, however, what use USGS makes of the anlayses since many types of incidents occur repeatedly with no change in operating orders. Under present laws and regulations, oil spills from exploration or production facilities within 3 miles of shore must be reported to the Coast Guard. Oil spills from facilities beyond 3 miles must be reported to the USGS. There is no coordination of the information gathered by the two agencies.

The oil industry has sponsored a significant amount of research into the effects of oil pollution, including a study of the effects of oil operations on the marine environment off the Louisiana coast by the Gulf Universities Research Consortium.[2] In addition, the American Petroleum Institute, the Coast Guard, and the Environmental Protection Agency sponsor regular conferences on prevention and control of oil pollution at which many reports on research efforts are presented.[3] There appears to be no equivalent coordination of pollution research efforts among Federal agencies which share responsibility for OCS management.

The report to Congress of the Secretary of Commerce on Ocean Pollution is one of the few examples of a coordinating effort.[4] The report describes oil pollution research efforts by the National Science Foundation, the Environmental Protection Agency, the Bureau of Land Management, the Fish and Wildlife Service, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, and others.

It appears that very little research money is allocated to projects that address the unknowns of the effects of oil spills and other OCS pollutants.

CONGRESSIONAL OPTIONS

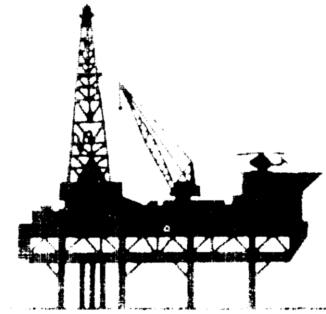
1. Sponsor additional research on the effects of pollutants at existing centers of excellence and specifically coordinate research pertinent to OCS operations through a central agency such as EPA.

2. Coordinate the collection of data about oil spills from exploration and production facilities by giving the USGS authority to require reports for all such spills, regardless of whether they are in State or Federal waters.

ISSUE 9

Conflicting Ocean Uses

There are potential conflicts between OCS oil and gas activities and vessel traffic engaged in commercial shipping and fishing activities. However, there has been no comprehensive study and analysis to identify all conflicts and to find ways of resolving them.



Oil **and Gas**

FINDINGS

1. It appears that proposed drilling rigs in the Baltimore Canyon Trough would be more vulnerable to ramming by ships than has been the case in the Gulf of Mexico.

2. Major traffic lanes for the ports of New York and Philadelphia lead through or near the lease area.

3. The Maritime Administration has stated that new traffic control systems have adverse economic impacts on shipping.

4. The Department of the Interior has already removed some tracts from leasing because of conflicts with fishing activities, but the presence of offshore structures could attract marine life, thus enhancing fishing and increasing watercraft traffic.

Public Participation Comments

DISCUSSION OF THE ISSUE*

Rammings of oil and gas platforms by merchant ships have occurred in the Gulf of Mexico. In a recent incident, the Globtik Sun, a 50,000-ton Bahamian-registered tanker, struck a Chevron platform in the Gulf on August 15, 1975, resulting in the death of six persons, a major fire aboard the ship and a 5-mile long oil slick. The platform was not operational, so no oil was lost from it.[1]

While the number of Gulf of Mexico rigs which have been hit by ships over the past 10 years has led to only 1 percent of all oil spills, the great majority of these rigs are

*This brief discussion of the issue is taken from the full text of "Development of Offshore Oil and Gas in the Mid-Atlantic, " chapter IV, particularly pages 136– 140, 144– 159, in quite shallow water, close to shore, and shipping lanes had been established to avoid them. Drilling rigs in the Gulf of Mexico are concentrated in areas where large ships do not normally travel, except at well-marked entrances to harbors. Only 10 major accidents involving ships striking drill rigs have occurred over the past 12 years. All but one (the most recent one) of the ships were under 20,000 tons. All were traveling closer to the coastline than was usual. By contrast, the Mid-Atlantic tracts proposed for sale are in deepwater commonly utilized by very large ships, but there is no proposal for traffic control. The EIS states that the Army Corps of Engineers issues navigation permits for locating rigs and platforms and "generally does not allow structures to be placed within traffic lanes as identified by the Coast Guard."[2]

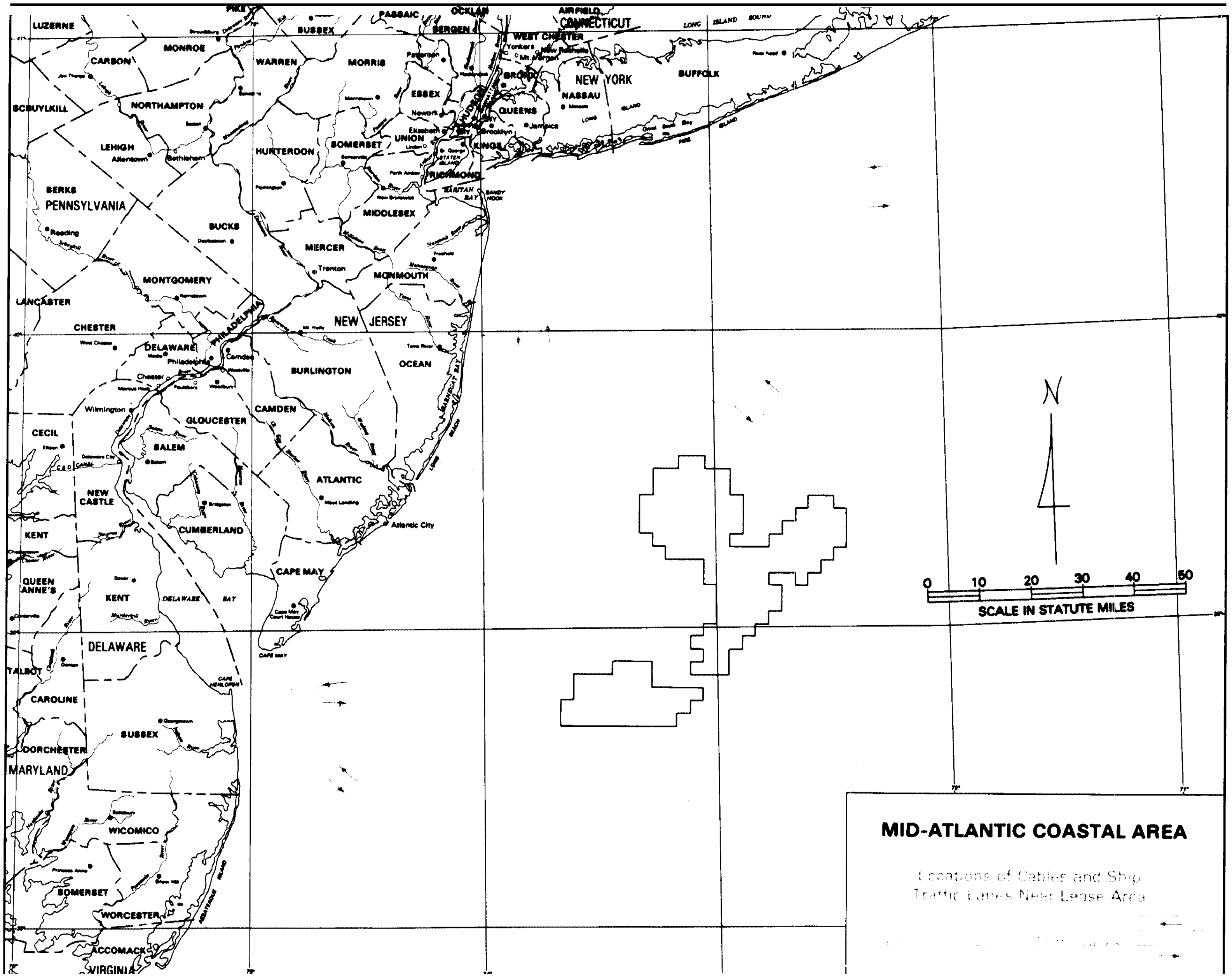
Off the coast of New Jersey and Delaware, both coastal and trans-Atlantic traffic lanes from the major ports of New York and Philadelphia lead through or near the lease areas. Major vessel arrivals at the Delaware Bay have been estimated at about 5,000 per year by the Philadelphia Maritime Exchange. Major vessel arrivals at New York Harbor have been estimated at 8,400 per year. These two ports handle more than one-third of all U.S. imported and domestic oil transported by tanker. International agreements have provided voluntary vessel traffic separation schemes, which are established lanes for arriving and departing ships at the major harbors of New York and Delaware Bay. These lanes, however, do not extend as far out to sea as the proposed lease areas, except for one New York lane extending to the Hudson Canyon near the northern region of interest.[3]

One way to reduce the potential hazard is by reducing the number of structures on the surface of the water. This can be done, and is done to some extent in the Gulf of Mexico, by the use of subsea completions which locate the valves and wellhead controls far underwater on the sea floor rather than on production platforms.

It appears that in general, any proposed structure on the surface of the Mid-Atlantic Ocean would be more vulnerable to ramming by ships than has been the case in the Gulf for the following reasons:

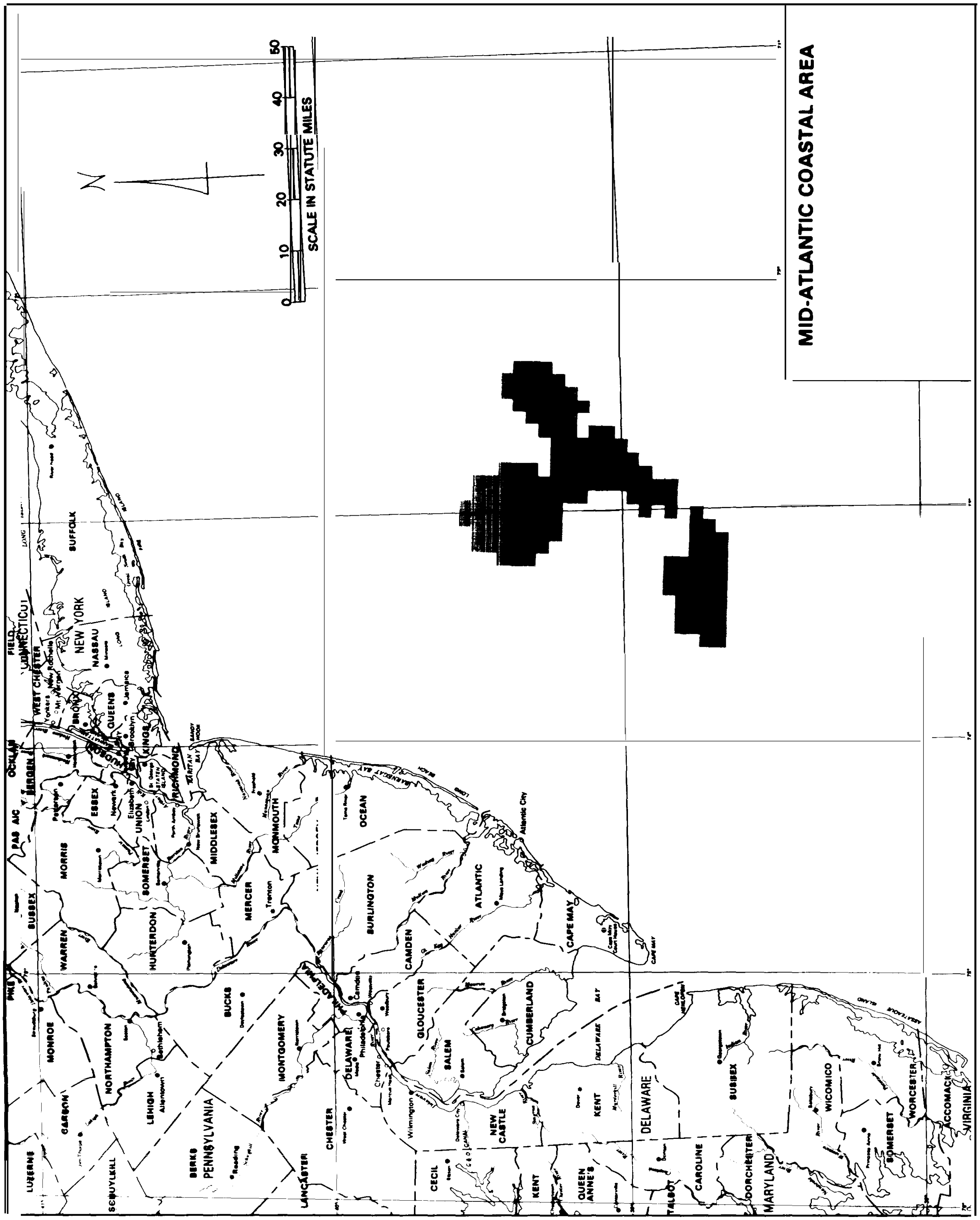
1. The large ship traffic density in the vicinity of potential rigs in the Mid-Atlantic is probably two to three times that of the OCS region of Louisiana.

Figure III-1.



Source Office of Technology Assessment and U S Department of the Interior

Figure III-2.



Source Office of Technology Assessment and U S Department of the Interior

2. Traffic patterns off the Mid-Atlantic coast tend to pass directly through potential rig locations while those in the Gulf have, to date, circumvented major concentrations of rigs.

3. The weather conditions, including wind, sea-state and fog, are more severe for longer periods of time in the Atlantic than in the Gulf.

The Maritime Administration of the Department of Commerce has agreed these factors increase the risk of contact between ships and structures, but Commerce believes that if all offshore structures are precisely marked and made known to mariners and equipped with warning lights, sound signals, and radar beacons or transponders, vessels should be generally able to avoid them without traffic control systems. Traffic control systems affect the speed, route, and fuel consumption of waterborne commerce, according to a Department spokesman. Because of this adverse economic impact on the shipping community, Commerce is reluctant to have new traffic control systems instituted.

In addition to commercial shipping vessels, more than 275 commercial fishing vessels operate out of New Jersey and Delaware and large numbers of fishermen from New England and the South Atlantic States operate in the offshore region nearby. Foreign fishing outside the 12-mile limit also is substantial. The number of foreign fishing ships sighted was more than 100 in one month in the Mid-Atlantic during the past year.

The fin fishing and scalloping areas which are of prime importance to U.S. fisheries cover a large portion of the Baltimore Canyon lease areas under consideration. Several areas proposed for leasing have been excluded from the proposed lease sale by the Interior Department at the request of the Atlantic Offshore Fish and Lobster Association. a

Sport fishing is very extensive in the New Jersey-Delaware offshore region, but statistics are not available to document numbers of vessels or fishermen currently utilizing this area. Many charter fishing boats and larger private sport-fishing boats regularly voyage offshore, and various angler's guides show locations of tuna, marlin, dolphin, bluefish, and other species in the region of proposed leasing. Offshore structures may attract marine life and encourage an increase in fish population density, which is considered an advantage by many sport fishermen.[5]

CONGRESSIONAL OPTIONS

Some of the options available to Congress for minimizing offshore conflicts are:

1. Congress could expand the authority of the U.S. Coast Guard to give it jurisdiction to establish an effective offshore traffic control system. Such authority already exists for Coast Guard jurisdiction over navigable waters and areas around deepwater ports.
2. Congress could authorize specific studies of conflicts in ocean uses and means to resolve them.

OTHER OPTIONS

1. Departments of Transportation and the Interior could draw up a memorandum of understanding in which they agree to a system for resolving conflicts between vessel traffic and OCS oil and gas activities.

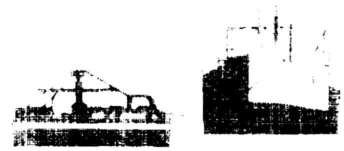
2. Industry, with or without Department of the interior regulations, could deploy as many subsea completions on oil and gas wells as is practical and economically possible to reduce the number of surface structures required for OCS production.

3. Informal planning groups, with the industries and public involved, could be established to resolve conflicts.

ISSUE 10

Tanker Design and Operations

Tanker spills are the source of 5 to 15 times as much oil as all offshore drilling and port operations combined yet pollution control regulations are far less stringent for tankers than for either deepwater ports or offshore oil and gas operations.



Deepwater Ports

FINDINGS

1. Tankers accidentally spill 200,000 tons of oil each year, worldwide, and 12,000 tons in waters within 50 miles of the U.S. coast due to accidents of all kinds.

2. The major causes of these accidents are structural failure, collisions, rammings, and grounding, many of which are in turn caused by human error.

3. Tankers deliberately discharge 1 million tons each year, worldwide, and some unknown portion of that in waters off the U.S. coast in routine ballasting and tank cleaning operations. Such discharges are illegal within 50 miles of the U.S. coast.

Public Participation Comments

DISCUSSION OF THE ISSUE*

Equipment used in deepwater ports appears to have performed well in many worldwide applications. But the supertankers which utilize the ports are far less dependable and greater efforts are needed to reduce tanker-caused pollution to acceptable levels.

Several changes in tanker design and construction have been proposed to reduce pollution. Such design improvements include: double bottoms and double hulls, inert gas systems, added maneuvering devices, improved navigation systems, and improved tank cleaning and ballasting systems.[1] Regulations regarding some of these have been challenged however, largely by industry groups on the grounds that the resulting reduction in the amount of oil spilled would be small in relation to total oil pollution.

*This brief discussion of this issue is drawn from the full text of "The Possibility of Deepwater Ports in the Mid-Atlantic, " chapter IV, particularly pages 195—196.

Oil spill statistics do not support assigning priority to any single improvement, but a case can be made that several design and operational changes together would substantially reduce oil pollution. A total system approach is needed to balance construction improvements with operating improvements such as traffic control and training.

The Ports and Waterways Safety Act of 1972 authorizes the U.S. Coast Guard to regulate design, construction, and operations of U.S. tankers and foreign flag tankers operating in U.S. waters. Regulations for U.S. tankers in domestic trade have been issued. Proposed rules for U.S. flag tankers engaged in foreign trade and foreign flag tankers in U.S. waters were published on April 15, 1976. The closing date for comments on these rules was June 12, 1976, and a final environmental impact statement was under review in August.

Hearings were held by the Senate Commerce Committee on March 2 and 3, 1976, at which witnesses expressed concern about the adequacy of Coast Guard tanker regulations. They questioned whether best available technology was, in fact, being required and Alaska said it would join other Western States in imposing regulations of its own on supertankers entering its ports. The Coast Guard testified that its regulations were based on thorough consideration of best technology and priorities of concern not only within the United States but worldwide. Industry representatives supported the Coast Guard position and pointed out that the Federal Government, not the States, has jurisdiction over interstate and foreign commerce matters, as defined by the Constitution. z

The problem of reducing pollution from tankers is compounded by economics and international politics. s

First, the most economical oil tanker transportation systems use methods that many authorities believe must be changed to reduce pollution. Needed are design improvements, which add costs for the operator; training and licensing programs, which may be financed by both government and operators; and improved traffic control and cleanup techniques, which also may be financed by both. It is not possible to project cost/benefit figures for pollution because few pollution damage costs have been quantified, because the effectiveness of many prevention measures cannot be quantified, and because the economics of tanker transportation are subject to extreme variations.

Second, there is controversy over the question of multilateral versus unilateral regulation of tankers in U.S. waters.

One school of thought is that international agreements are the best way of dealing with international trade problems and pollution control measures. One drawback to this approach is that international conventions have a history of extremely slow adoption and poor enforcement. The 1973 International Pollution Convention has developed tanker standards which would make substantial improvements, but they are not yet in effect because they have not been ratified by a majority of signatory nations—including the United States. As of mid-1976, only three countries had ratified it and it appears that the earliest implementation would be 1980 to 1983. Existing U.S. Coast Guard regulations on tanker construction and operation closely parallel the 1973 agreement but many States and environmental groups claim that U.S. regulations should be substantially stricter than international standards.

Another school of thought is that the United States should take unilateral action to improve tanker standards. Opponents of that approach claim that action by the United States to make more stringent rules without similar adoption internationally may make the U.S. tanker fleet less competitive. Ninety-four percent of U.S. imports are carried by foreign flag tankers and if the United States tries to enforce stricter standards on the foreign fleet, it could interrupt supplies.

Many environmental groups argue that the United States, through major oil companies, does control most foreign flag ships and that the United States is a major tanker customer for an industry that now needs customers.

By the end of 1976, about half of the world tanker fleet will be surplus to need, partly because of overexpansion and partly because the world recession sharply cut oil demand. Tanker owners are looking to the United States to take up much of the slack because U.S. imports are more likely to increase sharply than imports by other countries. The situation may provide substantial leverage for the United States to set standards for operation of foreign flag ships in U.S. waters.

Many States and environmental groups support the fact that the major reduction in operational discharges by tankers can be made by requiring segregated ballast systems aboard vessels so that ballast water is never mixed with oil. The Coast Guard has just published advance notice of proposed rules which would require such segregated ballast systems for all tankers over 70,000 dwt utilizing U.S. ports.[4] The proposed rules would apply to both foreign and domestic tankers. If adopted, this requirement would be a major improvement in regulation of tankers using deepwater ports. Comments on these proposed rules are now being evaluated by the Coast Guard.

CONGRESSIONAL OPTIONS

Among the options available to Congress for dealing with tanker technology issues are the following:

1. Congress could require the U.S. Coast Guard to analyze the causes of oil spills so that priorities may be set for implementing design and operations standards for supertankers calling at U.S. deepwater ports.
2. Congress could require the U.S. Coast Guard to develop specific regulations for supertankers using deepwater ports in the United States.
3. Congress could provide economic incentives for U.S. importers to encourage them to charter only those tankers that meet high standards of design and operations.

OTHER OPTIONS

States could impose their own rules and regulations for operation of tankers and deepwater ports in their waters.

ISSUE 11

Oil Spill Containment and Cleanup at Deepwater Ports

The use of offshore deepwater ports may reduce the risk of certain oil spills and environmental damage below that of transporting crude oil by smaller tankers into the congested New York Harbor and Delaware Bay. Even the very small risk of a catastrophic spill from a supertanker, however, dictates that stringent pollution control and cleanup systems be used.

FINDINGS

1. Even the most advanced Coast Guard equipment for high-seas containment of oil spills would be effective in winter seas off Delaware and New Jersey only 55 percent of the time.

2. Because of the serious limitations of containment and cleanup equipment, emphasis should be on preventing spills rather than on regulations for cleanup equipment,

3. Regulations for preventing spills from a deepwater port appear to be adequate. However, regulation of tankers using the ports can be improved greatly.

DISCUSSION OF THE ISSUE*

Department of Transportation regulations require that deepwater port operators have onsite equipment for containing and cleaning up spills of less than 1,000 barrels, but equipment for dealing with larger spills is not required onsite. Such equipment need only be "readily accessible" to the operator.[1]

Most of the equipment needed for dealing with large-scale spills from deepwater ports or tankers is maintained by the Coast Guard. The Coast Guard has recently developed oil pumpout and salvage equipment for use in major tanker accidents and containment and cleanup equipment for rough waters; it is not likely that privately built equipment would handle large volumes of oil in rough seas as effectively. However, even the Coast

*This brief discussion of the issue is drawn from the full text of "The Possibility of Deepwater Ports in the Mid- Atlantic," chapter IV, particularly pages 1 93– 195

1.'

Deepwater Ports

Public Participation Comments

The supertanker ports would be [illegible] ceptable to me unless new regulations were enforced in order to reduce the chance of major oil spills. At present [illegible] company policies are lax and [illegible] at self-regulation [illegible]

[illegible] operations are so risky [illegible] and expensive [illegible] and a deepwater port can't come soon enough. But remember [illegible] planning for [illegible] cleanup is [illegible]

Guard gear, which would be used under the provisions of the national contingency plan for an oil spill emergency, has strict operational limits.

Even the most advanced Coast Guard system for high seas oil containment is only effective in waves under 5 feet, currents of 1 knot or less, and winds of up to 20 knots. Winter seas off New Jersey and Delaware, where a deepwater port might be located, exceed these limits 45 percent of the time.[2]

Development of containment and cleanup systems which would more adequately handle large volumes of oil and would be dependable in rough seas would require a large commitment of money and technical expertise.

In addition to the limitations of existing equipment, projections of the movement of oil at sea are limited and little data is available for use in predicting the path an oil slick will take or when it will come ashore.

If a spill does-reach shore, there is little equipment available for use in cleaning up beaches and wetlands. What is used is costly and inefficient.

"... it may be argued that while the decrease in number of vessels [and] ... reduces the chances of ... spills, the increase in severity of an accident offsets this consideration."

Therefore, OTA has concluded that the emphasis must be on preventing oil spills rather than on requirements for cleanup and containment equipment. Regulations for preventing spills from a deepwater port itself appear to be adequate; however, regulations for tankers using the ports can be improved greatly. (See Issue 10: Tanker Design and Operations.)

"... deepwater ports should be far enough offshore to permit time for oil pickup before it could reach the beaches. All facilities should be purchased, maintained, and operated by private industry."

A lack of reliable statistics and analysis of causes and effects of oil spills hampers every effort to assess the risk and damage of oil spills.

The Coast Guard operates a Pollution Incident Reporting System which gathers and stores data on all spills in U.S. waters. The Coast Guard also collects world data on ship accidents and prepares some analysis of causes. These world statistics are much more relevant to the deepwater port question than U.S. figures because there are no deepwater ports operating in the United States as yet. But the world data are not well enough verified to be usable in forecasting nor does it document causes or trends in accidents and resultant spills. s

79-188 O - 76 - 7

CONGRESSIONAL OPTIONS

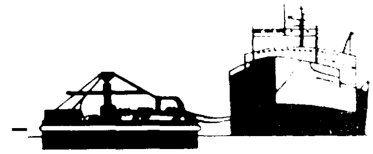
Among the options available to Congress in resolving problems relating to oil spills in the deepwater port system are these:

1. Require the Department of Transportation's Deepwater Port Project Office to report annually on oil spill cleanup technology and contingency plans for each proposed or operating deepwater port. These reports should contain the status of research and data efforts concerning oil spill statistics, causes, and effects so that it could be determined if operators are using the best available systems.
2. Expand research efforts within the Coast Guard, NOAA, and the Environmental Protection Agency on trends, causes, and effects of oil spills. The trend data base could be improved by expanding the scope of the National Transportation Safety Board to permit it to conduct an investigation of the causes of any major accident involving supertankers and deepwater ports abroad.
3. Require a case study of response time, containment, and cleanup efforts used in every major spill in order to determine whether existing equipment and systems are used to the best advantage and to identify areas where changes are needed.

ISSUE 12

Standards in State Waters

Under existing Federal law, operators of deepwater ports in State waters could ignore the safety and environmental pollution standards that apply to ports outside the3-mile limit.



Deepwater Ports

FINDINGS

1. Deepwater ports in State waters will be licensed by the U.S. Army Corps of Engineers, which is not obliged to require the same standards for construction and operation that are set by the Department of Transportation under the Deepwater Port Act of 1974.

2. The law does not require a Coast Guard Vessel Traffic Surveillance System for deepwater ports in State waters, and budget priorities conceivably could delay installation of such a system for a port in State waters.

DISCUSSION OF THE ISSUE*

Deepwater ports in a State's territorial waters or in inland waters such as the Delaware Bay would not be subject to the Federal Deepwater Port Act. All ports within 3 miles of shore would come under the jurisdiction of the U.S. Army Corps of Engineers, of the States, and of any regional commissions or authorities to which States had delegated authority. For example, the Delaware Bay Transportation Co. plan for a deepwater port would not be covered by the Deepwater Port Act.

Since the permit authority the Corps of Engineers could exercise over a near-shore port facility does not at this time include a requirement that ports comply with the same Federal standards as deepwater ports outside the 3-mile limit, there is no guarantee that they would meet minimum safety and environmental standards set at the Federal level to protect the national interest and interests of States other than the host State.[1]

Public Participation Comments

"We find your suggestion of a cooperative agreement between the Corps and the Department of Transportation to cover the installation of deepwater ports within the U.S. territorial limits an interesting one and one which possibly would help in addressing potentially serious environmental concerns raised by pending developments."

[illegible]

*This brief discussion of the issue is drawn from the full text of "The Possibility of Deepwater Ports in the Mid-Atlantic," chapter IV, particularly pages 185-186.

The Corps of Engineers may issue permits on the basis of its own judgment of an applicant's design, without regard to DOT regulations for deepwater ports beyond the 3-mile limit. By the same token, the Corps could require ports under its jurisdiction to comply with construction and operation regulations promulgated under the Deepwater Port Act.

The States retain influence over the Corps in permit decisions because an applicant must certify to the District Engineer that the activity conforms to the coastal zone management program of the State involved, If a State has laws that regulate deepwater ports, the Corps will issue a permit only if the State approves.

Under existing Federal law, the Coast Guard is required to install a traffic surveillance system for deepwater ports in Federal waters, but there is no such requirement for ports in State waters. Therefore, the Coast Guard would not be obliged to improve traffic controls in the Delaware Bay for a port proposed by the Delaware Bay Transportation Co.

Briefly, the Vessel Traffic Surveillance (VTS) system is an additional source of information with backup radar capability intended to contribute to the safe operation of vessels. It functions much the same as an air traffic control system.

The Coast Guard does have jurisdiction over VTS within the 3-mile limit under the Ports and Waterways Act of 1972, and is installing surveillance systems in major U.S. ports on a schedule dictated largely by budget considerations. Those budget considerations and prior commitments could mean that VTS would not be implemented in deepwater port areas in State waters as quickly as it is in offshore ports.

In addition to the possible lack of safety and environmental standards, deepwater ports in State waters would lack coverage under the insurance and liability sections of the Deepwater Port Act. z That Act makes compensation available only to persons damaged as a result of spills related to ports licensed by the Federal Government. That means that each State with a deepwater port within its waters must develop its own comprehensive liability and compensation plan to protect its citizens and property holders and those of neighboring States which might be affected by a spill.

CONGRESSIONAL OPTIONS

Possible courses of action available to Congress for resolving discrepancies in the laws governing construction and operation of deepwater ports in U.S. territorial waters and ports inside the 3-mile limit include:

1. Congress could amend the Deepwater Port Act to cover all ports, including those inside the 3-mile limit.
2. Congress could amend the law to require a vessel traffic surveillance system as a condition of operating a deepwater port under the jurisdiction of the Corps of Engineers.
3. Committees of Congress with jurisdictional authority could advise the Corps of Engineers to delay approval of deepwater ports until funding for a surveillance system was assured.
4. Congress could accelerate funding for surveillance systems generally, or it could provide special funding authority to the Coast Guard to meet requirements in specific port areas.
5. Congress could require, either formally or informally, that the Corps of Engineers comply with DOT standards for deepwater port construction and operation.

OTHER OPTIONS

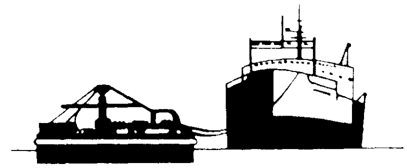
1. States could enact laws for deepwater ports in their waters that were modeled on the Deepwater Port Act of 1974.

2. The Department of Transportation and the Corps of Engineers could develop, by memorandum of understanding, identical standards for deepwater port construction and operations in State waters.

ISSUE 13

Adjacent Coastal State Status

Differing interpretations of statutory criteria for determining adjacent coastal State status make it difficult to predict which States could qualify for that status in the future and whether some States may be deprived of the benefits of such status.



Deepwater Ports

FINDINGS

1. A recent denial by the Secretary of Transportation of a Florida petition for adjacent coastal State status focused attention on disagreement among Federal officials and among State governments and other interested parties as to how statutory criteria for determining adjacency should be interpreted and applied.

2. The Secretary's decision left unresolved the question of whether tankers in transit to and from a deepwater port can ever be considered a factor in determining adjacent coastal State status.

3. If tankers in transit are to be considered, it is not clear whether the determining factor is only the increased risk to the petitioning State from tanker spills related to a deepwater port, or whether relative risks among the States should be compared, regardless of whether overall risks are increased or decreased by a deepwater port.

DISCUSSION OF THE ISSUE*

The Deepwater Port Act gives adjacent coastal States a role in approving or disapproving a license and an opportunity to benefit from the protections offered by law. Unless a State is located within 15 miles of a deepwater port or connected by pipeline to such a port, the Secretary of Transportation makes the final determination of which States are to be considered "adjacent."

An adjacent coastal State is entitled; to veto a pro-

*This brief discussion of the issue is drawn from the full text of "The Possibility of Deepwater Ports in the Mid-Atlantic," chapter IV, particularly page 139.

Public Participation Comments

"As you may be aware, Florida has now taken the matter to court and it may fall upon the judiciary to determine whether the law as written would grant Florida the adjacent State status it desires."

[illegible]

"I, personally, am convinced that that portion of the Act needs to be more clearly written in order to make it perfectly clear that States affected by tankers in transit to and from deepwater ports should be automatically granted special status."

[illegible]

posed port, to collect fees for environmental or administrative costs related to such facilities, and to receive priority over private applicants for a license to construct and operate a port. Because of the benefits of adjacent coastal State status and the fact that there are a large number of coastal States close together in the Mid-Atlantic region, several States may ask to be designated "adjacent" if a deepwater port should be proposed for licensing off the coast of New Jersey and Delaware.

The Act specifies that after having received recommendations from NOAA and the Coast Guard, the Secretary shall designate a petitioning State as "adjacent" if he determines that there is a risk of damage to the coastal environment of said State equal to or greater than the risk to a State directly connected by pipeline to the proposed port. Recently, Florida asked to be declared an adjacent coastal State in connection with the licensing of LOOP and Seadock deepwater ports off Louisiana and Texas. The Florida case brought attention to the fact that different interpretations of the statute could lead to different determinations as to whether a State's petition is granted or denied.] This lack of criteria for applying the statutory language to a specific situation may also figure in any applications for adjacent status made by Mid-Atlantic States.

Florida petitioned for adjacent coastal State status on grounds that the risk of an oil spill along its coastline from tankers moving through the Florida Straits to and from the deepwater ports posed a danger equal to, or greater than, the risk to either Texas or Louisiana, which are automatically "adjacent" by statutory definition.

Based on his interpretation of the statute, the Secretary of Transportation denied Florida's petition. In arriving at his decision, the Secretary considered the opinions of the National Oceanic and Atmospheric Administration and the Coast Guard, the two congressionally mandated "expert" agencies which advise the Secretary in an "adjacency" case. NOAA concluded that risk of damage to the coastal environment of Florida from proposed LOOP or Seadock is equal to, or greater than, the risk posed to the coastal environment of Texas or Louisiana, and would thus warrant granting adjacent coastal State status to Florida.[2] The Secretary acknowledged that the risks to Florida from tankers in transit were greater than, or equal to, those of Louisiana or Texas. However, instead of

"I have some concern over the [illegible] tion that NOAA [illegible] teria to be considered [illegible] adjacent coastal [illegible] volved in an adjacent [illegible] decision go beyond [illegible] expertise of NOAA [illegible] criteria for this [illegible] developed we fee[illegible] developed by the [illegible] Transportation as [illegible] input from NOAA basing his decision on a comparison of relative risks to which the States were subjected, the Secretary, on the basis of Coast Guard data, concluded that the risks to Florida from tankers in transit would exist whether or not the ports were built, and Florida's petition was not granted.[3]

The Secretary justified his decision by stating that the intent of the Act was to concern itself "with those environmental hazards that were to be generated by the (deepwater port) program it was authorizing—that is, with those risks that would be created by the construction of the ports in question." He concluded that because the deepwater port program itself did not create additional risks to Florida from tankers in transit, that was not a class of risks that Congress intended the Secretary to consider in his determination.[4] NOAA's interpretation is that the legislative history of the Act shows that reduction of small tanker traffic is one of the main justifications cited by Congress in support of passage of the Act. Because Congress already assumed this to be a benefit of deepwater ports, the provisions for declaration of adjacency could be viewed as an additional environmental safeguard or mechanism for assuring that States subjected to risks equal to, or greater than, adjacent States would participate in the decisionmaking process, and share in the benefits of adjacency.

More important, in arriving at its recommendation, NOAA determined that the Act mandates a comparison of the risks between the States, and that if tankers in transit are considered, the risk of damage to each respective State must be compared, regardless of whether the overall risk to all States was reduced.

Transportation Department officials said in later discussions with OTA that although tankers in transit were not a determining factor in the Florida case, they could be so considered in the Mid-Atlantic if a State could show that a port would cause a change or "distortion" in existing tanker traffic patterns that would result in an increase in the risk of oil spills.[5] However, it is not clear whether the Secretary's decision has set a precedent that would be inconsistent with this type of consideration.

Industry officials have complained that applications for adjacent status may add to the costs of deepwater ports by delaying construction. However, the law requires all interested States to apply for adjacent status within 14 days after a deepwater port application has been published in the *Federal Register*. The maximum delay that can result from the process of naming adjacent coastal States, regardless of the number of States involved, is 114 days. But industry might be subject to higher costs and more restrictions on the construction and operation of the port as a result of State stipulations and charges if several States are granted adjacent status.

CONGRESSIONAL OPTIONS

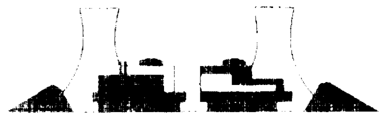
1. Congress could specify whether the risk of pollution from tankers passing a State's coastline to or from a deepwater port should provide grounds for declaring a State adjacent regardless of whether such ports increase or decrease risks from tankers in general.

2. Congress could specify whether the comparison of risks mandated in the Act (i.e., equal to or greater than the risks to a State connected to the port by pipeline) should be the only determinant of adjacency or whether this should be the key factor only in the context of overall increase or decrease of risks from a deepwater port to all relevant States.

ISSUE 14

Risks From Major Accidents

The Nuclear Regulatory Commission (NRC) is not evaluating the risks from accidents in floating nuclear plants comprehensively enough to permit either a generic comparison of the relative risks from land-based and floating nuclear plants, or an assessment of the specific risks from deploying floating plants off New Jersey.



Floating Nuclear Powerplants

FINDINGS

1. A preliminary analysis by OTA[1] indicates that the probability of a core-meltdown accident in a floating nuclear plant is no greater than the land-based plants considered in the NRC's Rasmussen Report (*WASH*- 1400).[2]

2. The OTA analysis indicates that the conclusions of *WASH*– 1400 concerning the expected consequences of releases of radioactive material into the atmosphere as a result of a core-melt cannot be directly applied to floating plants because:

—the probability of an atmospheric release of radioactive materials in case of a core-melt may be about seven times greater for a plant of the design used in the proposed floating system than for the plant analyzed in WASH–140Q3

—the plant design used in the floating system may reduce the amount of radioactive material released to the atmosphere if a core-melt accident led to a failure of the containment;

-offshore siting of floating nuclear plants may reduce the consequence of airborne releases because there would be no resident population for several miles in all directions around the plant; and

—the interaction of the molten core with seawater that would occur in case of a core-melt accident in a floating plant could be a potential source of additional atmospheric releases of radioactive materials not considered in *WASH– 7400.*

3. A study being prepared by the Nuclear

Public Participation Comments

Regulatory Commission that compares the radiological consequences of accidental releases of radioactive materials into water at floating nuclear plants and land-based nuclear plants is not as comprehensive as *WASH–* **7400's** analysis of the consequences of accidents because it does not translate radiological doses into health effects and does not consider economic impacts.

4. Certain aspects of the proposed site for the Atlantic Generating Station, such as the fact that the prevailing summer winds tend to blow from the Atlantic Generating Station site towards an island having a peak summer recreational population of more than 100,000, make it impossible to apply WASH-1400's conclusions about the expected consequences of airborne releases to the Atlantic Generating Station.

5. A substantial amount of information is available that could be used to assess the consequences of a core-melt in a floating nuclear plant, and research programs are underway to provide additional applicable information. There do not appear to be any significant information needs that will not be satisfied by **research programs already underway.**

DISCUSSION OF THE ISSUE*

The environmental and health effects of normal operations of a floating nuclear powerplant have been studied extensively by Government and industry analysts. A critical review of these studies discloses little foundation for concluding that either construction or routine operations of two plants at the Atlantic Generating Station would pose a substantial threat to public health or the environment.

However, while routine operations appear to pose few problems, the most serious accident that could occur in a nuclear powerplant—a meltdown of the fuel core—could pose a severe threat to public health and safety and to the environment. While operation of any nuclear powerplant involves some accident risks, a core-melt in a floating nuclear powerplant may involve unique risks since the molten core probably would melt through the

"Development of new ... ways accompanied ... Problems can be ... by taking care of ... rather than trying to ... might be and ... hazards."

"I doubt that ... for the sea in ... powerplants; thus ... accident is greater than ... based plant."

"There are no alterna... development and const... nuclear powerplants ... must regardless of ex... that they are safe and

*This brief discussion of the issue is taken from the full text of "The Proposal for a Floating Nuclear Powerplant in the Mid- Atlantic," chapter IV, particularly pages 230–237.

bottom of the floating platform and release large quantities of radioactive fission products directly into the body of water on which the plant is floating. Public concern about the risks from floating nuclear plants is reflected in the responses to OTA's public participation questionnaire, the contentions of interveners in the licensing process, and the State of New Jersey's request to the Nuclear Regulatory Commission for an assessment of such risks.

Recognizing that floating nuclear powerplants present unique safety issues, the Advisory Committee on Reactor Safeguards directed Offshore Power Systems to perform a number of studies related to these unique issues. As a followup, the Nuclear Regulatory Commission decided to conduct a general study of the radiological consequences of a release of radioactive materials into water from both land-based and floating plants. This Liquid Pathways Generic Study, scheduled to be published in draft form in late-1976, will analyze the consequences of releases from a wide range of accidents; from relatively minor ones to the most serious case, the core-melt. When completed, it will be published as a Nuclear Regulatory Commission study and will be considered in the licensing process for both environmental and safety reviews of the Offshore Power Systems application for a license to build eight floating nuclear powerplants.

By injecting into the licensing process a study which includes analysis of some of the consequences of a core-melt accident, the Nuclear Regulatory Commission appears to have taken a step away from its policy of not requiring any consideration of core-melt accidents in reviewing and approving applications for licenses to build and operate nuclear powerplants. However, it should be noted that there has been no change in the formal requirements for licensing, because the final environmental statement on the Offshore Power Systems application will contain only an analysis of the consequences of accidents less severe than a core-melt.

OTA concludes that the accident risks posed by the new technology of floating nuclear powerplants deserve thorough study. The analysis that supports the conclusion must begin with an examination of the way in which powerplant safety is treated under current Nuclear Regulatory Commission procedures.

"The quality of life on this planet is being degraded and its very existence threatened by large-scale nuclear fission such as used in power production. "

Environmental Official

"What's wrong with enlarging a floating nuclear power plant to include a resort hotel and offshore gambling ? Heated waters could be used for central heating systems, heated swimming pools, etc General public would eventually overcome science fiction - stimulated fears of nuclear power

New Jersey Citizen

"True, there are remote dangers but I am familiar with Oyster Creek Nuclear Plant and would not hesitate to live next door

New Jersey Citizen

"1 do not believe that offshore powerplants can survive the storm potential of the Jersey Coast

New Jersey Citizen

The Commission's objective is "to assure that the risk from normal operation and postulated accidents is maintained at an acceptably low level and to assure that the likelihood of more severe accidents is extremely small."[4]

The Commission attempts to meet the objective with three levels of regulations in which it:

- Establishes standards for the design, construction, and operation of nuclear powerplants that are intended to keep the probability of failure or malfunctions at a low level.
- Requires equipment and emergency procedures to cope with malfunctions that do occur, such as an emergency control mechanism that will terminate a fuel core's chain reaction under abnormal plant conditions.
- Requires safety systems to control a worst-case set of "design-basis accidents", such as a loss of a reactor's primary coolant that might lead to a core-melt unless auxiliary cooling systems were available.

"The nuclear energy proposal would result in the "cleanest" way of helping to develop our resources without unnecessarily endangering man."

N.. , , ..

'There is always risk in developing more energy resources but but we have no alternatives but to keep developing solving the problems as best we can.

N., 1.

The Commission divides the spectrum of postulated nuclear powerplant accidents into nine categories, ranging from minor incidents (Class 1) to the potentially. catastrophic but highly improbable core-melt (Class 9). Commission policy requires only Class 1 through Class 8 accidents to be considered in licensing designs and sites for powerplants.

Class 8 accidents include ejection of a fuel rod, a crack in a steam line and, most importantly, a loss-of-coolant-accident (LOCA) involving a major break in one of the lines carrying the water that transfers heat from the core to the steam system. The LOCA is one of two possible initiating events for a core-meltdown. The other is a temporary disruption of the system—known as a transient—which raises core temperature above the capacity of the cooling system. If a LOCA were followed by proper operation of the engineered safety features, such as the Emergency Core Cooling System (ECCS), it would be considered a Class 8 accident; if these systems failed and the core overheated and melted, it would be a Class 9 accident. The consequences of Class 9 accidents could be far more severe than the Class 8 accidents, because they could release substantial quantities of radioactive materials into the environment.

The NRC's rationale for not requiring consideration of Class 9 accidents in the design basis of protection systems and engineered safety features or in evaluating proposed sites is that the probability of their occurrence is judged to be so small that the total risk from such accidents (the probability of an accident multiplied by the expected consequences of the accident) is extremely low; so low that they can be safely ignored, even though their consequences could be far worse than those of other malfunctions.

Until 1975, this judgment was not supported by detailed analysis of the probabilities or consequences of various classes of accidents. In that year, the NRC received the final results of the Reactor Safety Study *(WASH–* 1400). This was intended to develop realistic estimates of the probabilities of major accidents, and of their public health consequences (such as death and illnesses) and economic costs (such as evacuation, decontamination, crop losses, and loss of productive use of quarantined land).

The report was issued in final form on October 30, 1975. It estimated that the probability of a core-melt accident in a land-based pressurized water reactor plant is about one in twenty thousand per year of reactor operation, and that only about one in seven core-melt accidents would lead to the release of significant amounts of radioactive materials into the atmosphere. It also concluded that the risks from operating 100 nuclear power reactors were small compared to other man-made and natural risks. While the Nuclear Regulatory Commission has not yet announced whether, or how, the results of the study will affect nuclear safety regulations, it did state after completion of the draft report that "the very low resultant risk described in the draft study amply justifies the conclusion that no immediate action is required or appropriate as a result of the draft study's present assessment of the probabilities and consequences of core-meltdown."[5] NRC's view does not appear to have changed after publication of the final report.

The validity of the conclusions of *WASH– 1400* concerning the absolute level of risks from nuclear powerplants is a matter of controversy, as is reactor safety in general. Any resolution of this controversy is far beyond the scope of this study. Consequently, OTA's consideration of *WASH–* 1400 was confined primarily to determining whether there are grounds for concluding that there are significant differences in the risks associated with floating nuclear powerplants and land-based plants, recognizing that there is disagreement over whether the risks associated with land-based plants are fully understood. It should be noted, however, that results presented in (Draft) *WASH– 1400* imply that whatever the absolute level of risks from all classes of reactor accidents may be, the total risks from Class 9 accidents are greater than the risks from Class 8 accidents, because the lower likelihood of Class 9 accidents could be offset by their greater potential consequences.[6] This finding supports OTA's conclusion that it would be advisable to conduct a realistic, comprehensive analysis of the overall risks from core-melt accidents in floating nuclear powerplants, even though current NRC regulations require analysis of accidents only through Class 8.

As noted earlier, the Liquid Pathways Generic Study does appear to represent a move away from the policy of not considering Class 9 accidents at all in the licensing process, although there has been no change in the formal licensing requirements. However, this study is not, and does not purport to be, a comprehensive comparison of the risks of floating plants with those of land-based plants similar in scope to *WASH– 1400.* Specifically, it considers only liquid pathways for dispersion of radioactive releases; it does not translate calculations of radiation doses into health effects; it does not consider economic impacts; and it considers only the consequences of an accident at a single plant, rather than attempting to calculate the risks of operation of a considerable number of floating plants.

OTA's comparison of the reactor used in the floating nuclear powerplant with the pressurized water reactor examined in *WASH– 1400* indicated that even though the probabilities of a core-melt appeared similar for both plants, the WASH– 1400 conclusions concerning the risks from airborne releases could not be directly applied to floating plants because of design differences affecting the probabilities and magnitudes of atmospheric releases from a core-melt. Furthermore, the wide range of sites on which *WASH– 2400* risk calculations were based did not reflect the more limited range of sites available to floating plants.

Thus, OTA concludes from its examination of the Liquid Pathways Generic Study and *WASH– 1400* that substantial additional analysis will be needed to produce a comprehensive generic comparison of the risks from floating nuclear powerplants with those from land-based plants. However, its examination of related research indicates that most of the information needed for such an analysis should be currently available or forthcoming from active research programs.

OTA also concludes that both the Liquid Pathways Generic Study and *WASH– 1400* have limited applicability in assessing the potential impacts of deploying floating nuclear powerplants in the study area. The calculations of expected consequences of accidents in *WASH–* 1400 are based on site characteristics averaged over 68 sites expected to be in use by 1981. The averaging technique used makes it impossible to determine how the characteristics of specific types of sites affect consequence calculations. Specifically, there are characteristics of the proposed Atlantic Generating Station site that suggest that consequence calculations based on average site characteristics would be misleading, For example, the economy of the region around Atlantic City depends heavily on summer recreational use of the beaches and the ocean; hence an accident that released large quantities of radioactive materials into the ocean could have a severe economic impact, both in the short run, through the effects of a limitation on use of the beaches and ocean in the area, and in the long run, through adverse effects on the attractiveness of the area for recreation relative to other areas. The potential severity of the impact of a major accident on the regional economy also highlights the limitations of the Liquid Pathways Generic Study, which does not analyze economic effects.

Another site-specific factor which could increase the consequences of a major accident is the fact that the prevailing winds during the peak summer tourist months would tend to carry radioactive releases produced by an accident towards Long Beach Island, whose southern tip is 2.8 miles north of the Atlantic Generating Station site, and whose year-round population of about 10,000 can reach a summer daytime peak of more than 100,000. This potential problem is compounded by the fact that only one bridge is available for evacuation of the island in case of an accident.

Neither *WASH– 1400* nor NRC procedures for analyzing the consequences of design basis accidents take into account correlations between wind direction and seasonal population peaks.

These peculiarities of the proposed Atlantic Generating Station suggest that a site-specific analysis would be required to assess the expected consequences of a major accident. A recent review of *WASH–* 1400 indicates that differences in population distribution around various sites considered in *WASH– 1400* can affect the expected consequences (and hence the risks) of serious accidents by factors of *one* thousand or more.[7] NRC regulations already require site-specific analysis of the radiological (but not economic) consequences of accidents through Class 8. Since *WASH– 1400* implies that the total risks from Class 9 accidents are greater than those from Class 8 accidents, the sensitivity of risk to site characteristics suggests that site-specific analyses of consequences of core-melts could be useful in decisions concerning siting alternatives. It should be noted that M. Bender and S. H. Bush of the Advisory Committee on Reactor Safeguards have expressed opinions supporting this view in the June 7, 1976, "Interim Report of the Floating Nuclear Power Plant," sent to Marcus Rowden, Chairman of the NRC.

CONGRESSIONAL OPTIONS

Congress has delegated authority to the Nuclear Regulatory Commission to exercise most of the options that OTA's analysis shows are available for dealing with questions about safety of floating nuclear powerplants.

Where powers have been delegated to NRC, the options open to Congress include:

- An informal notice to the Nuclear Regulatory Commission that it would support programs to exercise the options;
- A more formal inquiry through the hearing process into the validity of exercising the options; and, finally

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. A formal instruction to the NRC to exercise any of the options that seemed appropriate to Congress or committees with jurisdiction.

The specific options that OTA's analysis shows are available are:

1. The Nuclear Regulatory Commission could carry forward OTA's preliminary analysis of the probabilities of core-melts and associated atmospheric releases of radioactive material in floating nuclear powerplants as compared to land-based plants.
2. The NRC could expand the scope of the Liquid Pathways Generic Study to include the economic consequences of airborne and waterborne releases of radioactive materials following postulated accidents.
3. The NRC could perform an analysis of the consequences of a core-melt at the proposed Atlantic Generating Station for explicit consideration in the licensing process for that site.
4. The NRC could revise its regulations to require site-specific analysis of the consequences of Class 9 accidents as part of the site-licensing process.
5. The NRC could conduct a comprehensive risk analysis on floating nuclear powerplants comparable to *WASH– 1400*, as has been suggested both in *WASH– 1400* itself[8] and in the Environmental Protection Agency's critique of that study.[9]
6. In order to place the risks of floating nuclear plants in broader perspective, Congress could fund comparable studies of the risks of alternative sources of electric power, such as coal.

ISSUE 15

Deployment in Volume

As many as 59 floating nuclear powerplants could be built by a single manufacturer by the year 2000 but no policy analysis of the impacts of deploying that many plants in U.S. coastal waters has been done or is contemplated.

Floating Nuclear Powerplants

FINDINGS

1. Federal licensing of floating nuclear plants is confined to rather narrow technical and administrative questions related to building eight plants and deploying two of those plants off the New Jersey coast.

2. The one U.S. company now developing a capacity to build floating nuclear plants intends to build and market four such plants a year after 1985. If other manufacturers were to enter the field, production could exceed four plants a year after licenses were granted.

DISCUSSION OF THE ISSUE*

Offshore Power Systems, which is building a Jacksonville, Fla., facility to manufacture floating nuclear powerplants, estimates that it will have the capacity to complete 19 plants by 1990. Operating at peak capacity of four plants per year, it could complete 59 plants by the year 2000.

The only proposals which the Nuclear Regulatory Commission has been asked to license so far are proposals to manufacture eight plants and to deploy two of those plants behind protective breakwaters off the New Jersey coast.

While the Nuclear Regulatory Commission has prepared impact statements for these proposed actions it understandably has not taken it upon itself to examine the broader policy question of setting in motion a system that could produce large numbers of plants by the end of the century.

*This brief discussion of the issue is taken from the full text of "The Proposal for a Floating Nuclear Powerplant in the Mid-Atlantic," chapter IV, particularly pages 207– 210.

Public Participation Comments

The constr... offshore pow... taken un... with fuel pr... posal have...

... it is diff... protection for the... further R... current... repo...

If the floating plant concept were successful, other manufacturers might enter the field, not only in the United States but also abroad.

The long-range implications of setting in motion a total system for building, installing, and operating nuclear powerplants in ocean waters have not been addressed by the NRC or by any other public or private organization.

Among the policy questions that are raised by the possibility of volume production of floating nuclear powerplants are:

- To what extent should the Federal Government be involved in major private industry decisions to deploy new technologies such as floating nuclear plants which could be supplying almost 10 percent of the Nation's total electrical energy by 1990?
- To what extent should Federal action consider siting decisions for large offshore powerplants?
- To what extent should Federal or State planning address the need for floating nuclear plants including evaluation of local and regional risks and benefits?
- What would be the effect on coastal areas of accelerated industrialization that might result from more plentiful supplies of electrical energy generated by offshore powerplants?
- Conceivably, the Offshore Power Systems plant alone could build 59 floating powerplants by the year 2000. To what degree would coastal States become dependent on that form of offshore energy production, if that many plants were deployed?
- If design flaws manifested themselves only after coastal States had become dependent on offshore systems for power, how would prolonged shutdowns of offshore plants affect coastal economies and the organizations involved in producing and operating such systems?
- What would the economic and social costs of large numbers of floating powerplants be, compared with alternative sources of energy?

- What are the environmental and public health consequences of operation of large numbers of floating nuclear plants?

Raising these questions does not mean that this study has prejudged the answers. It is probable, however, that these long-range policy questions are at least as important as the shorter term technical and administrative questions which are being analyzed now and that they should be addressed formally.

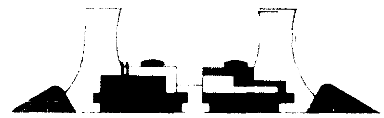
CONGRESSIONAL OPTIONS

Committees of Congress with jurisdictional authority could commission a study on the effects of large-scale deployment of floating nuclear powerplants in U.S. and foreign waters.

Technical Uncertainties

ISSUE 16

Several technical aspects of the deployment, operation, and decommissioning of floating nuclear powerplants have not been analyzed thoroughly enough to permit judgments about the relative risks of the overall system.



Floating Nuclear Powerplants

FINDINGS

1. **Techniques for hand ing fuel and radioactive wastes from floating nuclear plants have not been planned in detail. A system for supplying floating plants that includes barges or other vessels and shore bases is technically feasible, but without a specific design the risks cannot be evaluated.**

2. The Nuclear Regulatory Commission has not developed regulations for decommissioning large power reactors, and levels of radioactivity to be permitted in decommissioning plans are now determined on a case-by-case basis.

3. Twoseparate studies of decommissioning standards and practices for major power reactors are now underway-one sponsored by industry and the other by the Nuclear Regulatory Commission; however, neither study covers floating plants.

4. If past **practices were followed, only one of four methods the Nuclear Regulatory Commission proposed for decommissioning floating nuclear plants appears to be workable.** The one workable method of decommissioning seems to be dismantling highly radioactive materials with remotely controlled equipment before a retired plant is withdrawn from the breakwater. The NRC analysis did not take into account new information that indicates that radioactive materials in the reactor vessel will not decay to levels that permit disposal by conventional methods for 110 years after a plant ceases operation.

Public Participation Comments

"Nuclear power would make us less dependent on oil, but radioactive waste is a nearly prohibitive problem which should be dealt with before any further nuclear industry development."

"It is paradoxical that the United States faces a massive energy shortage for home, buildings, and factory space heating while nuclear powerplants have problems disposing of waste heat."

"Construction of floating nuclear powerplants should be banned until a technology for complete fuel reprocessing and storage of radioactive wastes is more fully developed. Also, adequacy of emergency core cooling systems must be demonstrated before additional nuclear powerplants are built."

DISCUSSION OF THE ISSUE*

Fuel and waste handling technology has not been fully developed for floating nuclear plants although existing techniques at land-based plants would apply to much of the system for floating plants. This includes standards for shipping containers, fuel storage and handling within the plants, and waste disposal. There are no obvious problems associated with fuel and waste handling which could not be adequately dealt with by properly engineered systems and there are no significant differences between floating and land-based plants as to the expected annual releases of liquid, solid, and gaseous radioactive waste. The draft environmental impact statement for the Atlantic Generating Station describes, in general terms, the most likely pattern for the fuel and waste handling system to be employed. As with land-based plants, major emphasis is placed on packaging of radioactive materials. Logical statements are made as to expected safety of handling and shipping operations but there is insufficient information to substantiate assigning a low risk to the operation. Analysis is needed on the detailed design of handling gear aboard the plant, design of equipment for ship-to-ship and ship-to-shore transfer, the design of a ship or tug-barge system to transport fuel and wastes, and the extent of the shore-side facility to receive and transfer fuel and waste. [1]

Decommissioning plans for floating nuclear plants have not been detailed and some of the options for decommissioning the Atlantic Generating Station, as stated in the environmental impact statement, have been proposed without thorough analysis of the expected inventory of radioactive materials after 40 years of plant operation. Decommissioning practices and the ultimate disposal of radioactive materials that are left after a large powerplant is shut down are questions which apply to all nuclear power reactors, and the problem is now being addressed, principally for land-based plants.

The NRC has issued a regulatory guide for decommissioning in general, but to date standards for future licensing of shut-down facilities are determined on a case-by-case basis. The Atomic Industrial Forum has sponsored a study of decommissioning land-based

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*This brief discussion of the issue is taken from the full text of "The Proposal for a Floating Nuclear Powerplant in the Mid-Atlantic," chapter IV, particularly pages 213–222, 224–230.

nuclear plants which is due to be released in the fall of 1976. A similar study was initiated by the Nuclear Regulatory Commission for land-based plants during mid-1976. It is anticipated that results of both studies will be used by NRC to reevaluate standards for, and practices of, decommissioning large power reactors and disposing of radioactive materials.

OTA sponsored a short study of the differences between land-based and floating nuclear plants when evaluating decommissioning alternatives and determined that, based on past practice, only the option of dismantling the plant on site is clearly workable. Other options of sinking the activated plant, mothballing at another site, or mothballing followed by dismantling, which were described in the EIS, do not appear workable without clearer standards and further analysis of the techniques and the consequences. The OTA study also disclosed errors due to inadequate analysis in past investigations of decommissioning the FNP. It appears that the questions raised by OTA's decommissioning investigation could be addressed by analysis of public health standards for decommissioned plants, options available to meet those standards, and other effects of certain options such as sinking the plant in the ocean. The question of what shore facilities and support would be required for various approaches could also be addressed.

CONGRESSIONAL OPTIONS

1. Committees of Congress with jurisdictional authority could examine these uncertainties in oversight hearings. Some specific options which could be explored in hearings include:

a. A requirement that design criteria and procedures for transferring materials to and from floating plants be completed in detail before an operating license can be issued.

b. A requirement that disposal areas for spent fuel be assured in the event that a complete system for waste disposal and fuel reprocessing still has not been designed by the time the Atlantic Generating Station begins operating.

c. A requirement that the Nuclear Regulatory

Commission reevaluate its conclusions and regulations on decommissioning for both floating and land-based nuclear plants.

2. Committees of Congress with jurisdictional authority could ask the NRC to estimate the time and resources required to resolve technical and administrative uncertainties, and to solicit independent judgments about whether the problems are serious enough to warrant such time and resources.

OTHER OPTIONS

The Nuclear Regulatory Commission, acting on its own authority, could initiate studies designed to resolve the technical and administrative uncertainties.

ISSUE 17

Siting of Floating Powerplants Outside U.S. Territorial Limits

Floating Nuclear Powerplants

Because there is no physical barrier to locating floating nuclear powerplants more than 3 miles offshore, proposals for siting plants outside territorial limits are possible. However, U.S. authority to regulate floating nuclear powerplants outside U.S. territory is not clear under existing international law.

FINDINGS

1. State laws which would otherwise apply to nuclear powerplants would not cover any portion of a facility sited outside a State's territorial waters.

2. The Nuclear Regulatory Commission appears to be unable to approve the installation of a U.S. nuclear powerplant in waters outside U.S. borders, but on the Continental Shelf.

3. The Outer Continental Shelf Lands Act applies only to the exploration and exploitation of natural resources and not to the construction of a breakwater, positioning of cables, and other activities associated with a nuclear power station.

4. Existing international law does not specifically settle the question of jurisdiction over a floating nuclear powerplant located beyond national territorial limits, and if the Third U.N. Law of the Sea Conference should fail to settle the matter, the question of jurisdiction will be left to the unilateral action of nations.

DISCUSSION OF THE ISSUE*

An offshore nuclear power station has been proposed for location within 3 miles of the New Jersey coastline. The Atlantic Generating Station consists of a pair of floating nuclear plants moored within a large breakwater. Since waters shallow enough to accommodate this type of facility (maximum 70 feet) can be found

*This brief discussion of the issue is taken from the full text of "The Proposal for a Floating Nuclear Powerplant in the Mid-Atlantic," chapter IV, particularly pages 207–210.

more than 3 miles from shore, proposals for more distant locations could be made. Furthermore, there may be technical, social, economic, environmental, or other advantages to siting a floating nuclear powerplant outside the 3-mile limit.

United States domestic law presently appears to prohibit the licensing of a nuclear powerplant in any location "not under or within the jurisdiction of the United States." (There are certain exceptions, but they are not relevant here.) Because legal authority extending U.S. jurisdiction for such purposes is lacking, it is questionable whether NRC would have the authority to issue a license for a nuclear power station moored in waters beyond the territorial sea. Legislation to clarify this situation would be necessary.

Moreover, the legal authority of the United States to extend its jurisdiction to water areas over its Continental Shelf, but beyond 3 miles, is uncertain under existing international law. Comprehensive U.S. sovereignty ends at 3 miles. Certain special purpose authority, e.g., on the Continental Shelf for exploration and exploitation of natural resources, is sanctioned by international law', but jurisdiction to authorize the construction or operation of floating nuclear powerplants is not presently recognized.

Thus, clarification of U.S. authority under international law to regulate this activity beyond its territorial limits is an important precedent to an extension of jurisdiction, if conflict with other nations is to be avoided. Treaty articles are now being debated in the Third U.N. Law of the Sea Conference, which may settle the international law question.

DOMESTIC LAW

1. State Jurisdiction

The regulatory jurisdiction of most States is limited to waters within the 3-mile limit. State laws which would otherwise apply to nuclear powerplants would not cover a facility sited beyond 3 miles. The State would have jurisdiction over transmission lines within State waters but it would have no control over such matters as environmental protection. In short, a State would have very little control over the nuclear facility located at 3.1 miles as opposed to the same facility located at 2.9 miles. Such a situation certainly would dampen a State's desire for involvement in an extra-territorial nuclear project.

2. Federal Law

Section 101 of the Atomic Energy Act (42 USC 2131) reads as follows:

> It shall be unlawful except as provided in section 91 of this Act for any person within the United States to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export any utilization or production facility, except in accordance with a license issued by the Commission pursuant to section 103 or 104 of this Act.

And section 103 provides in part:

> (d) No [commercial] license under this section may be given to any person for activities which are not under or within the jurisdiction of the United States. . . .

These provisions can be read to prohibit the awarding of a license by the Nuclear Regulatory Commission (NRC) for a floating nuclear powerplant to be sited outside U.S. territorial limits. The waters on the U.S. Continental Shelf beyond 3 miles are not clearly "under or within U.S. jurisdiction. " This being so, the NRC would be unable to approve the installation of a U.S. nuclear powerplant in waters outside U.S. borders but on the Continental Shelf.

NRC officials believe they have jurisdiction beyond 3 miles under existing law, but no written opinion has been rendered by the Commission.

The Outer Continental Shelf Lands Act creates a regulatory regime and a system for leasing land applicable only to the exploration and exploitation of natural resources (e.g., oil, gas, and sulphur). That law is not applicable to the construction of a breakwater, positioning of cables, etc., associated with a nuclear power station. Lack of this kind of authority is a further hindrance to offshore nuclear power development beyond 3 miles.

Other Federal regulatory mechanisms, e.g., environmental controls, likewise are geographically limited. Without a clear extension of all such authorities in legislation, the construction of a floating nuclear powerplant would either not be attempted or be refused by Federal officials.

INTERNATIONAL LAW

If clarification of U.S. law is desired, a geographical extension of U.S. laws and regulations must have international support. Without a legal basis for its action, the United States could face protests from neighboring nations or from nations which use the high seas off U.S. coasts.

Existing international law of the sea does not specifically settle the question of jurisdiction over a floating nuclear powerplant located beyond national territorial limits. Existing law clearly affords a coastal nation the authority to prescribe regulatory measures for nuclear powerplants sited within its territorial waters. The limit of territorial waters is presently set at 3 miles by custom but quite likely will be expanded to 12 miles in the near future, either through custom or by treaty. Beyond territorial waters, ocean areas are essentially free from national control except for very limited purposes recognized in convention or custom (Convention on the High Seas, 1958). Authority exists by treaty, for example, to regulate for sanitary, customs, or fiscal purposes in a contiguous zone of 12 miles from shore (Convention on the Territorial Sea and Contiguous Zone, 1958).

Presently under negotiation, in the fifth session of the Third United Nations Law of the Sea Conference, are treaty provisions which will clarify jurisdiction over economic activities in coastal waters beyond territorial limits. The Conference's revised single negotiating text (RSNT), part 2, contains several provisions relevant to the consideration of jurisdiction over floating nuclear powerplants. Directly relevant is chapter 3 of the RSNT which would create an exclusive economic zone extending 200 nautical miles from the coastline. (See especially Articles 44, 45, and 48.) Article 44 specifies the rights, jurisdiction, and duties of the coastal States in the exclusive economic zone and reads in part as follows:

> 1. In an area beyond and adjacent to its territorial sea, described as the exclusive economic zone, the coastal State has:
>
> * * * * *

(b) Exclusive rights and jurisdiction with regard to establishment and use of all artificial islands, installations, and structures;

(c) Exclusive jurisdiction with regard to (i) other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents, and winds;

*   *   *   *   *

These provisions, in essence, would provide the coastal State with the legal authority to regulate (and to authorize the location of) floating nuclear powerplants in this 200-mile economic zone. Consequently, the question of U.S. jurisdiction over floating nuclear powerplants constructed beyond 3 miles, but within 200 miles offshore may very well be settled by agreement in a new law of the sea treaty. However, there are many who believe that this Conference will fail and no agreement will be reached, In that event, settlement of the question of jurisdiction will be handled in the traditional customary law fashion, whereby nations will unilaterally claim jurisdiction, or the right to regulate and locate such facilities off their shores. Such claim will then be either accepted or rejected by other countries.

In summary, international law in this area is in a developing phase, but it may be clarified in the near future.

CONGRESSIONAL OPTIONS

In light of the ambiguity of the legal regime applicable to floating nuclear plants outside U.S. territorial waters, the Congress may wish to consider action which would:

1. Clearly establish a U.S. claim of extended jurisdiction in coastal waters for purposes of regulating power-production facilities such as offshore nuclear plants.
2. Extend seaward existing Federal laws governing such matters as the placement of structures offshore, the disposal of dredged materials and pollutants, and enforcement and monitoring

thereof. Alternatively, the Congress may wish to enact new legislation setting up a separate administrative structure for licensing of offshore power-production facilities.

3. Establish a process by which lands under the waters of the contiguous zone could be leased for purposes other than resource exploration and exploitation.
4. Extend adjacent State laws to such facilities.

Footnotes: Chapter III

ISSUE 1 OFFSHORE PRIORITIES AND PLANNING

1. Data based on conversation with National Fisheries Service, May **3, 1976,** and William F. Gusey, "The Fish and Wildlife Resources of the Middle Atlantic Bight, " January 1976.
2. Ibid.
3. Port Authority of New York and New Jersey, *Port of New York Statistics,* 1974, and *Philadelphia Maritime Exchange Statistics,* 1958-74.
4. Working Paper #2.

ISSUE 2 FEDERAL MANAGEMENT SYSTEM

1. Interviews with Interior staff members, February 1976.
2. During a February 17, 1976, interview with Office of Coastal Zone Management staff members, OTA researchers were told by one official: "It is not clear who is doing what, and the States are bewildered. No one even knows for sure who is going to do what. It is a very confused process. "
3. "The Federal Government doesn't seem to understand why we are being so dogmatic about some things, " a Delaware official told an OTA researcher on February 4, 1976. "We have to be because they are so sloppy. "

ISSUE 3 REGULATION AND ENFORCEMENT

1. Working Paper #1.
2. Ibid.
3. Ibid.
4. According to U.S. Coast Guard Pollution Incident Reporting System (PIRS) data on oil spills in 1974, a major source of discharge was pipelines.

ISSUE 4 OIL SPILL LIABILITY AND COMPENSATION

1. Written responses to an OTA questionnaire distributed August 1975-January 1976, and oral statements in OTA workshops in May, June, and August, 1975.
2. Martin C. Miller, Jerry C. Bacon, Ivan M. Lissauer, Office of Research and Development, U. S. Coast Guard, Department of Transportation, *A Computer Simulation Technique for Oil Spills off the New Jersey-Delaware Coastline,* Report No. CG-D- 1 / 1975, Springfield: National Technical Information Service, September 1975.
3. Interagency Comprehensive Oil Spill Liability Group, Department of Justice Draft Memorandum, March 14, 1975, p.5.
4. Ibid.
5. Section 4(a) (2) of the Outer Continental Shelf Lands Act, as amended by the Deepwater Port Act.
6. Interviews with State officials, June 1976.
7. Environmental Policy Institute, *Oil: Study of Pollution Insurance Liability Laws,* October 10, *1975.*
8. Ibid, pp. S-5 and 6, and op. cit., Interagency, pp. 26-27.
9. Ibid.
10. Bergman, Samuel, "No Fault Liability for Oil Pollution Damage, " *Journal of Maritime Law and Commerce, vol. 5,* October 1973, pp. **20-21.**
11. Lundquist, Thomas R., "Compensation for Oil Pollution Damages, " *The Institute on Man and Sciences, Symposium,* February 1974, and op. cit., Interagency, pp. 15-18.
12. For discussion of the current status of court decisions on these matters, see Interagency Study Group, March 15, 1975, pp. 14-16.
13. Maine, Massachusetts, Washington, Oregon.
14. Environmental Policy Center testimony on New Jersey, S. 1409, 'June 2, 1976.

ISSUE 5 OIL SPILL CONTAINMENT AND CLEANUP

1. Working Paper #3.

ISSUE 6 ENVIRONMENTAL STUDIES

1. Working Paper #10.
2. U.S. Department of the Interior, *Draft Environmental Impact Statement for Mid-Atlantic Sale #40,* VO1. 2, p. 359.
3. Straughan, Dale M., *Environmental Studies as They Relate to Offshore Petroleum Operations,* Report to the Marine Board, National Research Council, 1975.

ISSUE 7 STATE ROLE

1. Working Paper #1.

ISSUE 8 POLLUTION RESEARCH

1. Working Paper #3.
2. Gulf Universities Research Consortium (1974), "Final Project Planning Council Consensus Report," *Offshore Ecology Investigation,* Report #138, September 20, 1974.
3. American Petroleum Institute, Proceedings, 1975 Conference on Prevention and Control of Oil Pollution, March, 1975.
4. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Report to the Congress on Ocean Pollution, Overfishing and Offshore Development," January 1975.

ISSUE 9 CONFLICTING OCEAN USES

1. U.S. Department of Transportation, U.S. Coast Guard Investigating Officer's Report on the MV Globtik Sun collision with Chevron Oil Co. unmanned structure 175-2, December 1, 1975.
2. Op. cit., U.S. Department of the Interior, *Draft Environmental Impact Statement.*
3. Report by Subcommittee on Safety of Navigation of the International Maritime Consultative Organization, August 2, 1975.
4. Comments on Leasing the OCS Mid-Atlantic by the Atlantic Offshore Fish and Lobster Association, May, 1975.
5. Ibid.

ISSUE 10 TANKER DESIGN AND OPERATIONS

1. U.S. Congress, Office of Technology Assessment, *Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures,* Washington: Government Printing Office, 1975.
2. U.S. Senate Commerce Committee hearings on Ports and Waterways Safety Act of 1972, March 2 and 3, 1976.
3. Op. cit., Office of Technology Assessment.
4. *Federal Register,* vol. 41, No. 94, May 13, 1976.

ISSUE 11 OIL SPILL CONTAINMENT AND CLEANUP AT DEEPWATER PORTS

1. 33 *CFR* 149.319.
2. Interview with officials of U.S. Department of Transportation, U.S. Coast Guard.
3. U.S. Congress, Office of Technology Assessment, *Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures,* Washington: Government Printing Office, 1975.

ISSUE 12 STANDARDS IN STATE WATERS

1. Working Paper #1.
2. Ibid.

ISSUE 13 ADJACENT COASTAL STATE STATUS

1. Interview with Hal Scott, Florida Audubon Society, April 6, 1976.
2. Correspondence from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, to William T. Coleman, Secretary of Transportation, March 11, 1976.
3. Correspondence from U.S. Department of Transportation, U.S. Coast Guard, to William T. Coleman, Secretary of Transportation, March 17, 1976.
4. Interview with DOT officials, April 5, 1976.
5. Ibid.

ISSUE 14 RISKS FROM MAJOR ACCIDENTS

1. Working Paper #8.
2. U.S. Nuclear Regulatory Commission, *Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants.* WASH–1400, NUREG-75/014, Washington, D.C., October 1975. This study, performed by a group of about 50 specialists under the Direction of Professor Norman Rasmussen of MIT, is commonly known as the Rasmussen Report. This report dealt only with land-based nuclear plants.
3. The ice condenser pressure suppression system used on the floating plant is the primary reason for this difference; similar systems are being used in new land-based plants as well.
4. U.S. Atomic Energy Commission, Interim General Statement of Policy "Protection Against Accidents in Nuclear Power Reactors," *Federal Register,* Vol. 3, No. 167, Tuesday, August 27, 1974, p. 30964.
5. Ibid, p. 30965.
6. Op. cit., U.S. Nuclear Regulatory Commission. See following table:

Table III-1. Consequences of individual release categories

TYPE	ACCIDENT PROBABILITY PER YEAR	AVERAGE* Man-rem ($X10^6$)	AVERAGE* Acute Fatalities	AVERAGE* Damage ($X109)	PEAK** Man-rem ($X10^6$)	PEAK** Acute Fatalities	PEAK** Damage ($X109)
PWR 1	7X10-7	2,8	34	1.4	32	1,100	4.3
PWR 2	5X10-6	3.1	62	1.8	31	2,300	5.6
PWR 3	5X10-6	1.4	39	.70	13	1,100	2.6
PWR 4	5X10-7	.29	2.7	.24	2.9	106	1.6
PWR 5	1X10-6	.07	.22	.06	.70	17	.46
PWR 6	1X10-5	7.5X10-3	0	1.0X10-3	91 X10-3	0	4.9X10^{-3}
PWR7	6x10^{-5}	1.3X10-4	0	1.1X10^{-5}	16x10^{-4}	0	3.6x10^{-5}
PWR8	4X10-5	.92x10^{-3}	0	.43X10^{-3}	15X10^{-3}	0	2.2X10^{-3}
PWR9	4X10-4	1.1X10-6	0	* 0	19X10^{-6}	0	= 0
BWR1	9X10^{-7}	2.2	1.7	1.2	21	115	4.4
BWR2	2X10-6	1.8	48	1.2	16	1,200	4.0
BWR3	1X10-5	.89	3.0	.61	9.4	110	3.4
BWR4	3X10-5	.42	3.9	.28	4,2	90	1.5
BWR5	1X10-5	.19	1.1	.10	1.8	52	.86
BWR6	1X10-4	.22X10-6	0	= 0	3.5X10^{-6}	0	- 0

"Averageoverpopulafionandmeterological conditions, assuming accidentoccurs with unit probability, i.e,, given theaccident.
•"It should be understood that the probabilities of these peak values are approximately three orders of magnitude smaller than the accident probability values given in column 2.

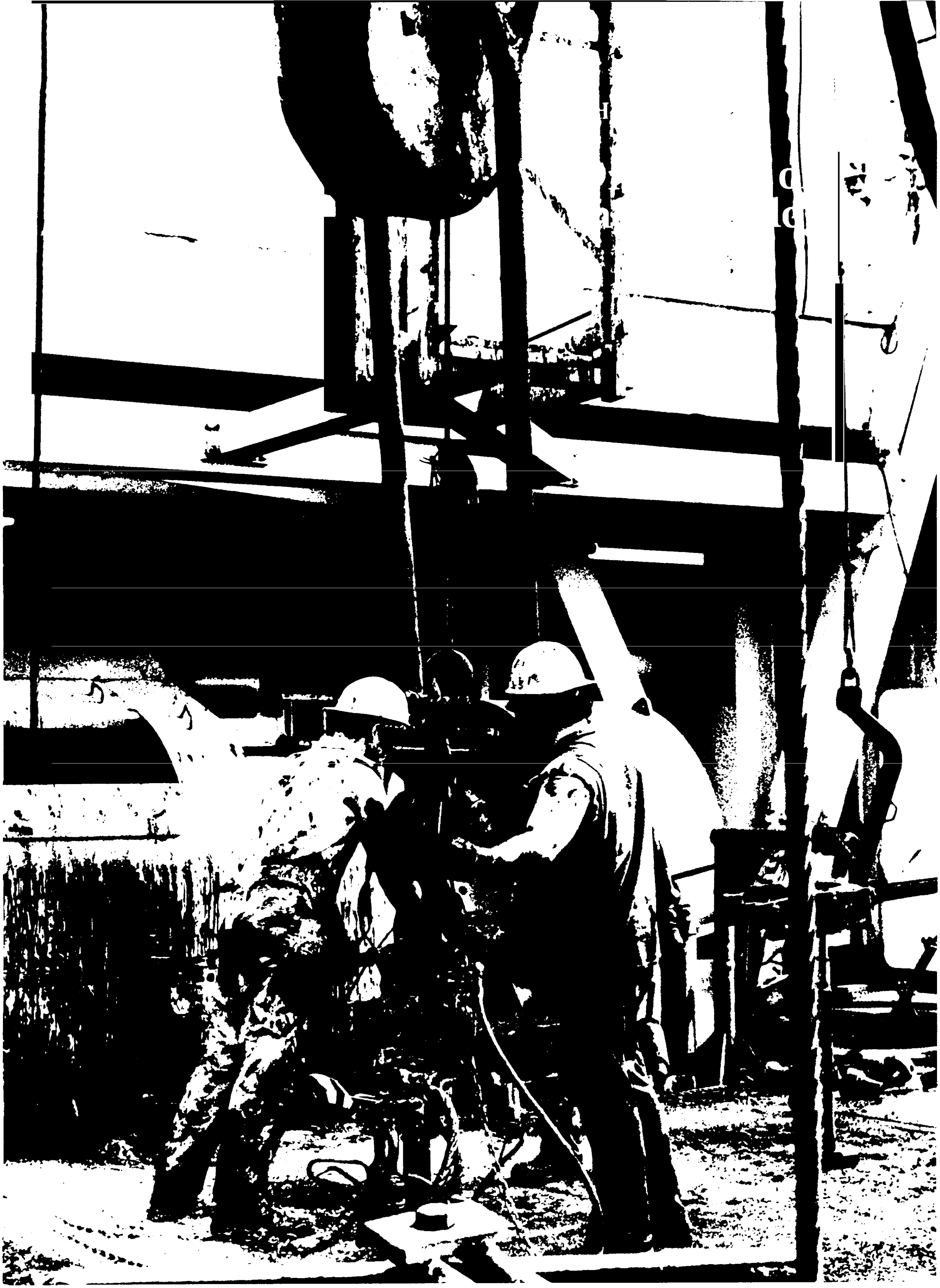
NOTE: The conclusion that the risks from Class 9 accidents are greater than the risks from Class 8 accidents is implied in the table 111-1, which was included in the draft of the Reactor Safety Study (page 71, Appendix VI), but not in the final report.

The rows labeled PWR 1 through PWR 9 represent sets of accident sequences in pressurized water reactors that procduce each of nine distinct categories of releases of radioactive materials from the contament. The probability given for each release category is the sum of the probabilities of the various accidents that could produce that type of release. Category PWR 9 approximates a Class 8 design-basis, loss-of-coolant accident, in which the safety systems function properly and no core-melt occurs. Categories PWR 1 through PWR 7 all result from Class 9 core-melt accidents involving some failure of the emergency systems and ultimately failure of the containment and escape of radioactive materials.

The relatively greater risks of Class 9 accidents can be seen by comparing the most severe category of core-melt accidents, PW R 2, with the Class 8 category, PWR 9. The table shows that PWR 2 is on Iv about 80 times less likely than PWR 9, yet the con sequences are man y orders of magnitude greater. For example, the expected total radiation dose to humans-the primary determinant of long-term cancer deaths—is nearly 2 million times greater for PWR 2 than for PWR 9 (3.1 million man -reins compared to 1.1 man-reins). In terms of early deaths, **P** WR 2 would produce on the average 62 deaths and could cause up to a peak of 2,300 deaths, while **PWR 9** is not expected to cause early deaths even under the worst weather and site conditions. In economic terms, **PWR 2** would produce on the average $1.8 billion in damages, while PWR 9 would produce essentially negligible economic impacts even i n the worst circumstanccs.

7 Yellin, Joel, "The Nuclear Regulatory Commission 's Reactor Safety Study, WASH- 1400," *The Bell Journal of Economics,* vol. 7, No. 1, Spring 1972, Table 2, p. 325.
8. Op. cit., U.S. Nuclear Regulatory Commission.
9. U.S Environmental Protection Agency, *Reactor Safety Study,* WASH-1400: A Review of the Final Report, June, 1976, pp. 1-8.

ISSUE 16 TECHNICAL UNCERTAINTIES
1. Working Paper #9.
2. Ibid.



Chapter IV

DISCUSSION OF THE TECHNOLOGIES

INTRODUCTION

This OTA assessment deals specifically with three technologies and the potential impacts on New Jersey and Delaware of the deployment of any or all of the three in the ocean waters off the two States. Those two States, with their divergent energy and environmental needs, are described in this chapter.

The assessment involved detailed study of the equipment to be used as well as the State and Federal management systems which license, regulate, and generally oversee the deployment and operation of the three technologies. The equipment and the management systems are described and analyzed in this chapter in the context of the history, current status, and possible future development in the Mid-Atlantic of oil and gas resources, deepwater ports, and floating nuclear powerplants.

During the assessment, OTA made its own projections of deployment and resulting impacts of the technologies. Other projections have been made by industry, various executive agencies, and private study groups. In nearly every case, the differences between the many projections of impacts are the result of differences in the basic assumptions made by the various groups. Those impacts and assumptions made by OTA are specified here.

OTA also investigated what would happen if any or all of the three technologies were not implemented. The possible alternatives to oil and gas, deepwater ports, and floating nuclear powerplants and how these alternatives are being pursued are discussed in the final section of this chapter.

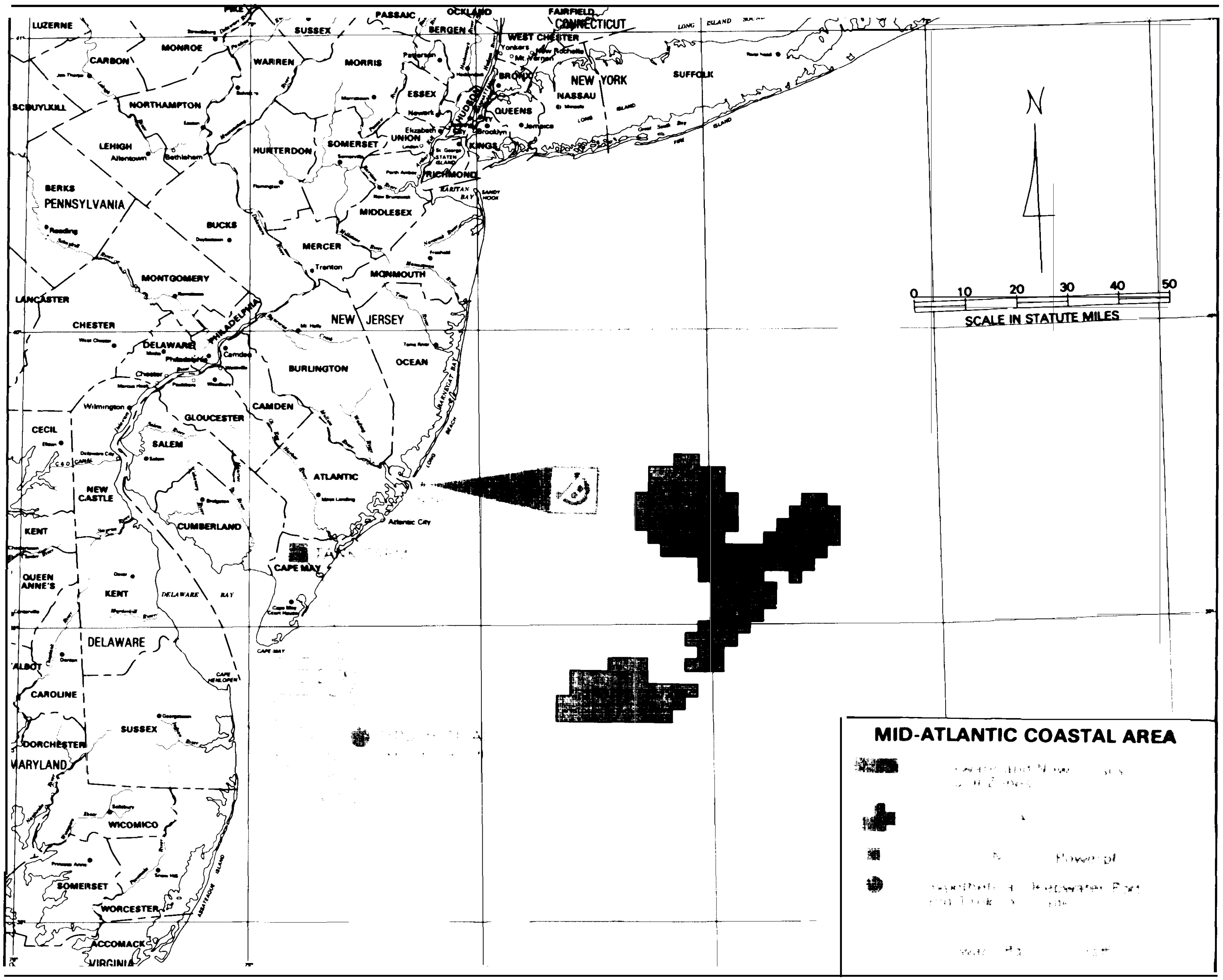


Figure IV-1. The coastal zones of Delaware and New Jersey

Source Off Ice of Technology Assessment, "Energy, 011 and the State of Delaware and "Inventory of New Jersey Coastal Area, 1975'

Description of the Study Area

Delaware and New Jersey—among the smallest and most densely populated of the 50 States—are a microcosm of the Nation's energy conflicts: burgeoning demand for petroleum and electric power accompanied by both a dependence on outside sources for energy and a continuing concern for the quality of life.

Wide Atlantic beaches that attract an estimated 100 million users annually[1] merge with coastal wetlands, marshes, and forests, then give way to intense industrialization farther inland.

Both States border the Atlantic Ocean; New Jersey with 126 miles of ocean coastline and Delaware with 28. Water along the ocean coast is relatively clean and most of the resort areas are located there. The States are separated from each other by the Delaware Bay, which is devoted mostly to boating, fishing, and shipping. Industrialization and pollution are heavy along the upper Bay and the Delaware River, which is at the southern end of an industrial corridor that stretches north to the Hudson River of New York.

Development in both States is clustered along the Delaware River Basin, a 300-mile long waterway which has attracted commerce and industry for three centuries.

In recent assessments of the Delaware River Basin, the Council on Environmental Quality has said the region is "at the cutting edge" of many of the environmental concerns facing America. Its water and air were among the first to be heavily polluted; its oldest cities were among the first to be changed by industrialization; its towns grew as a result of migration from Europe and from the Southern United States; its rural areas were among the first in the Nation to be urbanized by residential and industrial expansion; its mountains and beaches were among the most severely impacted by the recreation boom, With the energy shortage, it is a prime target for offshore energy systems and associated industrial development.[2]

The economic life of the two States is inextricably tied to divergent ventures: the energy-intensive manufacturing -refining - petrochemical complexes of the inland area and the tourist-recreation-fishing meccas of the coastal waters and beaches.

Both Delaware and New Jersey enacted laws to help deal with conflicts between industry and tourism. Delaware has a Coastal Zone Act which prohibits new heavy industries in the coastal zone. New Jersey has a Coastal Area Facility Review Act which sets up a permit procedure for new or expanding industry. In a further effort to plan for industrial growth, the urban sections of both States belong to regional planning commissions.

The demand for oil and electricity for increasing populations and the desire to avoid the adverse impacts associated with energy facilities in Delaware and New Jersey have produced pressures for clean sources of energy, new controls on existing energy systems and careful coordination of growth. The conflicts have posed severe planning and zoning problems and brought traditional State and local regulatory systems and land-use patterns into question. Both States are developing coastal zone management programs which may resolve some of the conflicts. They also are developing new State laws to deal with changing demands,

Neither State produces any oil or natural gas. Their energy needs are met with crude oil or petroleum product imports from foreign sources or from domestic wells along the Gulf of Mexico and natural gas from transcontinental pipelines.

Petroleum demand is expected to increase by nearly one-third by 1985. Electricity demand is projected to increase by at least one-half by 1985 assuming no change in the present growth pattern.

New Jersey, which has developed 29 percent of its total land area for housing, commerce, or industry, is the most heavily industrialized State in the Nations Increasing urbanization and industrialization are taking over New Jersey farmland at the rate of 40,000 acres a year. At the same time, New Jersey has more land in recreational uses than any other of the five Mid-Atlantic States.[4] Fourteen percent of New Jersey's land is recreational.

Delaware is predominantly a rural State with the highest percentage of wetlands and farmlands of any Mid-Atlantic State. Only 8 percent of its land is used for commerce, industry, or homes.[5]

New Jersey's recreational land serves the large populations of New York and Pennsylvania. Thirty percent of the demand for New Jersey recreational land is made by out-of-State tourists. Recreational demands are primarily for beaches and boating and are expected to almost double by the year 2000.[6] Tourism, or travel-related business, centers along the coast primarily in Atlantic and Monmouth Counties.

The tourist industry, which accounts for $3.5 billion of New Jersey's estimated $50 billion annual gross product, is second in economic importance only to the petrochemical industry. p

Petrocemicals, which depend on petroleum and natural gas byproducts for raw materials, account for $4 billion of the State's gross product. Eleven major plants are concentrated in Northern Jersey and along the borders with Pennsylvania and Delaware near a refinery complex that processes two-thirds of the crude oil refined on the east coast. [8]

When all manufacturing businesses are considered, more than 40 percent of New Jersey's 3 million workers owe their jobs to manufacturing. g Manufactured goods and petrochemical products are the primary exports from the two States.

About 31 percent of Delaware's 200,000 jobs are in the manufacturing sector.[10] The States largest industry is petrochemicals, with a complex of plants located in the Wilmington-Delaware City area at the northern tip of the State.

Tourism is ranked third among income sources in Delaware and annually generates $202 million worth of business,[11] located mostly in Sussex County. Most of the tourist business in Delaware involves fishing, swimming, and picnicking. With more than 16 million people living within a day's drive of Delaware, 87 percent of the increasing demand for sport fishing is from out of State.[12] Most of the visitors to Delaware are from the Baltimore-Washington area.

Despite the transportation demands made by both industry and tourism, neither State is amply supplied with major transportation facilities except where they coincide with the New York City to Washington, D. C., corridor. One major divided highway runs north-south through the coastal region of each State. Major rail service is limited to the metropolitan corridor and a freight service between Wilmington, Del., and Norfolk, Va., via a railroad ferry across the Chesapeake at Cape Charles. Mass transit systems are limited to the metropolitan areas.

Existing transportation probably could not support industrial and commercial activity that may result from any new large-scale development.

Two large ports serve Delaware and New Jersey. The Port of New York and New Jersey is the Nation's largest handler of imported general cargos. In 1973, the port handled nearly 218 billion short tons of cargo—primarily passengers, containers, grain, and petroleum. The petroleum terminals are mainly on the New Jersey side of the Port. The Delaware River Ports, centering around Philadelphia, have handled an increasing amount of cargo in recent years, more than 40 percent of it crude oil. Total tonnage through the ports in 1973 was 139 billion short tons.[13]

The wetlands of the two States—250,000 acres in New Jersey and 139,000 acres in Delaware—are crucial to coastal life. The areas are nursery and breeding grounds for much of the marine life in the ocean and bay. They provide nutrients which are carried by the tides into open waters to feed fish and other organisms. The wetlands provide shelter and food for waterfowl and migrating birds traveling one of the Nation's busiest flyways.[14]

In the coastal region of Maryland, Virginia, New Jersey, and Delaware, nearly 1 billion pounds of estuarine-dependent fish products are harvested annually with a wholesale value of almost $70 million. The important commercial species are menhaden, crabs, lobsters, clams, and oysters. More than a million sportmen fish in the same coastal areas annually and more than a half-million geese and ducks are harvested by sports hunters.[15]

In its final environmental impact statement on the proposed 1976 oil and gas lease sale in the Mid-Atlantic, the Department of the Interior indicated that the costs and risks associated with developing wetlands and sandy barrier islands can be very high and that destruction of the wetlands already has curtailed the productivity of some marine species.

The decline in the quality of commercial and sport fisheries in the region led to the passage of wetlands protection legislation in both New Jersey and Delaware.[16]

Behind the wetlands in New Jersey, a large and unique forest occupies most of the south central portion of the State. Known as the Pine Barrens, the area includes 1,500 square miles of sandy soil with stands of rare pine species and other plant and wildlife. Sparsely inhabited and virtually untouched by industrial development, the Pine Barrens covers a large untapped fresh water aquifer.

In this diversified area and off its shores, three new energy systems are now possible: production of oil and gas resources on the Outer Continental Shelf, construction of a deepwater port to handle petroleum imports by supertankers, and siting of the Nation's first floating nuclear powerplant. .

The offshore oil and gas leases run parallel to the southern half of New Jersey and the mouth of the Delaware Bay. The most promising site for oil and gas finds—as indicated by industry tract nominations—is located about 80 miles off Cape Henlopen, Del.

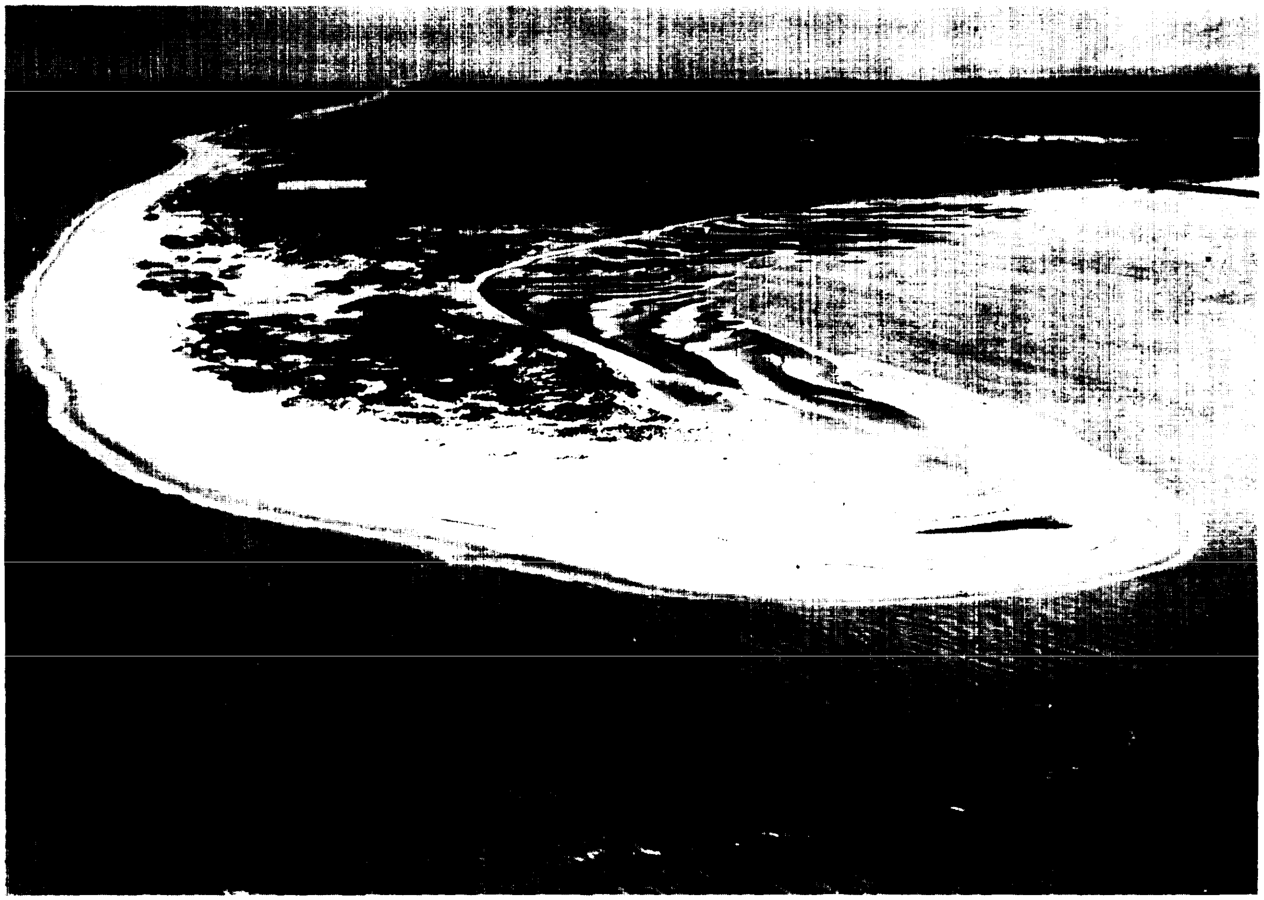
At present there is no serious proposal for a deepwater port outside the 3-mile limit of State waters in the Mid-Atlantic, but this study has determined that a likely site for an offshore deepwater port, should one be proposed, would be about 30 miles off Cape May County, N.J., across the mouth of the bay from the Delaware seashore.

The proposed site of the planned floating nuclear powerplant is off Atlantic County, N.J.

The citizens of the States reflect a wide range of views about the proposals. Industry representatives, labor, and the big city residents generally have favored the development of new energy systems off the coast of Delaware and New Jersey. Environmentalists, beach landowners, and tourist-oriented towns and businesses generally have opposed offshore development. The Governors of both States are on record in favor of exploration for offshore oil and gas if significant changes are made in the development process and Federal supervision. The Governor of New Jersey is on record in opposition to a deepwater port which would cause large-scale industrialization of rural areas, and Delaware has prohibited the port and pipeline landings by law. The Governors have taken no stand as yet on the proposed floating nuclear powerplant although New Jersey is currently investigating the risks of such a system.[17]

The position of each State in regard to the new energy systems is discussed in more detail in later sections of this chapter.

Figure IV-2. The beach at Cape Henlopen, Delaware State Park juts out into the water where the Delaware Bay meets the Atlantic Ocean. A few miles up the Bay, Lewes, Delaware, is a potential staging area for work crews and supplies that will be needed on offshore oil and gas rigs and platforms.



Source Delaware State Planning Off Ice

Development of Offshore Petroleum Technologies in the Mid-Atlantic

BACKGROUND

This study assesses the introduction of offshore petroleum development in the Mid-Atlantic region. Although the submerged Outer Continental Shelf (OCS) lands within this region were classified by geologists as a potential source of oil and natural gas in the late 1950's, they were not a priority target for development until 1974.

Initial notice of plans to develop petroleum resources on Federal lands off the Mid-Atlantic coast was given in a 5-year leasing schedule which the Department of the Interior first published in June 1971. However, in his energy message of April 18, 1973, the President announced that drilling on the Atlantic OCS and in the Gulf of Alaska would be deferred until a study of the environmental impact of oil and gas production in these areas could be carried out, The Council on Environmental Quality (CEQ) was instructed to conduct this study in consultation with the Environmental Protection Agency, the National Academy of Sciences, other Federal agencies, and the Governors, legislators, and citizens of the coastal States involved. The Council held public hearings, including hearings in cities on the Atlantic coast; established and met with an advisory committee comprised of representatives of the Governors of the coastal States; and consulted with representatives of environmental groups and industry.]

Development of the offshore petroleum resources of the Mid-Atlantic area was given high priority by the executive branch in 1974. This change in status followed the oil embargo imposed in October 1973 by the Organization of Petroleum Exporting Countries (OPEC). Accelerated development of the OCS, including the Mid-Atlantic, was one of the policies announced by the Administration for lessening U.S. dependence upon foreign sources. [2]

As initially announced, accelerated OCS development called for leasing 10 million acres in a single year, an amount roughly equal to all of the OCS land that had been leased during the 21 previous years. On the basis of its review of this decision, the General Accounting Office (GAO) reported that the decision to accelerate leasing was made "without carefully analyzing and considering several factors and problems affecting the decision's soundness."[3] The GAO concluded that the decision was hastily conceived by Interior and based on overly optimistic assumptions and inadequate data and that it was reached without considering environmental impacts, national-regional supply-and-demand needs, or alternatives to large-scale expansion of OCS leasing.

Despite the year-long CEQ study and the involvement of the State governments and citizens, OTA found that most affected parties in New Jersey and Delaware, including State and local officials, believe that the Administration's 1974 move to accelerate development off the Mid-Atlantic coast was made without giving them an opportunity to participate. They were, in part, reacting to the realization that the decision to develop the Baltimore Canyon Trough already has had significant social and political consequences for the States of New Jersey and Delaware and their coastal communities. They also were reacting to their dealings with the Department of the Interior in its role as manager of OCS resource development, Q experiences which led them to believe that few Interior Department officials recognize the magnitude and significance of the impacts that petroleum exploration and production may have on Mid-. Atlantic States and coastal communities.

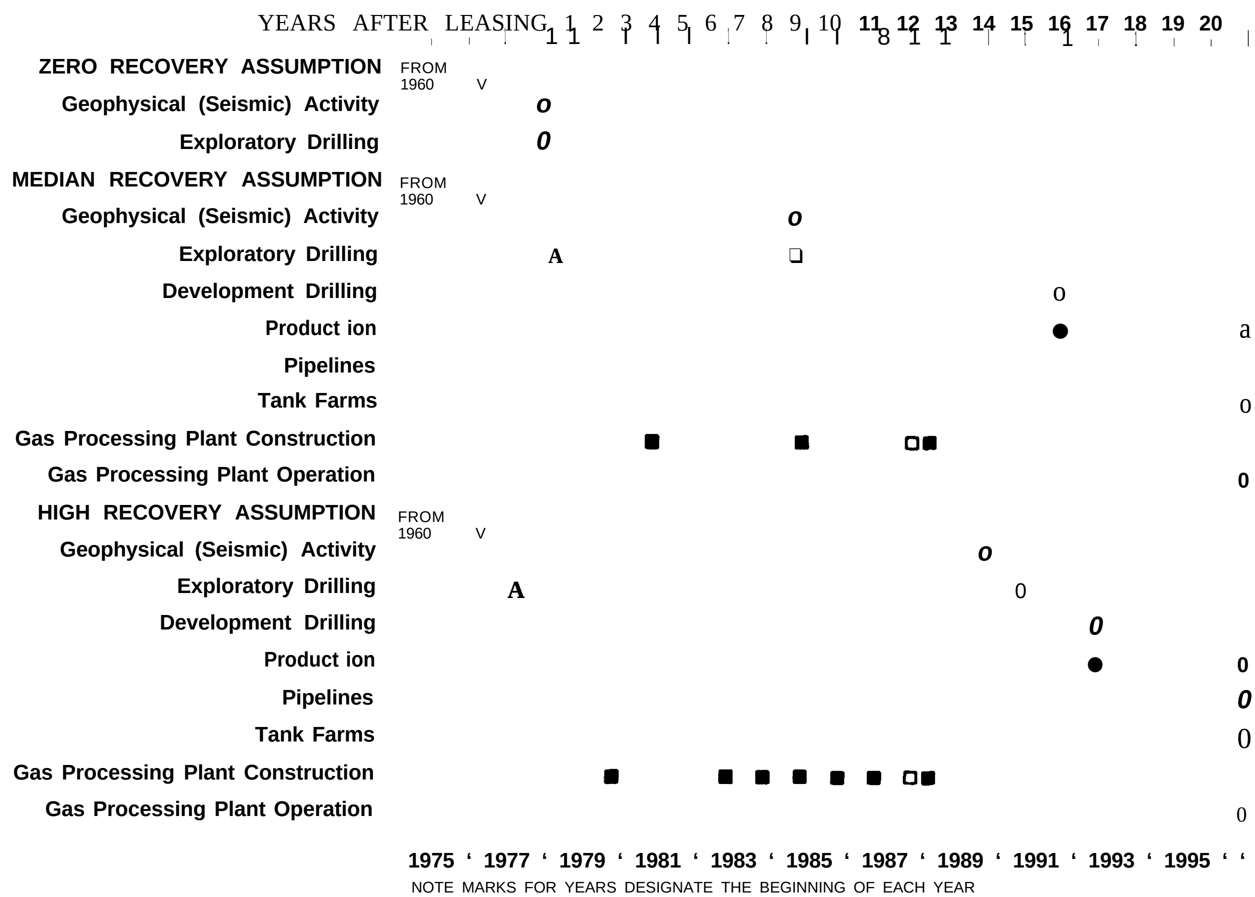
ACTIVITIES TO DATE

Seismic Surveys

Since about 1960 there has been active interest on the part of many U.S. oil companies in development of potential oil and gas resources on the Mid-Atlantic Outer Continental Shelf. The first technology which was deployed by industry to explore for potential deposits was that of seismic surveys.

Seismic survey ships have been tracing gridlines over the Baltimore Canyon Trough periodically since the early 1960's, using pneumatic or propane gas guns to generate sound waves which penetrate the rock of the sea floor and register their return to the surface on hydrophores which are trailed behind the survey ships. If petroleum exists in the Baltimore Canyon Trough, it is trapped in layers of porous rock which have been created over some 200 million years from soil, clay, and gravel which has washed to sea from the

Figure IV-3. Baltimore Canyon development activities by phase of development and by year



KEY: A First Major Discovery; ● Peak of Production; v Lease Sale; Construction; Operation;
❑ Termination of Activity; Gas Processing Plant on Line

Source Office of Technology Assessment

Appalachian highlands. [5]Because sound is reflected by different layers of rock through which it travels, the records of the soundwaves returning to the survey ships can be processed by computers to give an interpreter a detailed picture of the rock formations the soundwaves have penetrated.

A seismic survey is a rough and indirect measure of petroleum resource potential in a region and is most uncertain when it is used in a frontier area that has never been drilled such as the Baltimore Canyon Trough,

If oil is discovered in the amounts projected by geologists using seismic survey results these ships will continue to operate until 1990, overlapping the start of exploration and production drilling in an effort to outline possible areas where oil and natural gas might exist. Figure IV-3 summarizes the oil exploration and development activities that OTA has projected between now and 1995.

Although crude, seismic data is used to indicate the size and extent of potential oil fields. For this reason, the unsuccessful attempts of New Jersey and Delaware to obtain seismic data from the Government have been a source of irritation for many officials. The U.S. Geological Survey (USGS) itself has conducted some seismic surveys and the data, theoretically, could be transmitted to the States. The USGS also has various kinds of seismic data purchased or obtained from industry as a requirement for permits for seismic surveying. These data, however, are proprietary information and are not available to the States.

Delaware State Geologist Robert Jordan told OTA that, the States have been pushing USGS, without success, to make so-called "public" information available more quickly. If the USGS surveys were made available to the States 2 or 3 years in advance of a lease sale, he said, the States probably would have adequate information about the OCS for planning purposes.

Resource Estimates

It is common practice to use seismic survey data, measurements of magnetic fields, gravity and subsea geology as well as various indicators of past trapping of hydrocarbon deposits to make judgments of potential resources in a region. The oil industry invests substantially in surveys, data analysis, and expert judgments to make these estimates but does not publish specific results.

Based on seismic and other proprietary geophysical data, the U.S. Geological Survey has made several estimates of the resources in the Baltimore Canyon Trough. These estimates have changed several times over the past 2 years and even the methods of making estimates have been debated among geologists in industry and government.

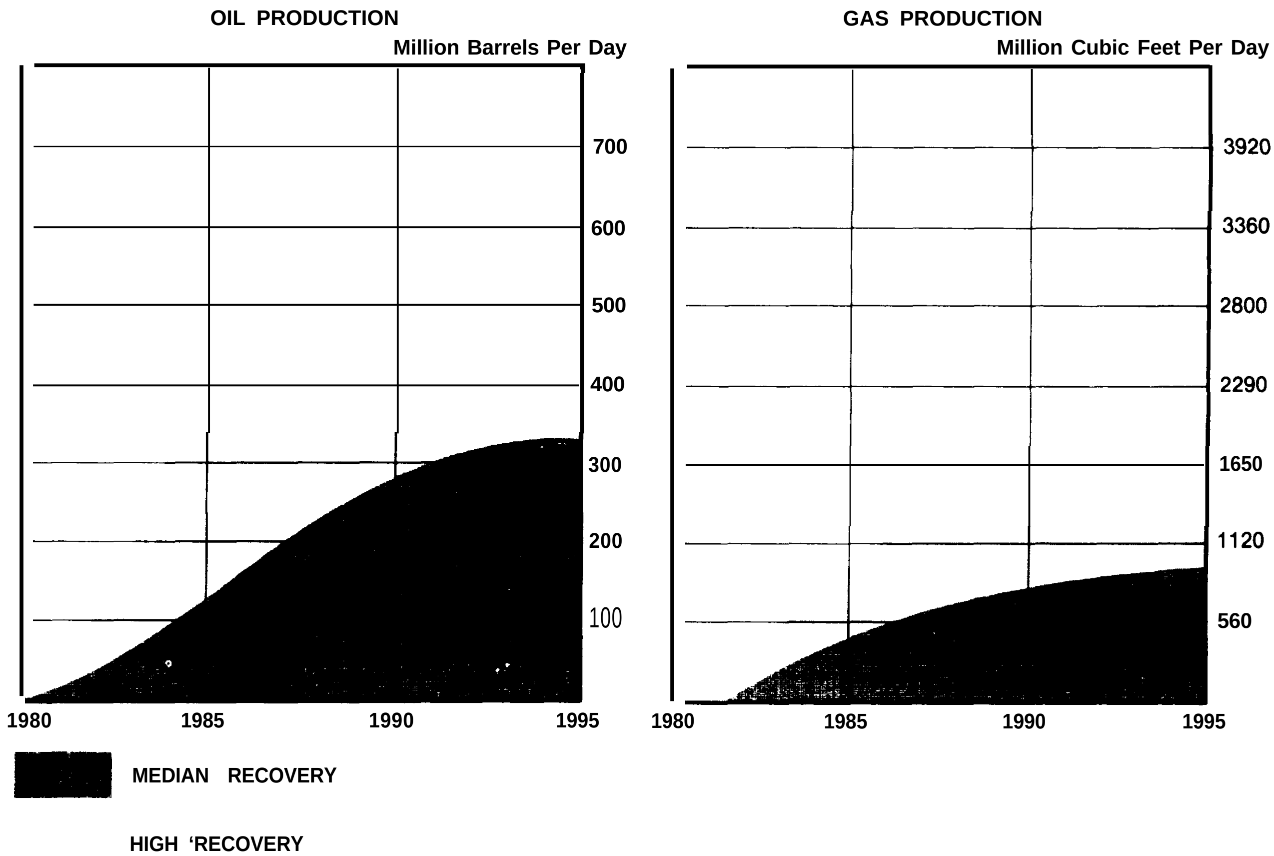
The USGS resource estimates for the Baltimore Canyon Trough were revised downward by about 50 percent in the last 2 years. The estimates are now given in terms of probabilities and ranges of possible discovery and recovery. The present estimate for the median of probable resource was announced for many OCS regions, including the Baltimore Canyon Trough in May 1975. The estimate was 1.8 billion barrels of oil and 5.3 trillion cubic feet of natural gas. [6]For the area which is being leased first, the USGS estimated in September 1975 that recoverable resources could range from 0.4 to 1.4 billion barrels of oil and from 2.6 to 9.4 trillion cubic feet of natural gas.

The continually changing nature of these figures indicates that they cannot be taken as any more than well-educated guesses about the amount of undiscovered resources.

Interior Department Preparations

Since the announcement that the Federal Government would accelerate the process of leasing Federal land on the Outer Continental Shelf for petroleum development, the Department of the Interior (DOI) and the Bureau of

Figure IV-4. Potential energy supply provided by Baltimore Canyon oil and gas development



Source U S Geological Survey resource estimates and Office of Technology Assessment development assumptions

Land Management (BLM)—Interior's leasing agency—have been preparing and proceeding with the many steps in the process. Leasing is carried out by BLM under the present system pursuant to the OCS Lands Act of 1953. A complete description of the present system is given in a March 1976 report prepared by the Congressional Research Service titled Effects Of *Offshore Oil and Natural Gas Development on the Coastal Zones.* Proposed changes as given by Senate and House bills to amend the OCS Lands Act are contained in Working Paper #l of this study. At present the Baltimore Canyon Trough region is one of more than a dozen OCS frontier areas now in the program for accelerated leasing which includes regions off the shores of all coastal States. As of this writing some of these areas have already been leased (deep portions of the Gulf of Mexico, Southern California, eastern Gulf of Alaska, and the Baltimore Canyon).

The steps up to leasing include:

- Planning and estimating the potential of a specific region;
- Selecting a lease area from industry and government-proposed targets;
- Preparing of Environmental Impact Statements and conducting environmental studies;
- Coordination of Coastal Zone Manage-

ment Programs and States' concerns for development impacts; and

- Final decision to lease, announcement of sale, and acceptance of bids from industry.

Although the Bureau of Land Management (BLM) had spent 2 years examining the possibility of accelerating lease programs before the 1973 proposal for a 10-million acre sale, they were not prepared for a sudden change of that magnitude.

In 1972, the BLM's OCS budget was $650,000 and 2 years before the Bureau had only nine staff members, some of them part time, in Washington to deal with offshore leases.[7] In the period since the acceleration program was announced, BLM has been chronically short of staff, particularly of specialists in urban land use, industrial

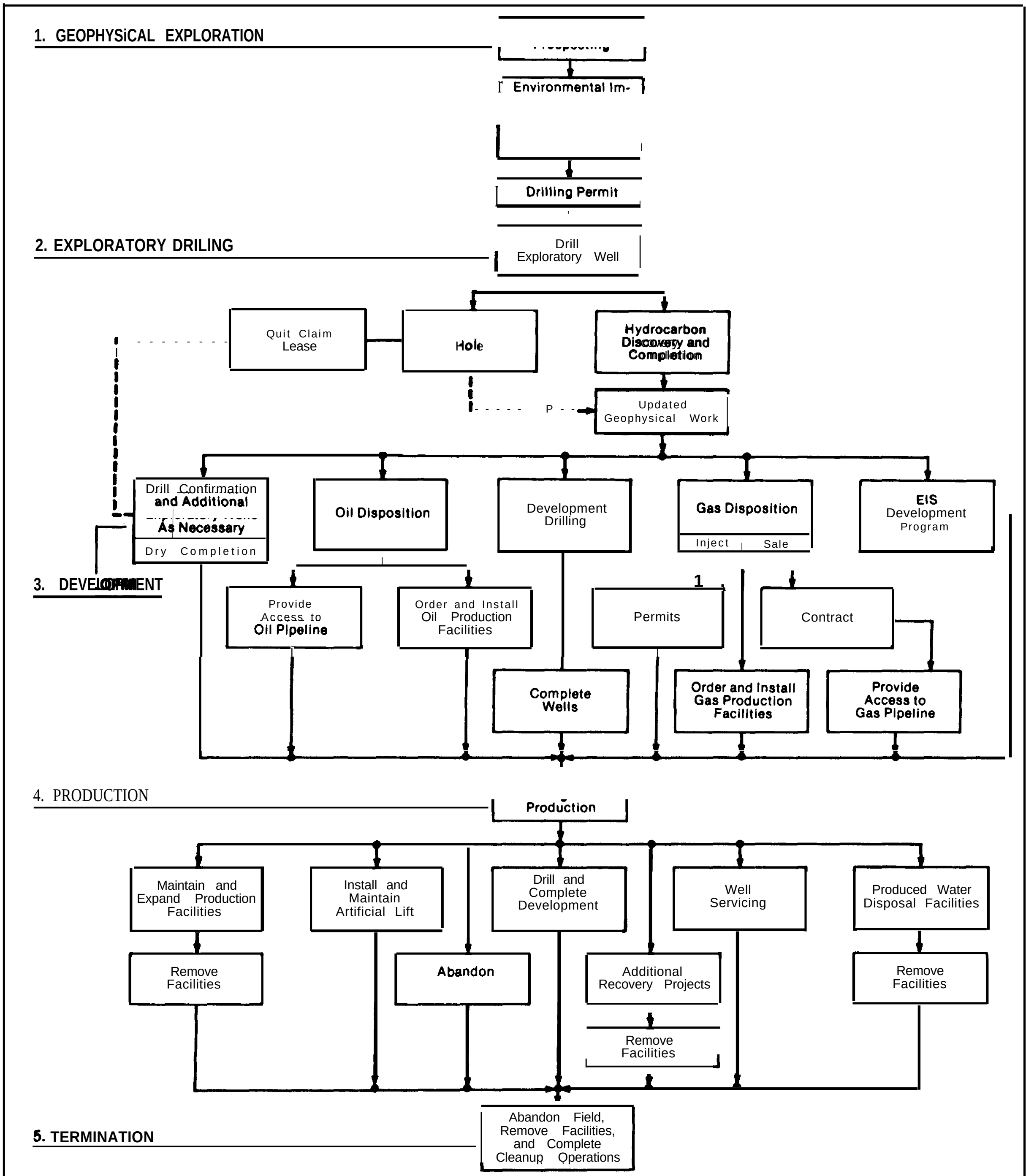
Figure IV-5. Estimates of undiscovered recoverable oil and gas resources(a) U.S. offshore areas

AREA	CRUDE OIL[(b)] (Billions of barrels)			NATURAL GAS (Trillions of cubic feet)		
Water Depths of 0-200 metres (includes state and Federal lands)	95% Probability (c) (e)	50/0 Probability (d) (e)	Statistical Mean (f)	95% Probability (c) (e)	5°70 Probability (d) (e)	Statistical Mean (f)
1. North Atlantic	0	2,5	0.9	o	13.1	4.4
2. Mid-Atlantic	0	4.6	1.8	o	14.2	5.3
3. South Atlantic	0	1.3	0.3	0	2.5	0.7
4. MAFLA (Eastern Gulf of Mexico)	0	2.7	1.0	0	2.8	1.0
5. Central Gulf of Mexico}(g) 6. South Texas	2.0	6.4	3.8	17.5	93.0	49.0
7. Southern California	0.4	2.1	1.1	0.4	2.1	1.1
8. Santa Barbara Channel	0.6	3.0	1.5	0.7	3.3	1.7
9. Northern California	0	0.8	0.4	0	0.8	0.4
10. Washington - Oregon	0	0.7	0.2	0	1.7	0.3
11. Lower Cook Inlet	0.5	2.4	1.2	1.0	4.5	2.4
12. Gulf of Alaska (h)	0	4.7	1.5	0	14.0	5.8
13. Southern Aleutian Arc	0	0.2	0.1	0	0.5	0.1
14. Bristol Bay Basin	0	2.4	0.7	0	5.3	1.6
15. Bering Sea	0	7,0	2.2	0	15.0	5.7
16. Chukchi Sea	0	14.5	6.4	0	38.8	19.8
17. Beaufort Sea	0	7.6	3.3	0	19.3	8.8
Water depths of 200-2500 metres ")						
4. MAFLA (Eastern Gulf of Mexico)	0	1.3	0.5	0	1.2	0.3
5. Central Gulf of Mexico }(g) 6. South Texas }	0	1.9	0.9	0	19.3	8.7
7. Southern California	0.2	2.9	1.2	0.2	2.9	1.2
8. Santa Barbara Channel	0.3	2.1	0.9	0.4	2.3	1.1

a) For assessment of maxlmurn anticipated enwronmental Impact, use of the 50/. probability resource estimate IS suggested.
'b) Natural gas Ilqutds not included. Total U S NGL resources to 200 metres water depth are calculated to be 28 billion barrels, based upon statistical mean estimates of undiscovered recoverable natural gas resources and an appropriate gas /oil ratio Information IS inadequate to warrant estimates for indlvidual areas
(c) 19 in 20 chances that *a?* least the amount estimated IS present. An estimate of O indicates that there IS less than 95%. probability of Commercial quantities **being** present Such estimates are made for frontier areas because the presence of 011 and/or gas has not yet been established by drilling
(d) 1 in 20 chance that *more than* the amount estimated IS present
(e) It IS statistically incorrect to sum either the 5°/0 or the 950/o probabtllty estimates for Indwldual areas to obtain totals for a region
[f) Mean estimates for lndwldual areas maybe summed for regional or U S totals
[g) Estimates for these two areas combined
[h) Includes Kodiak Tertiary Province
[ii Estimates Ilmlted to areas where development IS underway or Ieaslng IS planned {n the Immediate future

Source U S Geological Survey (estimates)

Figure IV-6. Simplified flow diagram showing operations necessary for discovery, production, and abandonment of an oil field



Comply with Section 102(2)(C) of National Environmental Policy Act if Federal lease requires preparation and approval of Environmental Impact Statement **(EIS)**

NOTES: (1) Manpower requirements, while not detailed above, are substantial in all phases of the petroleum industry. All types are required, including technical, skilled and common labor.

(2) Not shown are requirements for permits and approvals by numerous Federal, State and local agencies throughout the life of the field.

Source National Petroleum Council

economics, and other skills and expertise required for analyzing coastal and other onshore impacts in States like New Jersey and Delaware.[8] Efforts have been made to remedy this and, as of early 1976, BLM had four regional offices and an OCS budget of $55 million; however, it was still short of staff in the specialty areas cited above.[9]

BLM officials were also unprepared for the reaction of Atlantic coastal States to the 1973 accelerated leasing proposal despite the reactions they had observed following events like the 1969 Santa Barbara blowout. Most of the leasing experience of BLM officials was based on development in the Gulf of Mexico, which had taken place during a time when attitudes and the social context were quite different than they were in 1974.

Frank A. Edwards, Assistant Deputy Director of Minerals and Management, BLM, said in an interview with OTA on January 30, 1976, that the Bureau "had total agreement and understanding with Texas and Louisiana. They were pro- oil and -gas and we just didn't realize at first that the other States would be so different. We didn't realize it would be so crucial to educate them and coordinate with them. "

William R. Moffat, former Director of Policy Analysis for the Interior Department, said in an interview on January 29, 1976, that the Department "had been operating in a benign environment in the Gulf. Louisiana and Texas didn't really care what we did out there. The whole ethos was different. They considered it a waste of time when we tried to coordinate with them. So, at the time, it was not obvious to anybody that we were in a whole new ball game. "

But, State and local officials in the Mid-Atlantic States responded to the leasing proposal more like Californians responding to Santa Barbara than like the people of Louisiana responding to similar accidents in the Gulf. The Mid-Atlantic States were less receptive to proposals to produce oil and natural gas off their coasts and were skeptical of assurances that the development would not disrupt existing patterns of life and land use.

Except for its Gulf of Mexico experience, BLM's background as a manager of public resources came from managing Federal mineral, timber, and grazing rights on some 450 million acres of land, mostly in the Western States and in Alaska, This background had not prepared it to meet the new challenges posed by the accelerated leasing program.

To obtain more people with the required skills, BLM has generally had to look outside the agency. This, in turn, has lengthened lead times both in terms of staffing and in terms of acquainting new staff members with Bureau activities. One result was that the New York City office, which was set up November 26, 1973, and drafted the Environmental Impact Statement for the Mid-Atlantic lease sale, still was short of its full requirement for professional staff members by 10 positions in March of 1976.[10]

The rush of events set in motion by the proposal to accelerate lease sales meant that BLM was playing "catch-up" during most of 1974 and 1975.

The net effect of BLM's experience and personnel limitations was to leave it ill-equipped to coordinate offshore development with States such as New Jersey and Delaware. In an effort to overcome these limitations and to deal with State concerns, the Assistant Secretary of Interior for Program Development and Budget was designated the OCS policy coordinator. Although State officials told OTA that the effort improved the flow of information from Interior, BLM officials said the arrangement did not always work well, partly because lines of communication between BLM and the OCS coordinator sometimes broke down.11

One such case involved an assurance by the OCS coordinator that State officials could review sections of the Environmental Impact Statement in advance of its publication. Because of standing orders within BLM, which were not rescinded after the assurance from the OCS policy office, State officials were also advised that they could review sections of the statement, but only in the New York office of BLM and only during certain hours of the day.

It was only after considerable complaining that changes were made in the BLM order and State officials were given easier access to information as it was being assembled. The misunderstanding eventually led to the adoption of internal guidelines for contact with the States through the EIS process at Interior.

The resulting guidelines, Instructional Memorandum No. 76, dealing with "Contacts with State governments through the OCS leasing process," requires that States be contacted to attend meetings during which activities like tentative tract selection are discussed, to participate in preparation of the EIS, and to review preliminary drafts of the EIS. Other procedures require that the States be informed of the EIS contents where appropriate, and advised of such activities as announcement of tentative tract selection, release of draft and final EIS, and notice of sale.

Line responsibility for OCS activities at Interior is divided between two bureaus, both of which have a wide range of other activities that overshadow their OCS responsibilities in terms of manpower and budget. The Bureau of Land Management is the lead agency in developing leasing programs and granting rights to offshore exploration and development. Once leases are signed, responsibility for supervising offshore activities passes to the U.S. Geological Survey (USGS), which is primarily a scientific agency with a limited regulatory role. The USGS is also responsible for topographic mapping, monitoring of domestic water resources, and locating and estimating the extent of deposits of all minerals under both public and private lands. The USGS drafts technical regulations for offshore equipment and operations and enforces those regulations. The regulations have been, and continue to be, more concerned with specific items of equipment than with relationships between the equipment and the total oil and gas development system.

During the 14 months ending January 1976, the former Assistant Secretary for Program Development and Budget, Royston S. Hughes, was responsible for coordination of OCS activities at the Interior Department. It was an assignment he combined with managing the Department's budget, supervising policy planning and analysis, doing economic analysis of Department programs, and dealing with environmental and natural resource policy issues.

Officials in New Jersey and Delaware and at the Interior Department said that Hughes' departure to join the White House staff disrupted progress toward opening a line of communications through which substantive issues could be argued to conclusion. State officials also insisted that the lines of communication depended on Hughes being in the position he held, not on the way in which Interior was organized to deal with the States.[12]

Despite the fact that the program to lease tracts off the Mid-Atlantic coast had moved through several crucial phases, the position of the OCS staff director was vacant from September, 1975 to March 1, 1976, when Alan Powers was hired to replace Darius Gaskins, who had returned to academic life. The position of OCS Coordinator/Assistant Secretary was vacant from the time of Hughes' resignation until May 21, 1976, when Ronald Coleman was confirmed to replace him. In the interim, the Deputy Assistant Secretary for Program Development and Budget, Stanley D. Doremus, acted as coordinator.

A plan for reorganizing the OCS offices was completed early in 1976 for consideration by the Secretary of the Interior.[13]

In general, it called for the Assistant Secretary for Program Development and Budget to continue combining OCS coordination with his other responsibilities. In addition, the plan called for a fulltime OCS director who would report to the assistant secretary. The office would be responsible for analyzing OCS policies, assuring the participation of States in decisions, resolving differences among Interior officials who have line responsibility for offshore oil development, and coordinating studies involving OCS activities.

The plan would not change line responsibility for any aspect of offshore oil development. It contained no recommendations as to the size of staff required to coordinate offshore development. The plan, in effect, continued the structure that existed before Assistant Secretary Hughes left Interior.

Based on experience of the 2 years since the Administration adopted a policy of accelerated offshore oil development and because of fragmented responsibility and lack of a single leader, the present structure probably will not be adequate to solve the problems of coordination with other Federal agencies and with the coastal States. These problems will intensify when offshore development begins in the Mid-Atlantic.

Selection of the Lease Area

For administrative purposes, the Outer Continental Shelf is divided into a chessboard pattern of tracts each containing a maximum of 5,760 acres or 9 square miles. Oil companies bid for leases by tract rather than by oil-bearing structures.

On March 25, 1975, the Bureau of Land Management, which acts as agent for the Interior Department in lease sales, called for nominations by the oil industry of tracts it would like to have offered for leases. Oil companies designated 557 tracts covering 3.1 million acres of the Outer Continental Shelf—about ha 1 f of the Trough area which runs roughly parallel to the Atlantic coast for 150 miles between New York and the north coast of Virginia, [14]

In August 1975, BLM selected 154 tracts covering 876,750 acres from among those nominated and tentatively scheduled a sale of leases for the tracts for May 1976. (See figure IV-7.) Some of the 557 tracts nominated by oil companies were eliminated because of concerns among commercial fishermen that oil operations would interfere with their activities. In other cases, BLM gave no reason for withdrawing nominated tracts from the lease sale.[15]

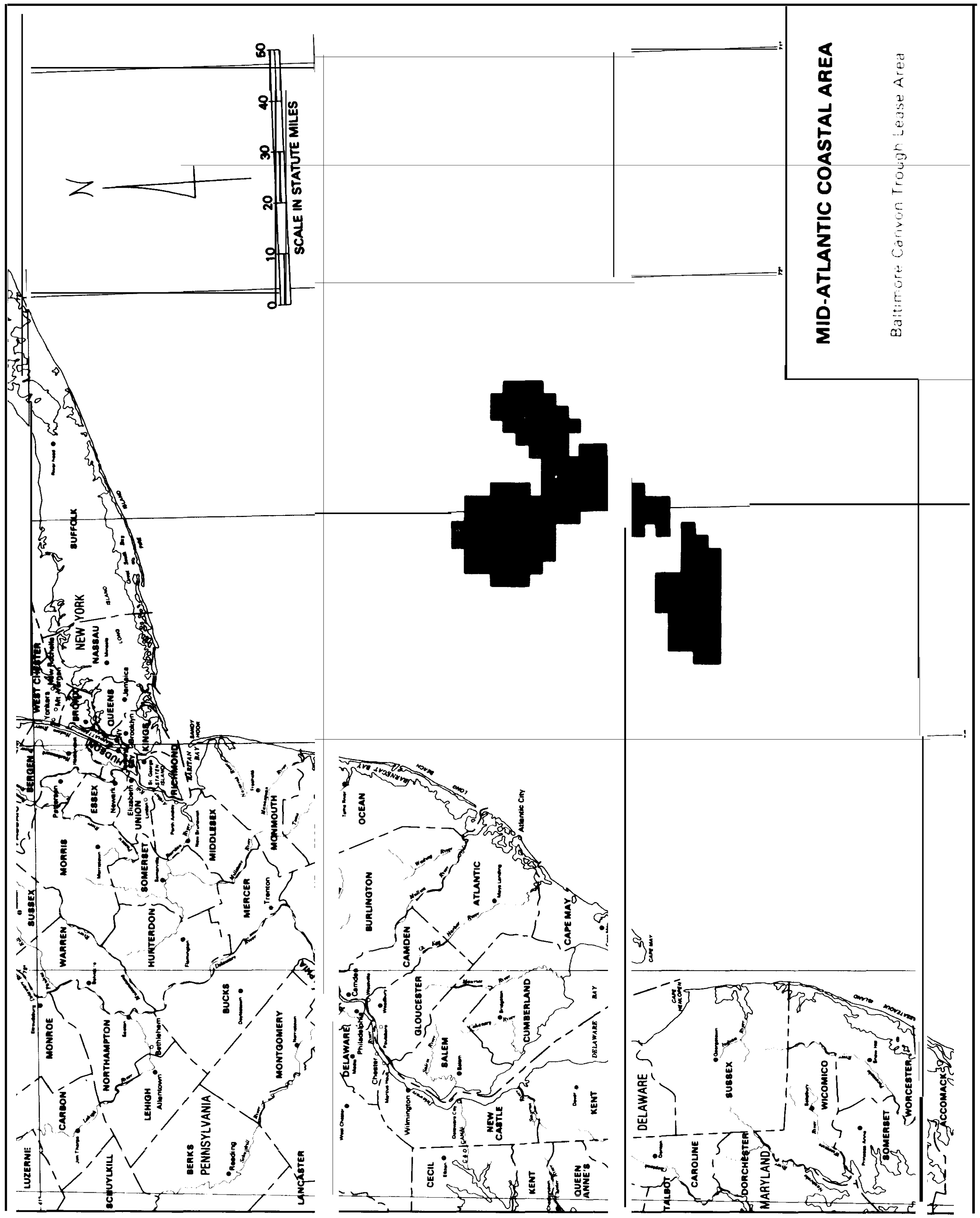
The final decision to hold the Mid-Atlantic Lease Sale #40 was made by Secretary of the Interior Thomas Kleppe late in June and the sale was finally held on August 17 in New York City.

Environmental Impact Statements

The most comprehensive packages of information which were provided to the States prior to the sale were the environmental impact statements (EIS) on the Baltimore Canyon Trough Lease Sale #40. The environmental impact statement is required by the National Environmental Policy Act (NEPA) for any Federal action that may have a "significant" effect on the environment.

Preparation of the document was largely the responsibility of the regional BLM office in New York. But staffing problems at the New York City office forced BLM to choose in early 1975 between meeting a deadline for the draft EIS and taking time to do research on coastal impacts at the county and local rather than the State level. BLM officials chose to rely on secondary data for such important data as tourist income to Cape May County and other New Jersey coastal areas. Although Interior claimed that contractor-prepared data was used for overall consistency among the tourist areas, in the case of Cape May County, the decision resulted in a basic conflict between the draft impact statement's assessment that annual

Figure IV-7. Baltimore Canyon Trough lease sale area



Source Off Ice of Technology Assessment and U S Department of the Interior tourist receipts for the County were $33 million and County records that showed the receipts as $120 million.[16] After protests by Cape May County and the State of New Jersey, tourist income figures were revised in the final EIS to reflect the county's tabulation.

The draft EIS was issued December 10, 1975, and circulated for comments by Federal, State, and local agencies. Public hearings were held January 27–30, 1976, in Atlantic City, N.J., and the final impact statement was released May 26, 1976.

Both impact statements were prepared without benefit of recent updated guidelines or regulations as to content. The only applicable guidelines for preparation of EIS in Interior are contained in two manuals and an instructional memorandum. Neither manual is more recent than 1972.[17] No recent manuals implementing CEQ guidelines of 1973 have been issued, although BLM did say that a revised manual is currently in preparation.[18]

The environmental impact statement is supposed to guide the Secretary on the question of whether a lease sale should be held and which tracts should be leased after consideration of the proposed action, the consequences of that action, and the alternatives.

But State officials and some participants in the OTA public participation program expressed doubt that the impact statement for the Mid-Atlantic was adequate for that purpose.

The declared intent by BLM to "lease in all frontier areas by 1978," including the Mid-Atlantic, has led to an impression among New Jersey and Delaware officials that the EIS process was a procedural requirement unrelated to the actual leasing decision.[19]

Predicting the environmental consequences of any proposed action must, of necessity, involve some uncertainties and some guesswork. In the case of OCS development, some of the most specific and significant impacts cannot be predicted before exploratory drilling produces information on the quantity and location of OCS oil and gas. Despite these limitations, pre-lease environmental impact statements can be made more responsive to State needs by requiring that the EIS contain details of alternative "exploration plans, " including possible locations of onshore support facilities for exploration, complete sets of OCS orders and lease stipulations covering specific geographic regions. To insure that the EIS contains as much useful information as possible, BLM could be required to solicit—in advance of preparation of the EIS—written comments by affected States on information they wish to have developed and included. Joint Federal-State preparation of the EIS also could avoid some of the difficulties encountered in the Mid-Atlantic statement where States and localities found that information about their areas was either inaccurate or missing. An additional requirement could be imposed that would call for the draft EIS to be submitted to the affected States well before it is released, with release conditional upon State agreement that the draft contains accurate and relevant information about the States.

The basic decision as to whether an impact statement will be written is left to the Federal agency initiating the "major Federal action. " There are only departmental guidelines on what constitutes a "major Federal action" for purposes of NEPA, and Interior officials concede that ultimately the decision on whether a statement is required is "a judgmental one" made by "responsible Federal officials. "[20] In the case of OCS activities, Interior has determined that the major action is the decision to lease and prepares impact statements at that stage. Subsequent stages, such as exploration or development of the leases, are not considered major actions and separate impact studies are not made.

Presently, the State role with regard to NEPA procedures-consisting primarily of written comments and oral testimony on the draft EIS—is, at best, that of commentator. State comments on an EIS are not binding on a Secretary of the Interior when he is deciding whether to hold an OCS lease sale that would affect coastal States. State recourse to the courts is purely procedural. A State can prevail temporarily, and thus delay a lease sale, if it can argue successfully that the Interior Department has not fulfilled the obligations of the Act, but it cannot reverse a decision on the merits of its case.

States question whether the timing or the contents of recent EISs qualify as decision-making tools for the Secretary rather than as justifications for his decisions.

The National Environmental Policy Act gives the States 30 days to comment on the final EIS but Secretary Kleppe announced his decision to hold Lease Sale #40 Only 21 days after the final statement for the Mid-Atlantic was released and without waiting for all the comments to come in.

Environmental and Other Studies

The EIS is supposed to guide the Secretary on the question of whether a lease sale should be held and which tracts should be leased. But it can do that only if it contains some minimum information gathered through baseline studies which are completed before the EIS is written. Without such data a Secretary cannot decide which offshore and onshore areas are environmentally sensitive or are otherwise not suitable for drilling or for siting of exploratory support facilities. However, the environmental baseline study for the Mid-Atlantic area will not even be completed until February 1977—nearly 6 months after the lease sale.

Baseline studies are intended to provide information about the existing chemical and physical state of waters before oil operations begin so that monitoring in later years can provide scientists with data to use to determine whether changes in marine-life patterns are associated with oil production.[21]

The Bureau of Land Management presently conducts an environmental studies program in OCS regions under a general mandate to collect environmental baseline data and monitor environmental changes in offshore areas under development. Prior to initiating these studies, BLM determines the kinds and amounts of data needed in each OCS lease area, usually after consulting State and local groups and the OCS Environmental Advisory Committee and holding planning conferences and workshops to design the studies. BLM usually contracts with private or university groups for the studies or, in some cases, delegates the work to the Commerce Department's National Oceanic and Atmospheric Administration.[22]

NOAA is presently conducting a broad range of environmental studies for BLM. In the Mid-Atlantic, the Virginia Institute of Marine Science is under contract to BLM to conduct an offshore baseline study only. In all cases, lease sales are planned before any data from these studies are available and, therefore, the timing of the studies has been severely criticized.[23] It is evident that the environmental studies to date are useful neither for the EIS process or to affect a leasing decision because they are not completed in time to be used. It also is not clear whether later OCS management decisions could or would be affected by data from environmental studies. Certainly there is no firm requirement to utilize the data. Interior has even opposed legislation which would give it the power to cancel leases if serious environmental problems were identified by the studies.

Presumably, a monitoring program in an OCS region where oil is being produced may detect adverse environmental impacts. However, no formal procedures exist for using monitoring data to regulate production activities. Some State representatives claim that a formal method to tie environmental studies to management decisions is needed. Others claim that too much effort is being spent on these studies, that a minimum of critical baseline and monitoring data is needed at leasing time, and that only after a discovery is made should environmental studies receive serious attention .24

BLM also handles or regulates the collection and dissemination of other types of information in addition to that gathered in baseline studies and environmental monitoring.

One example is a contract for a comparison of costs and benefits of oil development as it relates to coastal areas. This contract was sent out for bids in February 1976, nearly a year after the call for nomination of tracts for leasing, despite the fact that the States had been expressing concern for more than 2 years that they might have to underwrite part of the costs of offshore development by providing new roads, new schools, and other public service to support an increase in population. [25]

Deadline for completion of the contract—assuming the deadline will be met—is June 1977, by which time exploratory drilling probably will be underway off New Jersey and Delaware.

Interior has explained the discrepancy in timing by saying that the study is not intended to turn out information that will be useful to the Mid-Atlantic. Rather, according to staff members in the office of the OCS Coordinator, it is intended to use the Mid-Atlantic as a model for developing a system of predicting costs and benefits for other frontier areas.[26]

In another effort to collect and distribute data, the Bureau of Land Management and the Office of Coastal Zone Management planned a series of field trips to coastal States in early 1976 to ask State officials what information they required to begin planning to cope with the onshore impacts of offshore oil and natural gas development.

However, no plans were made to guarantee that studies and analysis would be initiated to answer the questions which the States might pose to the joint teams since many departments and agencies could be involved in answering the questions. This action could further undermine State confidence in the seriousness of the Federal Government's attempt to assist them in planning for OCS development.

According to Interior staff members, the list of data needs identified by the BLM/OCZM survey will be distributed to all agencies with potential interest or responsibility in the OCS and coastal zone so that each agency can deal with the problems in its own way. In a final report, BLM will identify needs that are common to all States, needs that are common to each leasing region, and needs that are specific to certain States. This report, which will be distributed to the States and Congress as well as the agencies, is expected in late 1975.[27]

In interviews, Federal officials have emphasized the long lead-time involved in offshore development and said that they felt that the States were operating under a misapprehension that offshore development would occur suddenly. In fact, they said, platforms probably could not be installed off the New Jersey and Delaware coast before 1980 and development of the Baltimore Canyon Trough would be drawn out over a period of 20 years or more.

There is one aspect of the pattern of development, however, that could compress the lead times for offshore development. Oil companies contract with independent service companies for most of the goods and services involved in exploratory and production drilling. Some service companies would establish operations on the East Coast at the onset of exploration drilling, which could begin early in 1977. Service companies tend to cluster in the same area so that the first of these companies to establish an east coast base might very we]] make a long-lasting decision about the location of staging areas and other support facilities before either New Jersey or Delaware had completed a coastal zone management plan.

Coastal Zone Management

With the passage of the Coastal Zone Management Act of 1972, the 30 States eligible for funds under the CZM program gained a potential lever in their efforts to influence Interior Department policies. At present, however, the emphasis must be on the word "potential," because the key section of the Coastal Zone Management Act—the so-called "Federal consistency provision' '—has yet to become effective.

The Act made funds available to coastal States and territories to develop coastal zone management programs. The Act contains broad guidelines for developing such programs, but leaves a large degree of flexibility to the States to meet their particular needs. While participation is voluntary, all 30 coastal States and three of four eligible territories have chosen to participate.

On completion of a coastal management program, a State submits its program to the Secretary of Commerce who approves or disapproves the program, depending on his judgment as to whether it meets legislative requirements. If the Secretary approves a State's program, the State becomes eligible to receive funds for the implementation and administration of its program, The approval of a State program also triggers the "Federal consistency" provision.

That provision, found in Section 307 of the Act, reads, in part, as follows:

> After final approval by the Secretary of a State's management program, any application for a required Federal license or permit to conduct an activity affecting land or water uses in the coastal zone of that State shall provide in the application to the licensing or permitting agency a certification that the proposed activity complies with the State's approved program and that such activity will be conducted in a manner consistent with the program. At the same time, the applicant shall furnish to the State or its designated agency a copy of the certification, with all necessary information and data. . . . At the earliest practicable time, the State or its designated agency shall notify the Federal agency concerned that the State concurs with or objects to the applicant's certification. . . . No license or permit shall be granted by the Federal agency until the State or its designated agency has concurred with the applicant's certification or until, by the State's failure to act, the concurrence is conclusively presumed, unless the Secretary . . . finds . . . that the activity is consistent with the objectives of this title or is otherwise necessary in the interest of national security. (Emphasis added.)

During the summer of 1976, the Office of Coastal Zone Management (OCZM) drew up a draft of regulations for implementing the Federal consistency policy.

The philosophy behind the regulations centers on the mutual "cooperation" and "involvement" of Federal and State agencies and is summed up in the draft:

> . . . the consistency provisions are dependent upon the continuing cooperative, participatory and reasoned interaction of the coastal States and relevant Federal agencies set forth throughout the Act and highlighted in its legislative history. This one aspect of the many implementary activities States will undertake, will require the closest possible one-to-one involvement of the State and Federal community. The Secretary, and through him, NOAA and OCZM, will maintain responsibility for prudent administration of the Act and assuring that the views of the Federal agencies and the States are balanced within the framework of national CZM policies. In addition to its 'good offices,' NOAA will also utilize its

responsibility to evaluate the continuing performance of the States and its reporting responsibilities to the President and the Congress to assist in achieving the intergovernmental goals embodied in the Act and its consistency provisions.

The draft regulations also set up procedures for maintaining consistency of Federal projects, licenses, and permits with State coastal zone management programs. In the case of conflicts which cannot be resolved by the State and Federal agencies involved and the OCZM, the Secretary of Commerce makes final decisions "guided 'by a presumption of validity of the State agency's position except to the extent that the (Federal) applicant makes out a case for the proposed activity being either consistent with the purposes of the Act or necessary in the interest of national security or both."

The Office of Coastal Zone Management has not finally defined "national interest" but has suggested that States meet the requirement for considering national interest by developing a policy statement concerning the national interest in their coastal zone.

The Secretary's decision on whether the Federal action shall be allowed is final, except that he is bound to report to the President and Congress on all activities and projects which are not consistent with an approved State management program.

There is some uncertainty about just how much leverage the Federal consistency provision would give a State over OCS-related activity. It is clear that having an approved coastal zone management program would give the State an additional vehicle for influencing the location of those onshore and nearshore facilities, such as pipelines, which require a Federal permit. However, because the State's objection to a proposed Federal action can be overturned by the Secretary of Commerce, Federal consistency does not provide an absolute veto over actions the State deems undesirable. Despite that limitation, the existence of the provision and the potential for delay that it gives a State should give a company seeking a permit, the permitting agency, and the Secretary of Commerce an incentive to work together to insure that State concerns are taken into account before any decisions about the location of facilities are made.

While the general relevance of the Coastal Zone Management Act to onshore and nearshore OCS-related facilities is clear, only under 1976 amendments to the Act was it specified that each Federal lease had to be submitted to each State with an approved coastal zone management program to determine whether the lease is consistent with the State program. The amendment specifically applies the consistency requirement to the basic steps in the OCS leasing process-exploration, development, and production—in an attempt to satisfy State needs for complete information, on a timely basis, about the details of the oil industry's offshore plans.

While the amendments give the States an important new point of access to the OCS decision process, they also will expedite OCS oil and gas development by specifying that once a lease is certified as consistent all individual activities described in detail in the leasing information submitted to the States also will be presumed consistent.

The leverage created by the "Federal consistency" provision is only potential at this time because no State has received approval for a coastal zone management program. In fact, the applicability of Federal consistency to OCS leasing was moot as far as New Jersey and Delaware was concerned because neither State had an approved management program at the time of the lease sale. Approved programs in both States are not expected until early 1977.

Grants to Delaware for coastal zone planning as of July 31, 1976, totaled $511,666, of which $102,000 was a supplemental grant to be used for work related to OCS development.

New Jersey grants total $1,082,750, including $377,000 in supplemental funds to be used by county planning offices to finance studies and planning for offshore development on a regional and more detailed scale than will be done by the State coastal zone planning office.

The 1976 amendments also intensify State needs for data about OCS activities and expected impacts because the amendments require that States plan for possible location of energy facilities in the coastal zone. The amendments also require that States show that they will be affected by energy facilities in order to qualify for planning grants and loans under the Act.

The Office of Coastal Zone Management (OCZM) could have a significant impact on offshore energy development when States begin to complete coastal zone plans. The Office has had a relatively minor role in offshore energy development to date. This could change when New Jersey and Delaware submit final plans and the Office- must make judgments about whether the plans make sufficient allowance for coastal zone activities that are in the "national interest" and whether, in turn, Federal activities in coastal zones are "consistent" with State plans.

State officials have expressed a hope that once coastal plans are completed the Office of Coastal Zone Management would- function as a clearinghouse for Federal activities and plans to help States sort out various Federal programs with coastal implications. They also have said they hope that once coastal plans are completed OCZM will assert authority to force coordination among Federal programs that involve coastlines.

With the passage of the 1976 amendments to the Coastal Zone Management Act, giving OCZM an additional $1.2 billion for grants and loans to coastal States, Congress has additional criteria for determining whether OCZM is adequately asserting its role as coordinator.

State Views.

The list of specific grievances which State officials say arise from existing laws and practices is long. For example:

- A decision was made within the Bureau of Land Management in January to postpone the sale of Mid-Atlantic OCS leases from May 1976 to August or later. State officials had not been advised of the decision as late as March, although the decision was common knowledge among State officials as a result of informal discussions with BLM personnel.
- The Interior Department has refused to share seismic data with State officials on the ground that it is proprietary information. State officials could purchase the data from individual seismic survey companies and pay geologists to interpret the data to give the States early warning about the possible location of major exploration activities and, in turn, about specific areas of coastal impact.[28] Delaware officials were told by the Office of Coastal Zone Management that they could use Federal grants to pay for the data and interpretation which the Interior Department declines to share with them.[29] As of August 1, the State had spent nearly $27,000 acquiring seismic data.
- The State of New Jersey proposed that the task of preparing an environmental impact statement be handled by the affected coastal States under contract to the Interior Department. The Interior Department said such an arrangement was not possible, but the Council on Environmental Quality advised OTA that it would be acceptable for the Interior Department to contract with a coastal State for data and informational support for Interior preparation of an EIS, including a State-oriented analysis of environmental impacts.

- State officials complain that there has been no single person or office within the Interior Department to which they could turn for answers to important questions about OCS development.
- They also say they have been forced to argue their right to information that should have been offered freely.
- State and county planners said that they had invested both money and manpower in gathering data to aid in assessing potential impacts of offshore energy development but that the draft EIS did not reflect the data that was forwarded to the Bureau of Land Management.
- Information which was supplied to the Bureau of Land Management about the importance of the tourist industry was not used in the environmental impact statement on the proposed Lease Sale #40 and was, in fact, replaced by inaccurate data which was obtained from other sources.[30]
- The Outer Continental Shelf Lands Act of 1953 does not provide for State involvement in offshore energy development decisions and the States claim that the Interior Department has stuck to the letter of the law.
- Some State officials feel Congress has missed the mark in efforts to provide State access to the offshore energy process. One State geologist said "The proposed legislation seems to want to shake up the system almost in a punitive fashion . . . but the States still would stand somewhat on the outside. Having more power pulled into Congress wouldn't help the States."

Under the present system, there are several stages in the process where a form of State participation is possible but not required. In a "fact sheet" dated December 1975, the Bureau of Land Management listed eight steps in the process (environmental study program, development of OCS orders, call for nominations, tract selection, draft of Environmental Impact Statement, public hearings and comments, decision by the Secretary, review of development plan) at which they note that there is "public participation."[31] The States participate at each of these stages by three basic methods: (1) serving on advisory bodies (e.g., the OCS Research Management Advisory Board); (2) reviewing and commenting on various documents (draft impact statement, development plan); (3) being "consulted" before various actions are taken (e.g., tract selection and offer of tracts for sale).

The BLM has instituted some changes in the past year "in an attempt to meet concerns expressed by the public and the States to improve the leasing program."[32] Included in the changes are provisions for State participation in the preparation of the final environmental impact statement and operating orders for leases off their shores. Interior has also issued a ban on joint bidding among major oil companies, cooperated with the States in securing access to proprietary geologic data from a stratigraphic test program for the Mid-Atlantic (although Interior officials told OTA they will not push industry to make similar information available in all cases), modified the bidding system, and proposed legislation for a loan program to deal with State needs for front-end money and a comprehensive oil spill liability and compensation plan.

Congress also is dealing with several pieces of legislation which will alter the processes involved in offshore leasing and development of oil and gas resources; establish ground rules for liability for oil spill damage; and place some aspects of energy development within the realm of the Coastal Zone Management Act of 1972.

No legislation, however, addresses the problems which the States view as most serious—problems that arise, by and large, from the way in which Federal-State relationships in OCS matters are now structured. State officials feel that they have no power to negotiate in a serious way decisions that affect their responsibility to State residents both to minimize harmful impacts that might result from OCS development and to assure supplies of energy that meet the needs of State residents generally and State industries in particular.

FUTURE ACTIVITIES

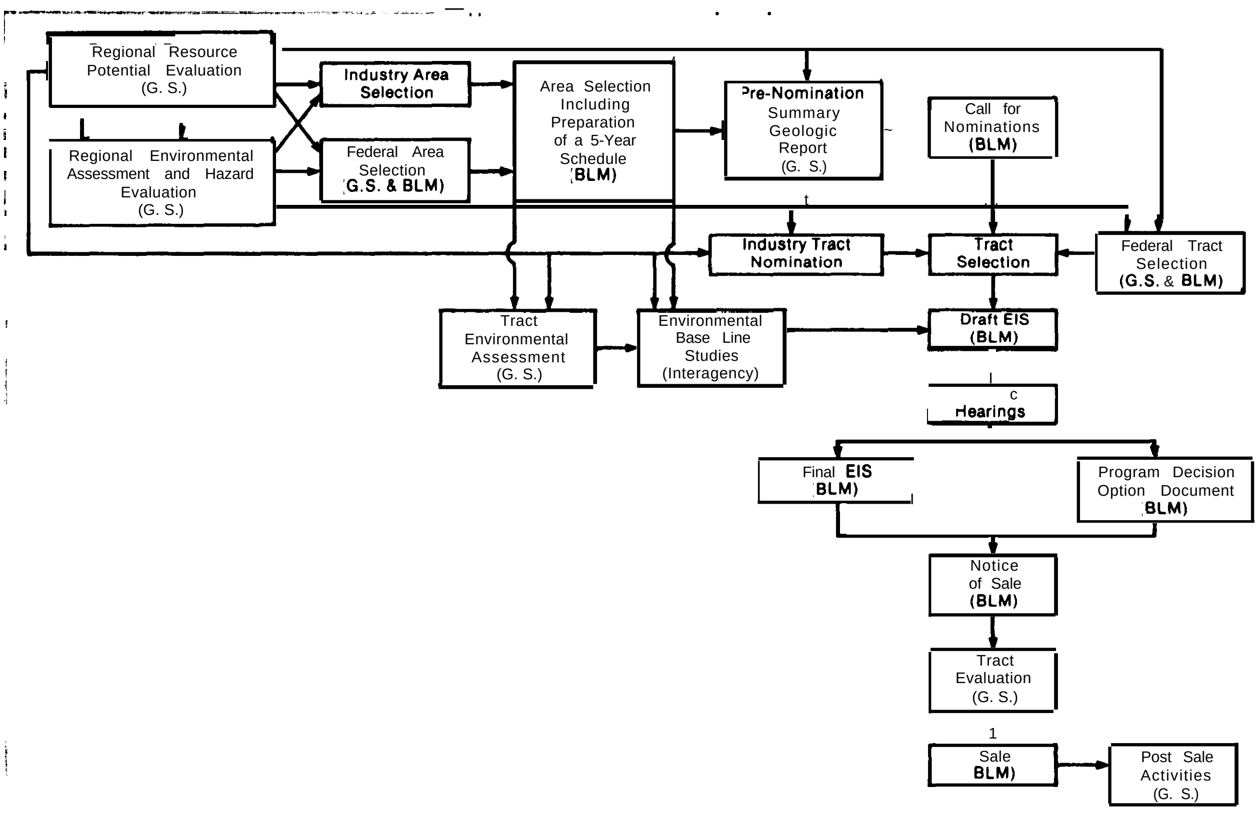
Lease Sale

The lease sale for the Mid-Atlantic frontier was held on August 17, 1976, in New York City while legislation dealing with the system for leasing and developing the potential oil and gas fields was pending in Congress.

Several U.S. Senators and Representatives asked Secretary of the Interior Thomas Kleppe to delay the lease sale until after pending amendments to the (3CS Lands Act became law.

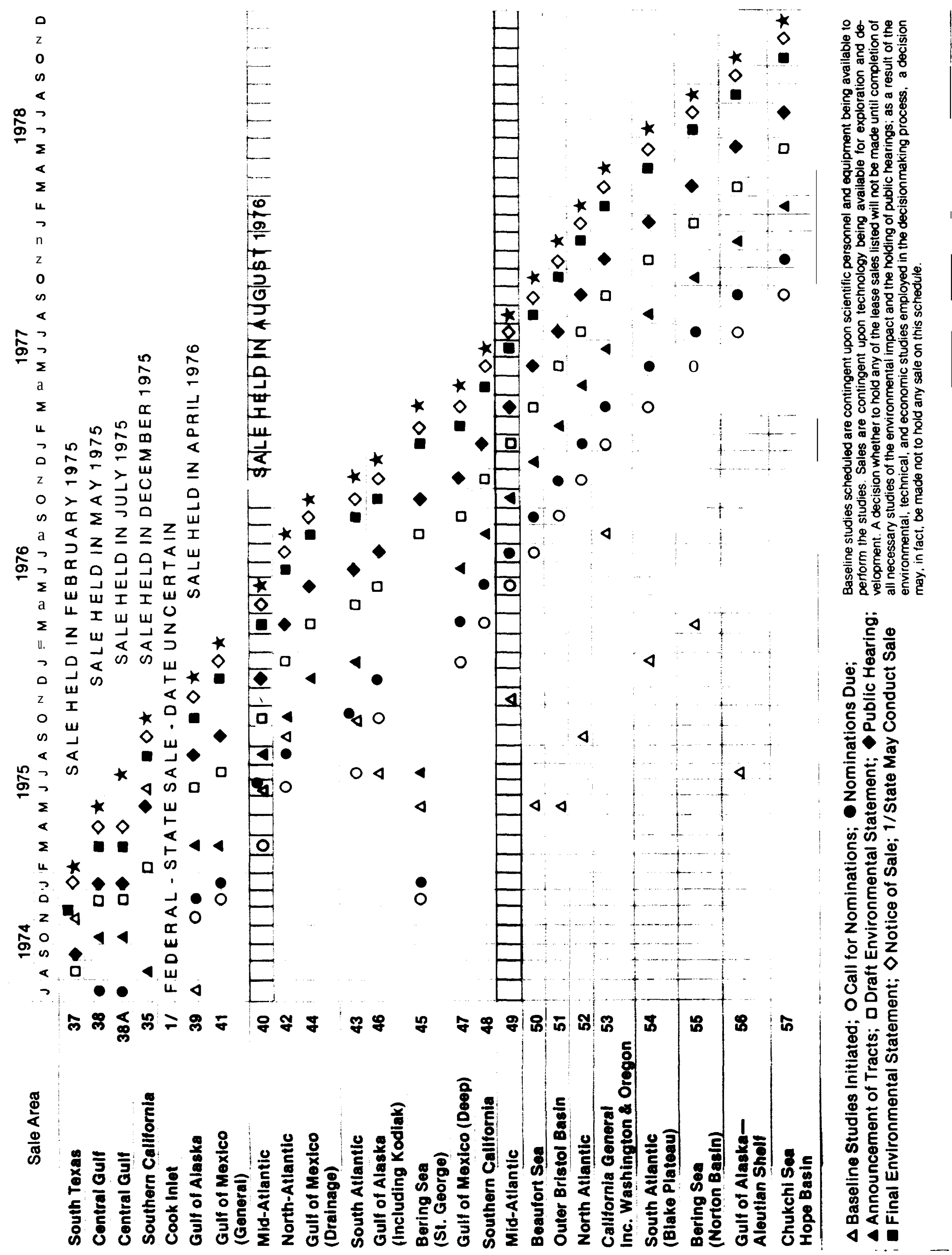
Kleppe responded that he felt "it would not be in the national interest" to delay because legislation had not yet been enacted and signd into law by the President and it was not clear that it would be.

Figure IV-8. OCS leasing procedures: information flow into decision points



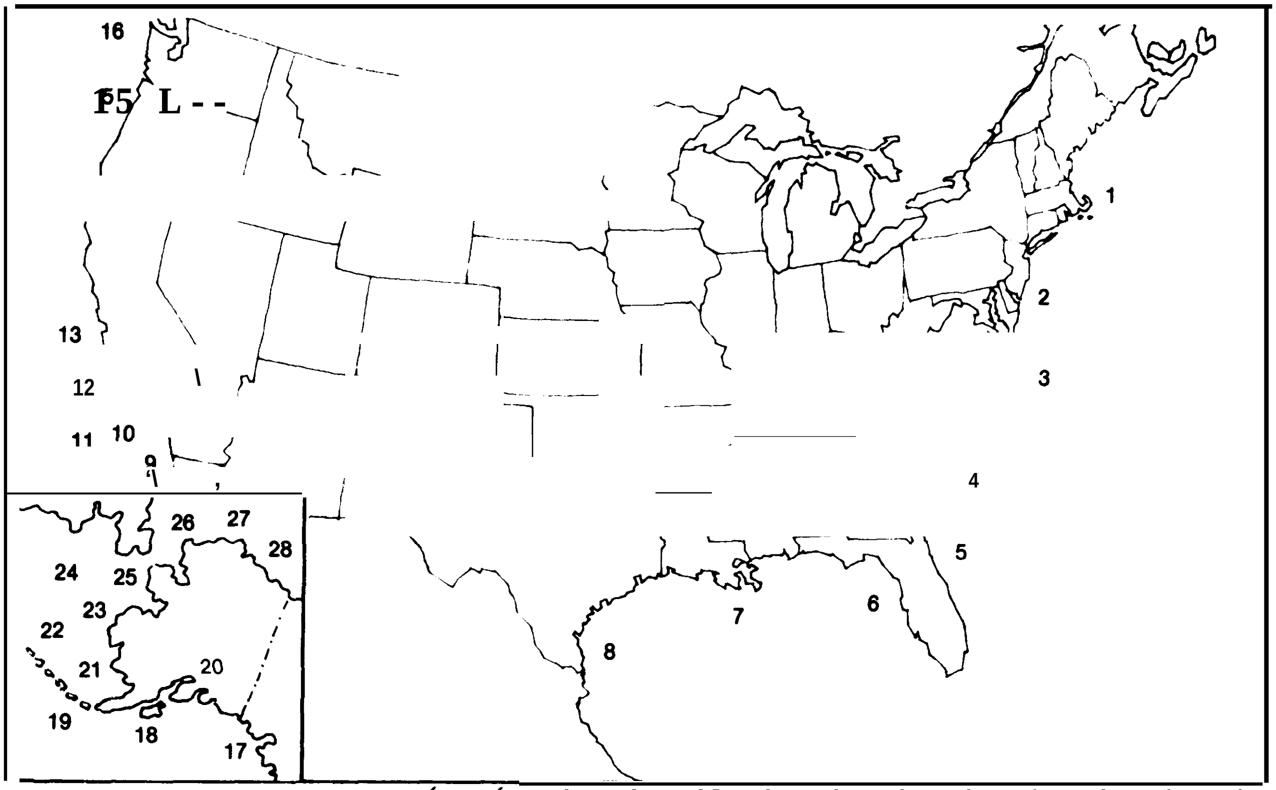
Source" Draft Environmental Impact Statement Proposed Geological Geophysical Expiration, Department of the Interior, May 1975

Figure IV-9. Proposed OCS planning schedule (June 1975)



Source U S Department of the Interior

Figure IV-10. Ongoing activities in U.S. offshore areas



Area	No.	Regional Studies	Reconnaissance Seismic	Basin Evaluation	Prospect Detection Seismic	Prospect Delineation Seismic	Prospect Evaluation	Tract Evaluation	Bid Preparation	Sale	Exploratory Drilling	Platform Construction	Development Drilling Completed	Production
Georges Bank Trough	1													
Baltimore Canyon Trough	2													
Cape Fear Arch	3													
S.E. Georgia Embayment	4													
Blake Plateau Trough	5													
Gulf of Mexico Eastern	6													
Gulf of Mexico Central														
Gulf of Mexico Western	8													
California Borderlands	9													
Santa Barbara Channel	10													
Santa Maria Basin	11													
Santa Cruz Basin	12													
Arena Bodega Basin	13													
Eel River Basin	14													
Astoria Basin	15													
Olympic Basin	16													
Gulf of Alaska	17													
Kodiak Shelf	17													
Aleutian Shelf	19													
Lower Cook Inlet	20													
Bristol Basin	21													
St. George Basin	22													
Bering Shelf	23													
St. Matthew Basin	24													
Norton Basin	25													
Hope Basin	26													
Arctic Offshore Basin	27													
Beaufort Basin	28													

Source Shell 011 Company

Kleppe said that in his opinion the present leasing program was not "seriously deficient" and the legislation under consideration would not clearly improve existing practices. In addition, he said, most of the provisions of the proposed legislation would be fully effective on Mid-Atlantic leases and others already issued.[33] However, a major section of the proposed legislation deals with State participation in the leasing decisions and with methods of leasing to insure competition among oil companies and participation of small firms. Those provisions, of course, could not be retroactive to leases which had already been sold.

Kleppe's determination to hold the lease sale on August 17 also ignored the fact that the State of New York, the Natural Resources Defense Council, Nassau County, N.Y., and Suffolk County, N.Y., had filed suit to halt the sale.

The sale set in motion events that will lead to at least some land and water impacts on Delaware and New Jersey whether or not oil and gas are discovered.

Virtually every phase of oil and gas exploration and development off the coast of New Jersey and Delaware would alter the physical, biological, and social environment to some degree. The biological environment could be affected by oil spills and other pollutants. The physical environment could be altered by the installation of platforms, the drilling process, the construction of pipelines, and the clearing of space for warehouse and service facilities. The social environment could be affected by expected increases in job opportunities, increases in population, and expanded need for public services.

Much of the information that is required to predict the degree to which the environment could be altered is unavailable. Much of what is available is based on resource estimates which may or may not be proved valid when actual drilling is undertaken. That situation cannot be changed but other types of data, such as that on the effects of oil spills, can be improved by additional research.

The moving force in leasing, exploration, and development is the oil and gas companies operating on the basis of developing maximum energy resources at minimum cost. Their actions are monitored, regulated, and guided by as many as 15 Federal agencies, two State governments, and a number of county and municipal governments.[34]

Top management of an oil company is involved in major decisions concerning Outer Continental Shelf activities at two points:

1. On the question of whether to bid for a lease on OCS tracts and at what price; and
2. On the question of whether to commit major funds for development on the basis of exploratory drilling results.

Most corporate decisions on bids are based on formulas that include such factors as a company's tax position, cash flow, and production costs and emphasize both the geological data available on a field and the price a company anticipates it will get for the oil once production has started.

Because offshore drilling platforms range in cost from $25 million to $50 million, depending on the depth of the water in which they are to be placed and many other factors, proceeding with development is a major management decision.

Other decisions during development of an OCS field are, by and large, technical and engineering decisions rather than policy decisions.

OTA studied the technology and deployment patterns that probably would follow the leasing of OCS land off New Jersey and Delaware as well as resulting impacts which could be projected through 1995. After Mid-Atlantic tracts are leased, the following actions will take place. The extent of each will depend on the quantity and location of oil and gas that may be discovered:

- Exploratory drilling of the most likely prospects for discoveries;
- Planning of production facilities for any fields located;
- Further development and delineation of oil or gas fields to determine actual production potential;
- Construction and installation of production platforms, pipelines to shore, and other offshore production facilities;
- Construction of shore facilities for processing, transporting, or utilizing any oil or gas produced;
- During all steps above—provision of offshore and onshore support: ships' personnel and equipment;
- Actual production of oil and gas for periods up to 20–30 years thereafter.

Many government and industry projections have been made of the number of drilling rigs, support equipment, personnel, and facilities that might be developed after a lease sale in the Baltimore Canyon Trough. During this assessment OTA projected certain deployment patterns for the New Jersey and Delaware study region. While some of the projections differed. from previous ones by industry or government agencies, the differences given were small compared with the great uncertainties associated with the oil exploration and production business.

The following sections dealing with future technology deployment and possible impacts are based on some major assumptions stemming from these OTA projections, as follows:

- Exploratory drilling will start by mid-1977.
- Total potential oil reserves in the Baltimore Canyon Trough range from a median of 1.8 billion barrels to a high of 4.6 billion barrels.
- Total potential gas reserves in the Baltimore Canyon Trough range from a median of 5.3 trillion cubic feet to a high of 14.2 trillion cubic feet.
- There is a one in twenty chance that no oil or gas in commercial quantities will be discovered.
- Given the above, OTA has, in turn, made assumptions about production levels, rig deployment, employment, and land use. These assumptions are shown in figure IV-11.

Exploration and Its Impacts

A final period of intensive seismic surveying probably would follow the signing of the first leases in the Baltimore Canyon Trough, after which exploratory drilling rigs would move onto station and begin drilling, probably within 6 months of the lease sale.

Based on current practice, industry probably would first move three rigs to the best lease prospects. If early exploration provided evidence that oil resources in the area were large, the number of exploratory rigs on station could grow to 10 during the first phase.

EXPLORATORY RIGS

Three classes of exploratory rigs, which are self-contained drilling platforms designed to be moved from area to area in an offshore development field, could be used in the Baltimore Canyon Trough area. They are drill ships, jack-up rigs, and semi-submersible rigs.

Jack-up rigs are large, complex platforms-up to 300 feet on a side-containing drilling equipment, crew quarters, and storage. They are support by massive steel legs that are lowered to the ocean floor and then used to jack the rig decks up 50 to 60 feet above the sea surface.

Semi-submersible rigs are similiar large platforms which are supported by steel legs that are mounted on submerged pontoons. When operational, the pontoons float below the sea surface and the legs extend through the surface to hold the platform 50 to 60 feet above the water. They are usually moored to the sea floor with large anchors.

Drill ships contain the same equipment, quarters, and supplies as semi-submersibles arranged instead aboard a large ship, thus providing selt-propulsion capability.

The arrival of exploratory rigs would start in operation a system of support that would expand as the field was developed.

The rigs normally carry a crew of more than 100 persons who work 12-hour shifts for 7 to 14 days. Such a system requires about 217 people, including some shore supervisors. If existing practice were followed, more than half of the crews of exploratory rigs would return to the Gulf of Mexico area when they were on leave. In addition, a large shore and workboat support force would be required, reaching a total of about 260 workers for 10 exploratory rigs.

Figure IV-11. OTA assumptions for oil and gas development in Baltimore Canyon Trough at peak production of median- and high-recovery projections (reached about 1992)

OIL AND GAS PRODUCTION

	Median Recovery	High Recovery
Oil Production (in million barrels per day)	313,000	650,000
Gas Production (in million cubic feet per day)	844	1,933

DRILLING RIG DEPLOYMENT

	Zero Discovery	Median Recovery	High Recovery
Exploration Rigs (from start to peak)	3	3-5	3-1o
Production Rigs (peak level)	o	25	52
Production Wells (peak level)	o	600	1,248

EMPLOYMENT FROM ALL OCS ACTIVITIES IN NEW JERSEY AND DELAWARE

	Median Recovery	High Recovery
Direct Employment (peak–reached about 1985)	4,500	9,000

LAND USE FOR ALL OCS ACTIVITIES PROJECTED

Activity	Land Required
Geophysical Surveys and Support	Docking space for one or two ships in coastal ports
Exploratory Drilling support	5 acres per rig in coastal ports
Platform Construction	500-1,000 acres for one major fabrication facility
Piatform Installation support	Docking space for tugboats and crane barges in a iarge port
Development Drilling support	5 acres per rig in coastal ports
Pipeline Construction support	Docking facilities and storage of 10-20 acres in large port
Oil and Gas Production support	½ acre per platform in coastal port
Pipeline Corridors	2 corridors: approximately 90 miles total onshore, 20 miles each in coastal zone, 7.5 acres/mile right of way
Tank Farms	2 sites near the coast; total 50-75 acres
Gas Processing Piants	100 acres per plant near the coast

NOTES:

- Gas processing plants will be built in the region to handle all gas produced but no new refineries are expected
- Onshore pipelines and tank farms will be the major permanent coastal facilities required to handle the transportation of OCS oil produced
- Support bases for exploration and development drilling will be located at coastal ports in the region such as Atlantic City, Cape May or Lewes, Delaware
- Construction of platforms and support for major operations such as pipelaying may take place partially in the major port areas in the region and partially at traditional construction sites outside of the region

Source Off Ice of Technology Assessment

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On the average, each exploratory rig would require about 5 acres of onshore land for logistic support. The total land requirement for this activity would peak at 25 acres under the median recovery assumption and at 50 acres under the high recovery.

This land for logistic support, known as staging areas, would serve as supply centers for offshore drilling operations. The staging areas will be the flowthrough points for drill pipe, drilling mud, fuel, repair parts, food and other materials required to maintain round-the-clock drilling operations on offshore platforms. The staging areas may be located on the coast or at deepwater harbors.

Supply boats would transport materials, and helicopters would move crews to and from the rigs and staging areas and respond to emergency calls for small items of equipment.

REGULATIONS

The U.S. Geological Survey, principally through OCS orders and other lease stipulations, regulates OCS technology and related activities. Recent studies have concluded with recommendations for several changes, including more stringent regulation of oil spill prevention equipment and techniques, better equipment standards, and increased inspection and training.

These studies have been conducted by the National Aeronautics and Space Administration, the USGS, the General Accounting Office, the National Academy of Engineering, and the Council on Environmental Quality. Recommendations have been submitted to the Department of the Interior with some regularity since 1971 and a USGS Work Group was formed to review these and recommend action.[35]

Few of the substantive recommendations of these studies—which included development of comprehensive standards and specifications, improved training, and improved inspection and enforcement practices—have been reflected by changes in proposed OCS orders for the Mid-Atlantic or other regions such as Alaska. The USGS, in fact, debates the need to complete orders and inspection plans prior to a lease sale. The USGS has, on the other hand, instituted a number of the procedural recommendations of these studies and others are planned.[36]

The USGS decided that in the case of the Mid-Atlantic, orders on platforms and pipelines would not be issued until some unspecified time after the lease sale and that inspection procedures would be established only after exploration and development activities take place. (In the case of the Gulf of Alaska OCS sale, the Council on Environmental Quality recommended that OCS orders be developed and that the sale be delayed until they were issued, but the Department of the Interior proceeded with the sale without changing its procedures.)

Development Plans

There is no assurance that oil or gas will be discovered in the Baltimore Canyon; until it is, it is not possible to predict with any certainty what kind of platforms, well completions, pipelines, pumping stations, and processing equipment may be employed. If a discovery were made, however, specific planning would begin. Each offshore operator would be required to submit a development plan for approval to the Interior Department prior to any production.

Most development plans prepared for the Gulf of Mexico have been brief descriptions and have not covered any parts of the system which were not located on the lease block.

The fact that exploratory drilling must be conducted before definite information on the reserves and, therefore, on specific onshore requirements in the development phase are known has led States to advocate separation of exploration from development.[37] State officials say they are entitled to information about onshore impacts gained from exploration before a decision is made to permit development to proceed.[38]

On November 4, 1974, the Interior Department published a revision of 30 CFR 250.34 which requires offshore oil and gas operators to submit it to States both a technical devolopment plan and a description of activities that would be associated with development.

The regulation requires operators to deliver a development plan to the States 60 days before it is filed with the Interior Department and a supplemental description 30 days before the development plan is filed.

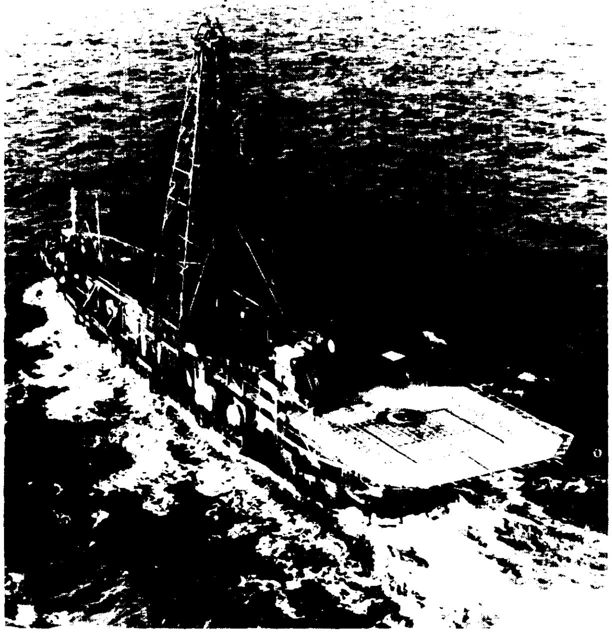
Governors would be invited to comment on development plans but final decisions on whether plans contained sufficient information to meet either the terms of the regulation or the needs of the States would be made by the USGS's area oil and gas supervisor.

While regulations on development plans do require the industry to provide certain information to the States and while officials at In-

Figure IV-12. Drilling crews work with the drill string at an offshore well similar to those which will be put down in the Mid-Atlantic.

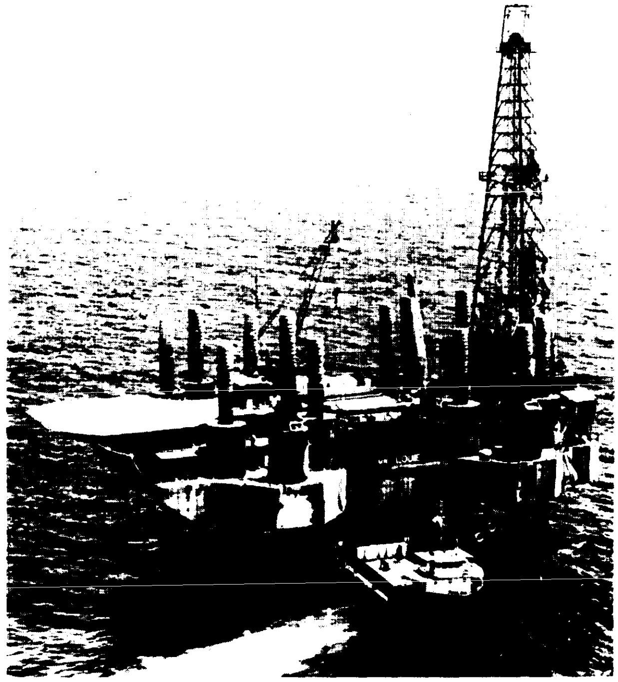
Source Shell 011 Company

Figure IV-13. Three exploratory rigs for possible use in the Mid-Atlantic



Drill ship

Source: Exxon Oil Company.



Jack-up rig

Source: Mobil Oil Corporation.

Semi-submersible **rig**

Source Marine Engineerlng/Log

terior are now asking the States what information they believe should be included in development plans, there is no description in law or regulations that specifies information that is to be provided to the States in development plans or related impact statements.

information that could be required for inclusion in inidustry plans and in supplements to standard development plans include:

- description, quantity, and location of the resources discovered;
- complete description of the oil and gas production system, including platforms, gathering lines, pumping facilities, separation equipment, and pipelines;
- all operating procedures, including environmental and other safeguards and how these will be maintained;
- a detailed analysis of the site-specific environmental conditions for the offshore, nearshore, and onshore areas where oil and gas has been found and at which platforms and pipelines would enter; and
- a detailed description of the size, required land, personnel, and proposed sites for each onshore facility, including pipeline corridors, staging areas, supply boat docks, tank farms, gas processing plants, and transportation plans for all elements of the operation.

Figure IV-14. Assumed rates of exploratory drilling

Year	Zero Recovery Assumption		Median Recovery Assumption		High Recovery Assumption	
	Rigs	Wells	Rigs	Wells	Rigs	Wells
1977	3	12	3	12	3	12
1978	3	12	3	12	3	12
1979			5	20	6	24
1980			5	20	8	32
1981			5	20	10	40
1982			5	20	10	40
1983			5	20	10	40
1984			5	20	10	40
1985			5	20	10	40
1986					10	40
1987					10	40
1988					10	40
1989					10	40
1990					10	40
1991					10	40
Total Exploratory Wells		24		164		520

Summary of Assumptions

- Drilling Begins in 1977
- Each rig drills 4 holes/year
- Basis for drilling program
  - -Zero Case: Stop in two years
  - -Median: Explore 7 major traps plus additional exploration in intermediate traps
  - -High: Explore 7 major 23 intermediate traps plus additional exploration

Source Office of Technology Assessment

The overall timing of the field development and production should be described, as well as the specific timing of each of the required facilities.

An EIS could be required to accompany development plans. The question of whether an EIS should be prepared is now left to the discretion of the USGS area supervisor (CFR 250.12). Such an EIS should incorporate all data gathered since the preparation of the draft EIS and throughout the exploratory phase as well as data to be gathered as soon as the industry begins to make proposals about specific aspects of the development plan. Included in this information should be:

- shallow geologic and oceanographic descriptions, including sediment behavior and identification of hazardous areas;
- biologic descriptions, including identification of sensitive areas;
- meteorological information; and
- information on other ocean uses in the area.

The EIS, which should be prepared jointly by the Federal agency and the affected States, should then compare various locations for each type of onshore and nearshore facility (including pipeline corridors) in terms of environmental and other consequences and should evaluate each set of alternatives with regard to consistency with the State's coastal zone management plan or comparable statements of State planning objectives for the coastal zone.

Production and Its Impacts

At peak production under the high-recovery assumption, the daily flow of oil and natural gas from the Mid-Atlantic would be 650,000 barrels a day. By comparison, the entire Gulf of Mexico, where proven reserves are dwindling, is now producing about 800,000 barrels a day.

The series of actions involved in production would have environmental, economic, and institutional consequences for New Jersey and Delaware. OTA has assumed, for the purpose of this section, no change in existing laws, regulations, or practices among oil companies or Federal, State, and local regulators.

None of the information that has been gathered during the study leads OTA researchers to conclude that oil and gas development off the Mid-Atlantic coast would produce irreversible damage or changes in patterns of life in either State, provided that the technologies were properly planned and engineered and their operations were strictly monitored. State officials, including Gov. Brendan T. Byrne of New Jersey and Gov. Sherman W. Tribbitt of Delaware, have said publicly and privately that they have reached similar conclusions.[39] They also have said repeatedly that in view of the potential for damage to their coastal areas, which are valued both for their environment and for the tourist income that they produce, the governors have an obligation to satisfy themselves that offshore development would be conducted at least as prudently as the States would proceed if they had control over the process.

PRODUCTION PLATFORMS

Working decisions during the development of a field are made by the oil company chosen as operator of the field by the owners of leases over the oil trap. The operator would contract for engineering studies for a development plan for the Baltimore Canyon Trough area, including locations of platforms, design, and locations of pipelines and size and location of tank farms. It is not likely that all elements of the system would be included in a first plan for development. The operator also would oversee construction of platforms and pipelines. In most cases, goods and services involved in developing offshore oil are provided under contract by independent companies.[40]

Production drilling would follow roughly the same pattern, insofar as offshore activities are concerned, as exploratory drilling, except that the flow of men and materials would be substantially heavier.

Depending on size, location, and extent of possible field discoveries, between 25 and 52 production platforms, each standing as much as 650 feet above the ocean floor and 60 to 70 feet above the ocean surface, would be deployed offshore. Each platform would be capable of handling 24 producing wells. Assuming discoveries in the median range, the last of 25 production platforms would be in place 14 years after the lease sale, and the last wells would be drilled 17 years after the sale. If discoveries of closer to 4.6 billion barrels were made, 52 platforms would be placed offshore, the last one some 15 years after the lease sale.

The type of platform that is most common in the Gulf of Mexico and most likely to be used off the Mid-Atlantic coast is the conventional tower or "jacket" design, a four-cornered framework of large steel pipe with legs generally 4 to 6 feet in diameter. Once the platform was in place and secured to the ocean floor by pilings, drilling decks and crew quarters would be fastened atop the jacket, the entire process usually taking a few months.

Unlike exploratory rigs, production platforms are permanent fixtures fastened to the ocean floor by pilings and designed to drill wells, hold crew quarters, and remain in place until an offshore oil field has been exhausted.

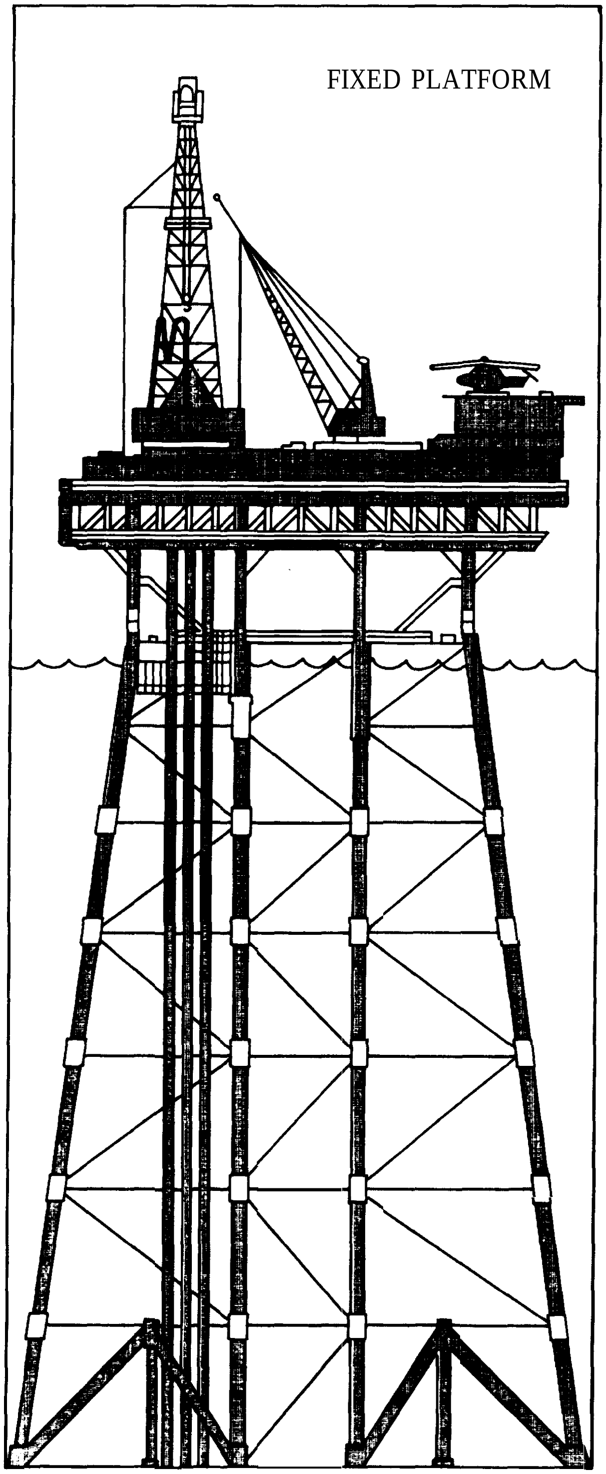
Portions of platforms could be fabricated in the Gulf of Mexico and towed to the east coast. They also could be assembled at a site in Cape Charles, Va., which was purchased in 1975 for that purpose by Brown & Root, Inc. (Rezoning for this facility has been approved, but approval of a detailed site plan is still pending.) The platforms could be fabricated at existing east coast shipyards. One large platform was constructed in a Baltimore shipyard in 1974 and towed to the Gulf of Mexico for use. Decisions on the source of platforms would be made, as would most hardware decisions, at the time the platforms were needed and on the basis of least cost to the operator. The decision would involve so many variables, such as workload in gulf assembly areas and the ability of east coast shipyards to compete for orders, that there is not enough data at this time to make a judgment about where Mid-Atlantic platforms would be fabricated.

Platforms other than those of conventional design could also be used in the Mid-Atlantic. Concrete platforms—reinforced concrete cylinders resting on submerged pedestals—are in use in sections of the North Sea. The legs and bases of such concrete structures double as offshore storage tanks which can serve both tankers and pipelines.[41]

Another possibility for oil production systems would be the use of partial or total subsea completions. With conventional platforms, drilling rigs and crew quarters are removed when all wells have been drilled. The wells are completed with systems of valves, pumps, separators, and other equipment that channel oil and gas toward collection points for shipment to shore either by pipeline or tanker. With subsea completions, a package of wellhead valves, pumps, and separators would be placed on the ocean floor rather than on a platform. A partial subsea system could also be used which combines underwater parts with a few platforms with some equipment above water.

During drilling operations to start production the "drill string" is composed of long sections of hollow pipe reaching from the platform to the bottom of the well, is suspended from a derrick. The pipe is rotated to spin the drill bit which digs each well. "Mud," a mixture of chemicals, clay, and water, is pumped through the hollow pipe of the drill string in a closed system that lubricates the bit, carries rock cuttings to the surface, and seals a well

Figure IV-15. Artist's drawing of production platform similar to those which might be used in Mid-Atlantic



Source Mobil 011 Corporation

against blowouts during the drilling process. In the Baltimore Canyon Trough, wells may be drilled to about 15,000 feet. "Storm chokes" or downhole safety halves are installed in producing wells after drilling is completed to seal off an oil flow if pressure rises suddenly and threatens a blowout. "Blowout preventers, " stacks of heavy valves, are inserted between a drilling rig and a well to control blowouts during the drilling process,

CREW REQUIREMENTS

Development and production drilling would require about the same number of platform crewmembers as exploration rigs, working 7 to 14 days and taking 7 to 14 days of leave. The flow of food, fuel, drilling pipe, casing, mud, and other materials to offshore platforms would be about the same as that required for exploratory drilling.

Once drilling was completed and wells were connected with a distribution network, maintenance crews would live on central platforms from which they would travel to producing platforms to pm-form routine repairs and inspection. On average, 50 personnel-mechanics, electricians, painters, and other maintenance workers-could service four producing platforms. Thus, offshore personnel requirements would drop, once drilling was completed, from more than 800 workers for four platforms to about 50 workers.

PLATFORM REGULATIONS

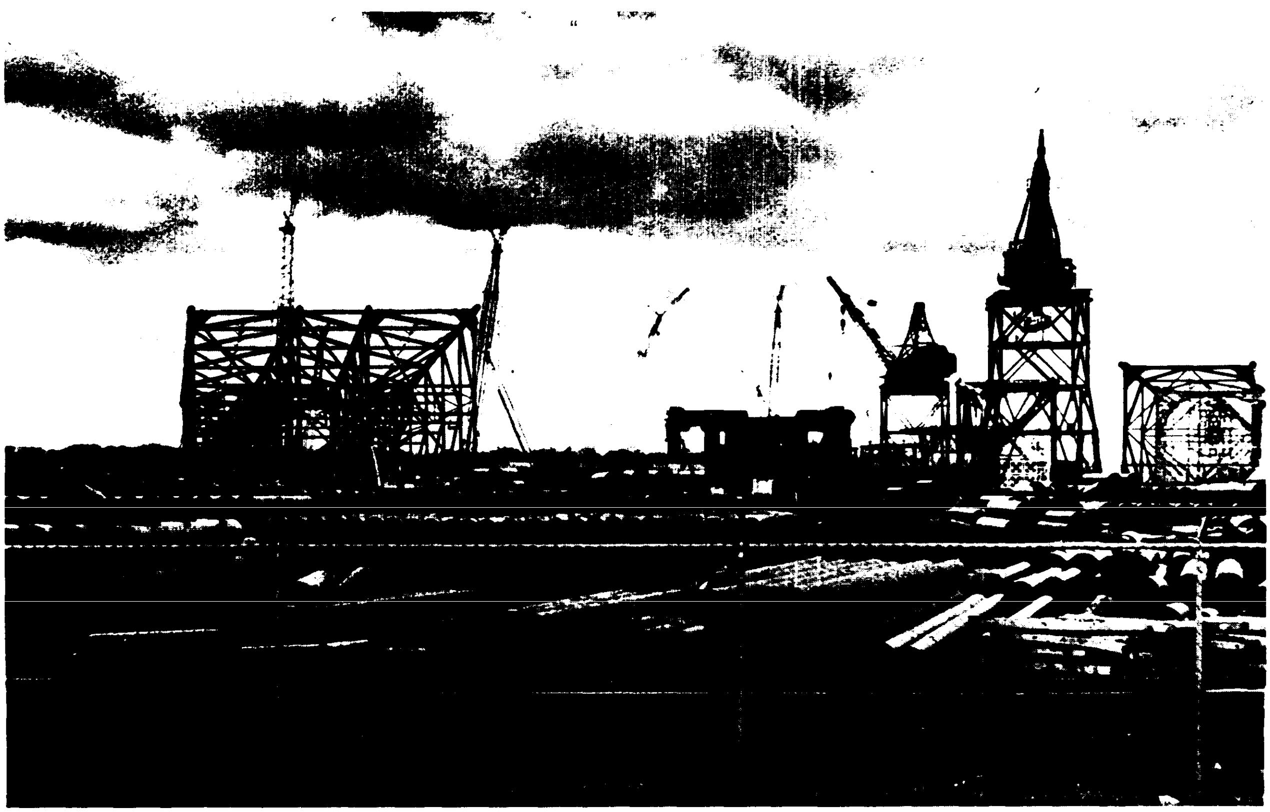
Oil production platforms are highly complex systems, subject to great uncertainties. The platforms are designed, built, and installed by oil companies under stringent, self-imposed guidelines. There is very little regulation of this technology. Most recognized industry standards at-c not required to be followed; the OCS order for platforms merely states that they shall be adequately designed and certified. Government inspections of construction, installation, and operations are not systematically planned.

The OCS order covering platforms for the

Mid-Atlantic was not issued before the lease sale. The EIS for the Mid-Atlantic states that "Major offshore structures are designed to withstand environmental stresses specified by the owner or operator. Typically, forces associated with the 100-year storm have been the specified stress." This is a major area of uncertainty: first, it is not known for sure that operators would design to a 100-year storm and regulations do not require it; second, the nature of a 100-year storm in the Mid-Atlantic is not known with any accuracy; third, the magnitude of many other interacting environmental factors such as temperature, waves, currents, and bottom stability is not known with any accuracy; and fourth, there are no recommendations as to safety factors a designer must use to account for uncertainties.

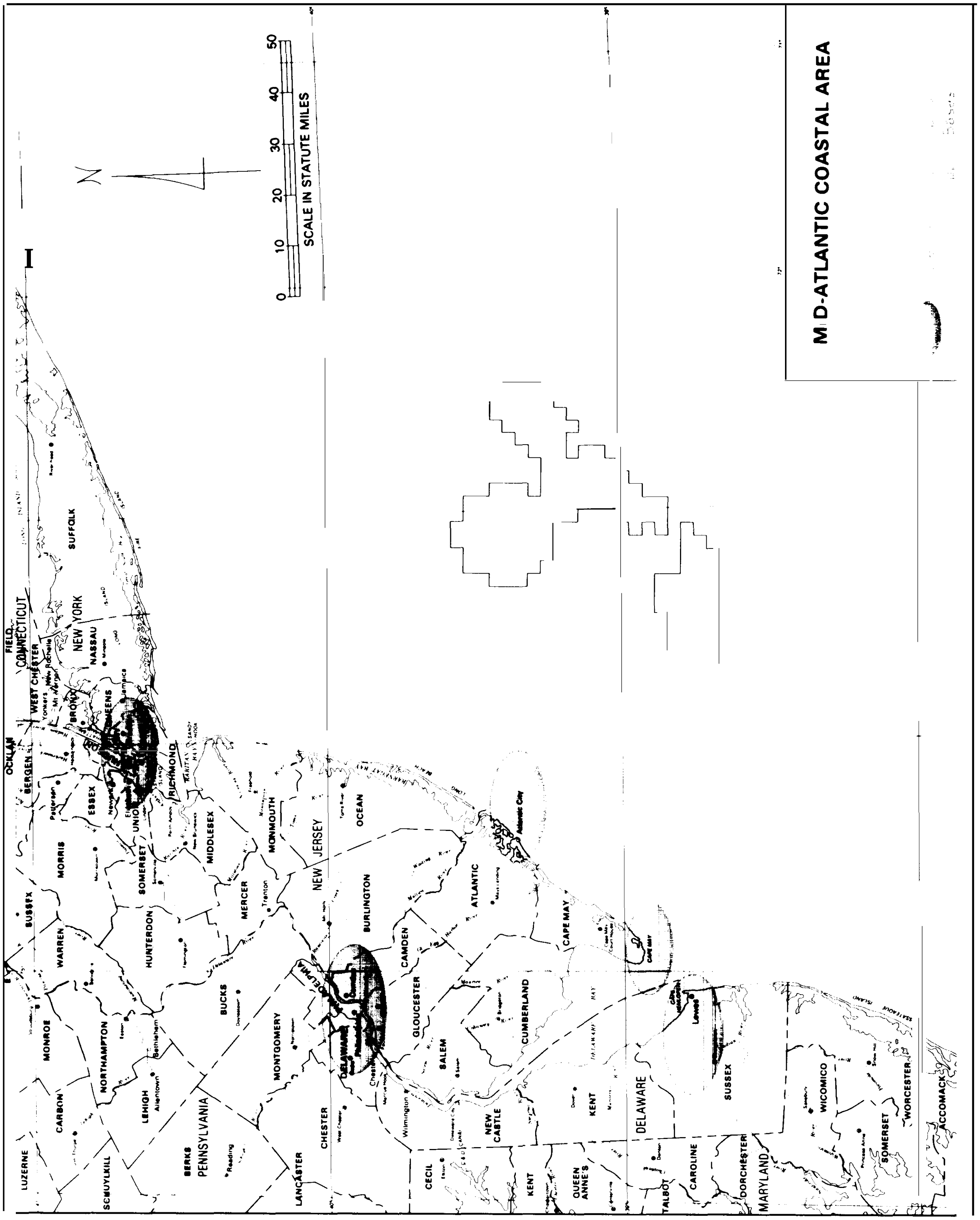
The American Bureau of Shipping, a private classification society which sets design standards and inspects offshore equipment for insurance companies, has developed specifications and inspection procedures for offshore platforms. The Bureau has certified the design and operation of over 200 floating drilling rigs (exploration rigs) and regularly works with the U.S. Coast Guard to certify ships and other floating equipment. The procedure includes publishing a book of design guidelines, completely reviewing and approving or rejecting all design plans, inspecting all materials and components as they are built, and finally, testing all major parts. The procedure has been in use in the United States for all ocean-going merchant ships for many years. Adoption of the principle by OCS regulatory agencies could increase the effectiveness of the present system immediately.

Figure IV-16. Platform construction yard outside Morgan City, Louisiana



Source: Office of Technology Assessment

Figure IV-17. Potential sites and land requirements for OCS support bases.



Source Office of Technology Assessment

Figure IV-1 7. continued

The total acreage given below is for onshore support bases which most likely would be located in coastal ports such as Atlantic City or Cape May, New Jersey, and Lewes, Delaware. The totals are for peak activity years, most likely between 1980 and 1985.

	Acreage for Median Recovery	Acreage for High Recovery
Exploratory Drilling Support	25	50
Development Drilling Support	55	120
Total Support	80	170

Source Office of Technology Assessment

It should be noted that the Coast Guard recently developed regulations for deepwater ports which, in many cases, cover technology and hardware similar or identical to that used in OCS operations. In fact, it is possible that two side-by-side structures—an OCS platform and a deepwater port platform—operating in the same environments and conducting operations with the same product at similar conditions could be regulated under quite different standards. The Coast Guard philosophy of regulation appears to be one of setting detailed, firm, and comprehensive rules for designing, building, and operating, and then carefully checking adherence to those rules. On the other- hand, the USGS philosophy appears to be one of asking for industry's best efforts and then making broad judgements about its adequacy.[42]

CONFLICTING OCEAN USES

The offshore region of New Jersey and Delaware is now used intensively for such traditional activities as commercial fishing, marine transportation, disposal of sewage sludge, and military operations. The most serious near-term offshore conflicts will probably be between proposed oil and gas operations and both commercial fishing and commercial shipping. Both coastal and trans-Atlantic traffic lanes from the major ports of New York and Philadelphia lead through or near the lease area. Many commercial fishing vessels operating out of New Jersey and Delaware and fishermen from other Atlantic coastal States also operate in the offshore waters, as do foreign fishermen. Increased marine traffic and manmade offshore structures resulting from oil and gas operations will increase the collision risk for all ship operators in the region. Offshore structures may also prevent access to some traditional fishing areas, fishing gear may be damaged by large debris accidentally dropped from oil support vessels and structures, and oil spills could cause temporary or long-term losses for fishermen.

In a letter to the Bureau of Land Management from the EPA commenting on the draft EIS for the Mid-Atlantic lease sale, the following statement was made about possible navigation hazards:

> We are concerned that the conflict between heavy vessel traffic in the Mid-Atlantic and the prescence of offshore platforms could, in the event of the lease sale, become serious. Five tracts are in the direct path of an existing shipping lane, six other tracts are considered most hazardous to navigation, and thirty-one additional tracts are in conflict with or in close proximity to commonly used shipping routes. Any accidents or collisions involving platforms and vessels, particularly during anticipated storms or fog, could pose a substantial threat of adverse environmental, social, and economic impacts on the shoreline communities where recreationl values of wetlands and beaches at-c high. Considering that adequate technology does not exist for containment of oil on the high seas, there is a probability that oil spills would impact the sensitive shorelines.[43]

SUPPORT BASES

Direct support for development drilling would require about 55 acres of staging land if the Baltimore Canyon Trough area were to yield 1.8 billion barrels of oil, and about 120 acres if the yield were 4.6 billion barrels. This land is in addition to that required for exploratory drilling, Figure IV-17 summarizes total land requirements for support bases likely in the region.

Five possible areas in the New Jersey-Delaware region could serve as staging areas for offshore development, three coastal sites and the port complexes of New York City and Philadelphia-Camden. All three coastal sites—Atlantic City and Cape May, N. J., and Lewes, Del.—would meet such staging area requirements as availability of good supply boat harbors with about 15 feet of water depth, accessibility by rail, proximity to lease sites, and availability of land for storage and service facilities. ‘

Service firms under contract to oil companies would choose staging areas on the basis of lowest overall operating cost, which cannot be evaluated in enough detail at this time to pet-m it determination of the most likely sites. Operating from coastal sites, supply boats would travel between 80 and 250 fewer miles on each round trip to the oil field than they would if they were based at either inland port. The resulting savings, however, might be offset by lower land prices at inland areas or by the cost of warehouse facilities which would have to be built if coastal sites were chosen.

Atlantic City, N. J., could provide enough acreage to meet all requirements for support development if median estimates of recoverable oil and natural gas are correct. If exploration activities expanded, additional staging areas might be required, such as Cape May and Lewes.

At present, State and local government control of land use provides the greatest leverage over OCS-related development. With State-to-State variations, the control of land through zoning and permit powers, including State powers relating to air and water pollution, is an effective tool for controlling development. Nonetheless, in the case of OCS development, States and localities find themselves limited to reacting to Federal decisions which set in motion chains of events that can affect population levels, employment patterns, requirements for State and local expenditures for public facilities and services, and social patterns. With key OCS decisions being made at the Federal level, States can only approve or disapprove location of refineries, platform construction sites, and service bases; or react favorably or unfavorably to genera] oil company efforts to build OCS-support facilities. They cannot participate in the process which leads to such decisions. Their only option is to try to exercise their legal rights to choose whether or not to approve OCS-related facilities after the fact of Federal decisions, oil company investments, and actual oil disco series.

CAPITAL INVESTMENT

Development of oil and natural gas off the New Jersey and Delaware coast could involve $2 billion to $4 billion in initial capital investments and could influence the U.S. balance of trade by as much as $50 billion over the life of the project, based on very rough figures for capital investment and discount over the life of the field.

Figure IV-18. Total new land requirements related to OCS development during years of peak activity (1 980 to 1990) in New Jersey and Delaware under high recovery assumptions

Activity	Acreage Required
Support Bases in Coastal Ports	170
Pipeline Corridors in Coastal Zone	150
Pipeline Corridors outside Coastal Zone	550
Tank Farms	75
Gas Processing Plants	700
Total Peak Land Requirement	1,645

Source Off Ice of Technology Assessment

Direct employment in New Jersey and Delaware would peak at about 9,000 workers if the high estimate of resources were correct and at about 4,500 workers if the median estimate of resources were correct. Capital expenditures would peak during the seventh year of development at approximately $1 billion. Peak land requirements are estimated to be 1,645 acres in New Jersey and Delaware. Of that, 320 acres would be coastal land and the remainder would be inland. Seven hundred acres would be required for pipeline corridors which probably would parallel existing highway or rail road lines. Figure IV–18 summarizes the total new land required.

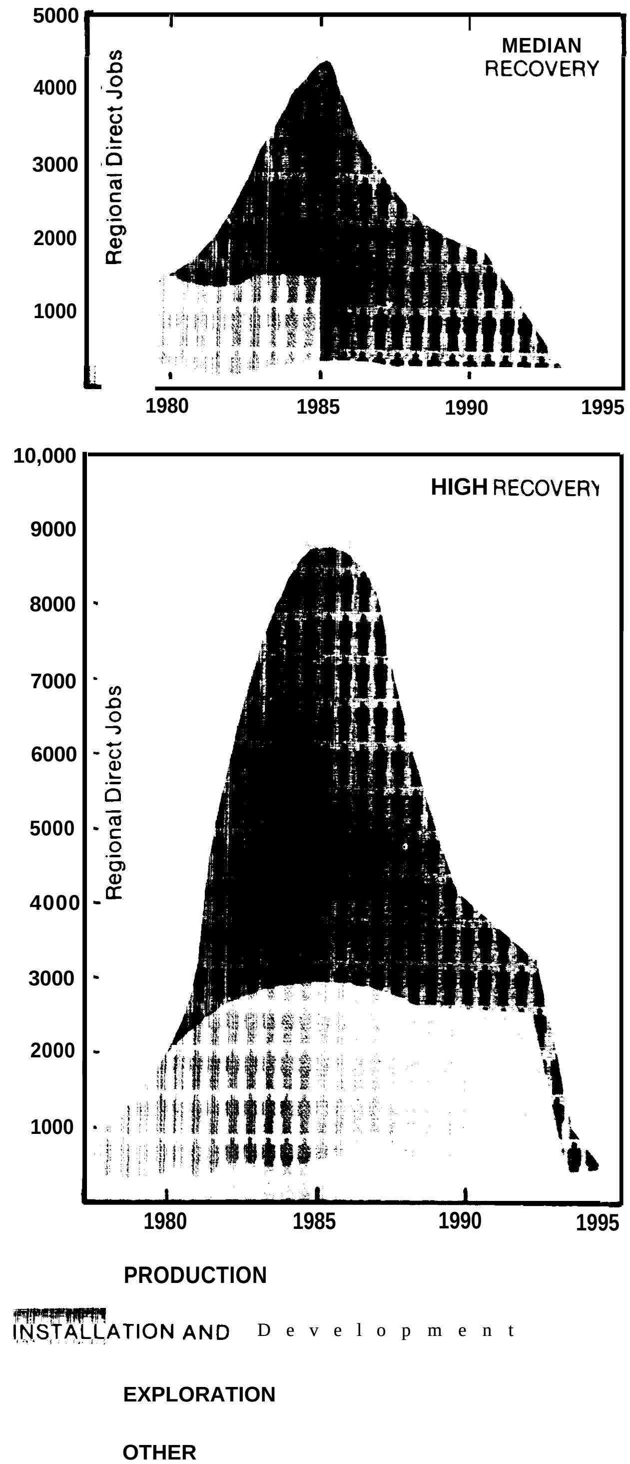
FISCAL EFFECTS

Analysis of the effects of offshore development on tax revenues in a wide variety of coastal States, including New Jersey and Delaware, shows that in States where major onshore facilities are located the per capita tax revenues from OCS activities probably would be significantly higher than from businesses and individuals in the rest of the State economy except during one time period. During the first 2 or 3 years of OCS-related development, very little revenue would be received from OCS-related businesses so that per capita revenues would be lower than the statewide average. Beginning in the fourth year, however, the net statewide fiscal impacts would become favorable as investments were made in capital-intensive onshore facilities needed during the production phase.[44]

OTA has prepared a fiscal analysis of costs and revenues from OCS activities in the States of New Jersey and Delaware assuming projected development associated with discovery of 1.8 billion barrels of oil in the Baltimore Canyon Trough.

The fiscal analysis concludes that, in general, per capita tax revenues from OCS-related activities would be considerably higher from the fourth year onward than statewide

Figure IV-19. Direct employment from all OCS activities under the high and median recovery assumptions



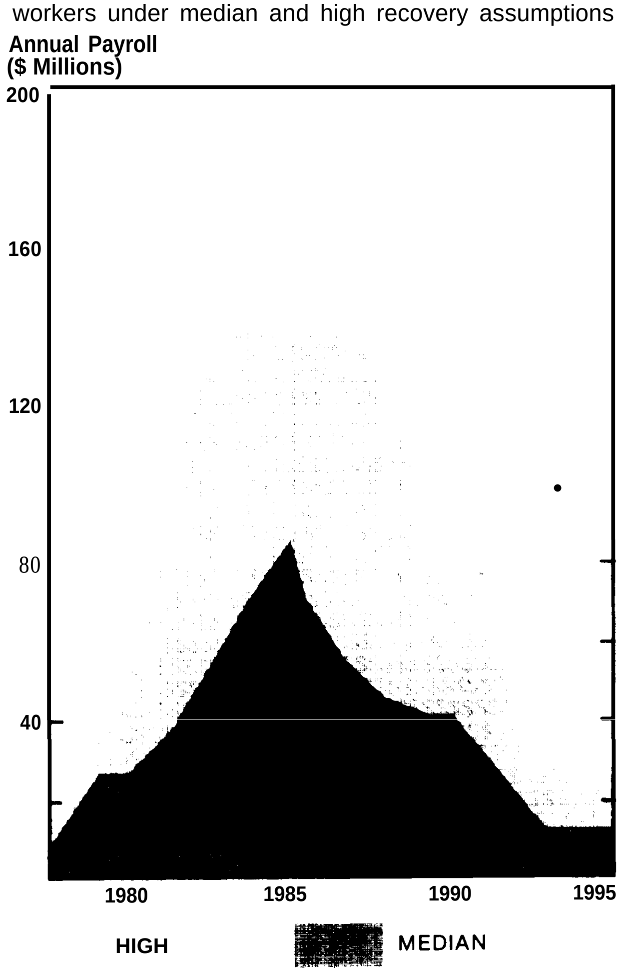
Source Off Ice of Technology Assessment

per capita revenues from other sectors under the assumptions of the study.

There is an important caveat to the conclusion. It assumes that public costs of supporting OCS bases and providing services to OCS-related workers and their families in one State would be offset by revenues from onshore investments in that same State. If, however, most of the support areas and OCS employees were located in one State and the landings of oil and natural gas were made in another, the results would be very different.

In 1972, per capita State and local revenues in New Jersey were $847. Before any major

Figure IV-20. Annual earnings of direct regional OCS workers under median and high recovery assumptions



Source Office of Technology Assessment

onshore investments occurred, revenues produced by OCS activities would be primarily those from taxes on individuals which average $512 per capita in New Jersey. Assuming that per capita expenditures for public services are about equal to total per capita revenues of $847, per capita expenditures to support OCS-related population would exceed the per capita revenues from OCS activities by about $335 during the first 2 years of development. The gap would decrease to $225 in the third year as some business taxes accrued.

The picture would change in the fourth year when major onshore investments would be made for pipelines, tank farms, and . natural gas processing plants. In the year when these investments were made, the State would receive revenues from a real estate transfer tax and from its sales tax (or equivalent use tax). Since these are assumed to be concentrated in the fourth year, the per capita tax revenue is calculated to jump nearly $11,000 in that year in New Jersey. The jump would not be so pronounced in Delaware where there is presently no sales tax.

In subsequent years, the property tax would become the main source of revenues. Property tax revenues would decline on a per capita basis for a period because they would be divided among an increasing direct population engaged in offshore construction and development drilling, Finally, per capita property tax revenues would begin to rise in the ninth year when completion of construction would lead to a decrease in OCS-related population. For all years after the fourth year, per capita revenues from OCS activities would substantially exceed the statewide average.

If either business gross receipts or corporate income taxes are added, the per capita revenues accruing from OCS-related activities would be even higher after the sixth year or so as production was under-taken. The other un - certainty—that some components of onshore construction may be exempt from sales taxation—could reduce actual sales tax revenues below the calculated levels. However, this would not alter the conclusion that, for most States, the per capita tax revenues produced by OCS development should exceed the statewide average after the first 3 years of development.

There are important qualifications to these conclusions. First, higher than average per capita tax revenues from OCS development activities imply net fiscal benefits only if these activities do not require proportionately high or higher expenditures for public facilities and services. In some States, OCS development may require facilities such as roads in areas of unusually high construction costs. This could lead to a net negative fiscal impact in spite of relatively high per capita tax revenues.

Second, the analysis deals only with normal governmental expenditures and does not take into account such less easily quantified costs as environmental degradation and loss of recreational lands.

Thus, the conclusion that there may be net fiscal benefits does not imply that there are no uncompensated costs of development.

Third, while there may be a net fiscal benefit on a statewide basis, there could still be serious localized fiscal problems if development were concentrated in a small community. One of these problems is that during the first 3 years when revenues are low, a local government may not have the fiscal capacity to provide public services to the related population, and even in year four the major revenues are sales taxes which accrue primarily to the State rather than local government. It may also be the case that onshore investments subject to sales and property taxation are in one local government jurisdiction while a majority of the associated population resides in another. This same problem may occur between States if OCS exploration and development activities are supported from bases in a State different from the one in which the oil and/or gas is ultimately landed.

STATE ROLE IN DEVELOPMENT AND PRODUCTION

Because of the uncertainty, State officials have been increasingly insistent that they be brought into the development process as participants rather than observers. State officials have been, and continue to be, concerned that such critical decisions as choosing pipeline corridors, siting tank farms, and locating staging areas may be made without adequate consultation and that, in the end, States would have to accept the decisions or try to block development. The lack of State participation at early stages of the decision process therefore creates an adversary relationship in which the State's only option for controlling adverse onshore impacts is to obstruct, possibly through lengthy litigation, thus bringing about the very delay in OCS development that the Federal Government is trying to avoid.

The States and localities have several avenues for blocking OCS development. The most dramatic is simply to file suit to block a proposed lease sale. Neither New Jersey nor Delaware has threatened such action publicly. However, staff members of the Attorneys General of both States have explored courses of legal action open to them if the Governor of either New Jersey or Delaware were to decide at some future date that the State should try to block or delay offshore development.

States and localities also have some legal basis for intervening later in the development process to block decisions that they oppose. For example, they could refuse to permit the construction of pipelines in their coastal zones by invoking their rights under either the 10th Amendment or their own riparian laws. However, State and local officials are concerned about reliance upon such measures for several reasons:

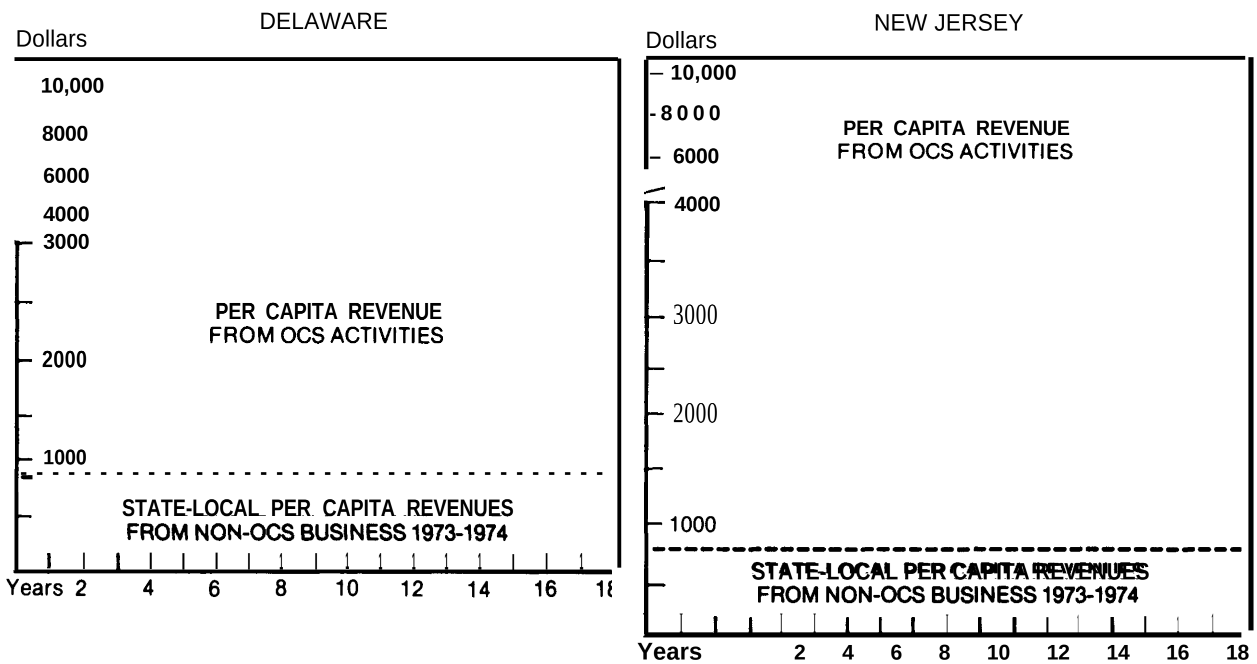
- There is some doubt about the effectiveness of these powers because they have not been tested under circumstances identical to those the States would face in confrontation with Federal powers.
- Neither State wants to block development of energy sources that may exist in the Baltimore Canyon Trough, particularly if it means fighting rearguard actions on technical points.[45]
- Some State and local officials fear that their concerns would be overwhelmed by the combined forces of the Federal Government and the energy industry joining in the search for new sources of energy. In August 1975, Thomas O'Neill, former assistant commissioner of Environmental Protection for New Jersey, said: "There is a fear among coastal residents and officials that they're not going to have any control. They see a combination of big Government and big oil coming down on them and you've got some poor commissioner in Wildwood, N. J., who feels like he's standing up there all alone against this juggernaut. "

What State officials seemed to be seeking, as reflected in interviews with OTA researchers, is a new process that would require formal, effective channels for State participation that would satisfy State obligations to protect their coastlines and still assure adequate supplies of energy for State residents and the Nation as a whole.

Transportation and Storage and Their Impacts

The next phase in development of oil and gas off the coast of New Jersey and Delaware would be construction of a network to move oil and gas from platforms to storage tanks

Figure IV-21. State-local tax revenue per OCS employee and their families compared to revenue from non-OCS workers and their families



Source Office of Technology Assessment

and processing plants and from there to refin-cries and into the distribution system.

It is technically possible to lay pipelines to shore and build storage tanks on a schedule that would have them in place when commercial quantities of oil and natural gas begin flowing from the Baltimore Canyon Trough area. OTA has assumed for this description that pipelines and tank farms would be built. It is possible, however, that pipelines would not be built if:

- oil or natural gas were found in quantities too small to justify the approximately $1 million-per-mile cost of pipelines;
- oil companies decided that for market reasons they would refine Mid-Atlantic crude in some other location;
- oil companies decided that regulation of pipelines or refineries in either State would be too stringent to warrant pumping crude ashore in New Jersey or Delaware.

In any of these cases, crude oil could be pumped from platforms into offshore storage tanks and carried to refinery sites by tanker.

PIPELINES

If pipelines were laid, the work would be done by 175-man crews working on 300-foot "lay barges" which can assemble and drop to the ocean floor 1 mile of pipeline per day. The process involves welding 40-foot sections of steel pipe, coating them with asphalt paste or epoxy resin, bathing them in concrete to make them heavy enough to stay in place on the ocean floor, and trailing the assembled pipe over the side or stern. Smaller barges, dragging a "jet-sled" over the ocean floor, follow the lay-barges and pump water through nozzles on the sled to dig a trench into which the pipeline settles.

The environmental impact statement for the Mid-Atlantic lease sale states that the following lease stipulation will be applied: "Whenever technically and economically feasible, all pipelines . . . shall be buried to a depth suitable for adequate protection. . . ." It should be possible to specify burial depths where current and sand-shifting are high, where shipping lanes and anchoring grounds are located, where pipelines are traversing beaches, or where fish trawling or dredging takes place. The terms "suitable" and "adequate protection" could be defined more precisely.

Two kinds of pipelines would be laid on the ocean floor to transport oil to shore from offshore platforms. Gathering lines, usually 12 to 24 inches in diameter, connect individual wells to central platforms. Flow lines connect central platforms to shore. In the Baltimore Canyon Trough area flow lines probably would be more than 2 feet in diameter and extend 80 to 100 miles to shore.

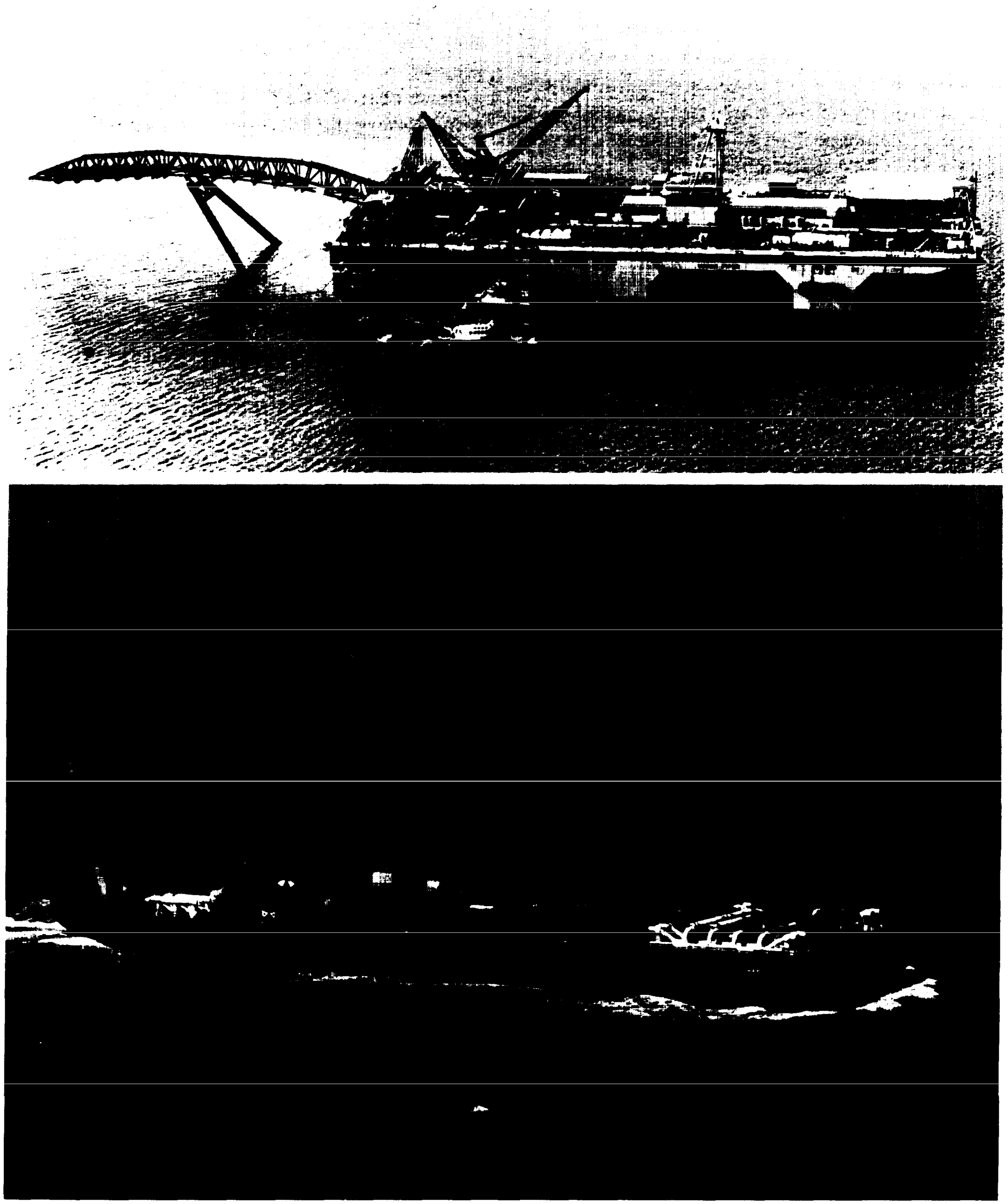
Pipelines from offshore oil and gas production facilities might carry an initial installation cost in range of $100 million[46] for a 24- to 36-inch pipeline between New Jersey or Delaware and an offshore oil field.

Given the size of the investment, it is in the best interests of industry that pipelines be coated with corrosion protection coatings and properly weighted with concrete where necessary, be installed with care from pipeline barges, be adequately welded and inspected, be buried throughout most of the distance offshore as well as onshore, and be adequately tested prior to use.

PIPELINE REGULATIONS

Pipeline networks, however, have not been subject to stringent regulatory standards in the United States in the past and pipeline failures, with resulting oil discharges, have occurred in the Gulf of Mexico as well as other offshore development regions. According to the Coast Guard Pollution Incident Reporting System data on oil spills in 1974, a major source of discharge was from pipelines.

Figure IV-22. Typical pipelaying barges similar to those which could be used in the Mid-Atlantic



Source Marine Engineering/Log

Regulatory authority for setting pipeline design standards is now divided between the Office of Pipeline Safety (OPS) in the Department of Transportation (DOT) and the USGS in the Department of the Interior. The OPS standards apply to both offshore and onshore pipelines without differentiation or allowances for special seafloor conditions or stresses due to ocean installation.

OPS has proposed modifications to standards for offshore pipelines which are quite detailed and firm but the proposed rules were not in effect when the Mid-Atlantic lease sale was held. The USGS has developed an OCS order covering pipelines in existing areas such as the Gulf of Mexico but has not developed a similar order for the Baltimore Canyon Trough. A memorandum of understanding has been developed between OPS and USGS concerning pipeline regulations, but the formal process of translating an agreement into Federal regulations could take some months.

The memorandum sets out the responsibilities of each Department, basically giving DOT responsibility for pipelines from a production platform to shore and giving Interior responsibility for pipelines from the wells to the production platform. The two Departments will coordinate inspection and enforcement activities and will jointly be responsible for research, according to the agreement, and at least once a year will jointly review all existing standards, regulations, and operating practices concerning pipelines. (See figure IV-23.)

Specific design standards, installation practice specifications, and scheduled tests and inspections could readily be adopted for pipelines in the Mid-Atlantic region and in other OCS regions based on existing knowledge and technology. Such regulations do not require detailed knowledge of the regions or environmental conditions because specifications normally establish standards based on a formula which would accept a range of inputs and include safety factors for a specific design.

Much new technology is available to assure pipeline safety and could be incorporated in regulations, in some cases without additional research. Such technology includes:

- Standards for coating pipelines with corrosion protection materials that have been tested and proved to be effective over long periods of time.
- Standards for welding and inspecting welds and specifications for pipe materials and sizes including temperature characteristics which could assure an initially sound line.
- Procedures for installing and burying pipe which would protect the line from overstressing as water depths increase.[47]
- Pipeline inspection devices which could be used regularly over the life of a pipeline to detect any deterioration prior to a possible leak.[48] Some private firms are now using these devices to inspect offshore pipelines although few will make the inspection results public. As a regulatory tool the Government could readily perform its own inspections with these devices.

Another element of the system that would require particular attention is the placement of pipelines at coastal landfalls. Most biologists and other scientists agree that pipelines should be routed to avoid marshlands, a design that would be difficult to achieve along the Delaware or New Jersey coast. If marshlands cannot be avoided, biologists argue for ‘‘minimum disruption of such areas although there is no accepted definition of either “mini mum” or “disruption. “[49]

STORAGE TANKS

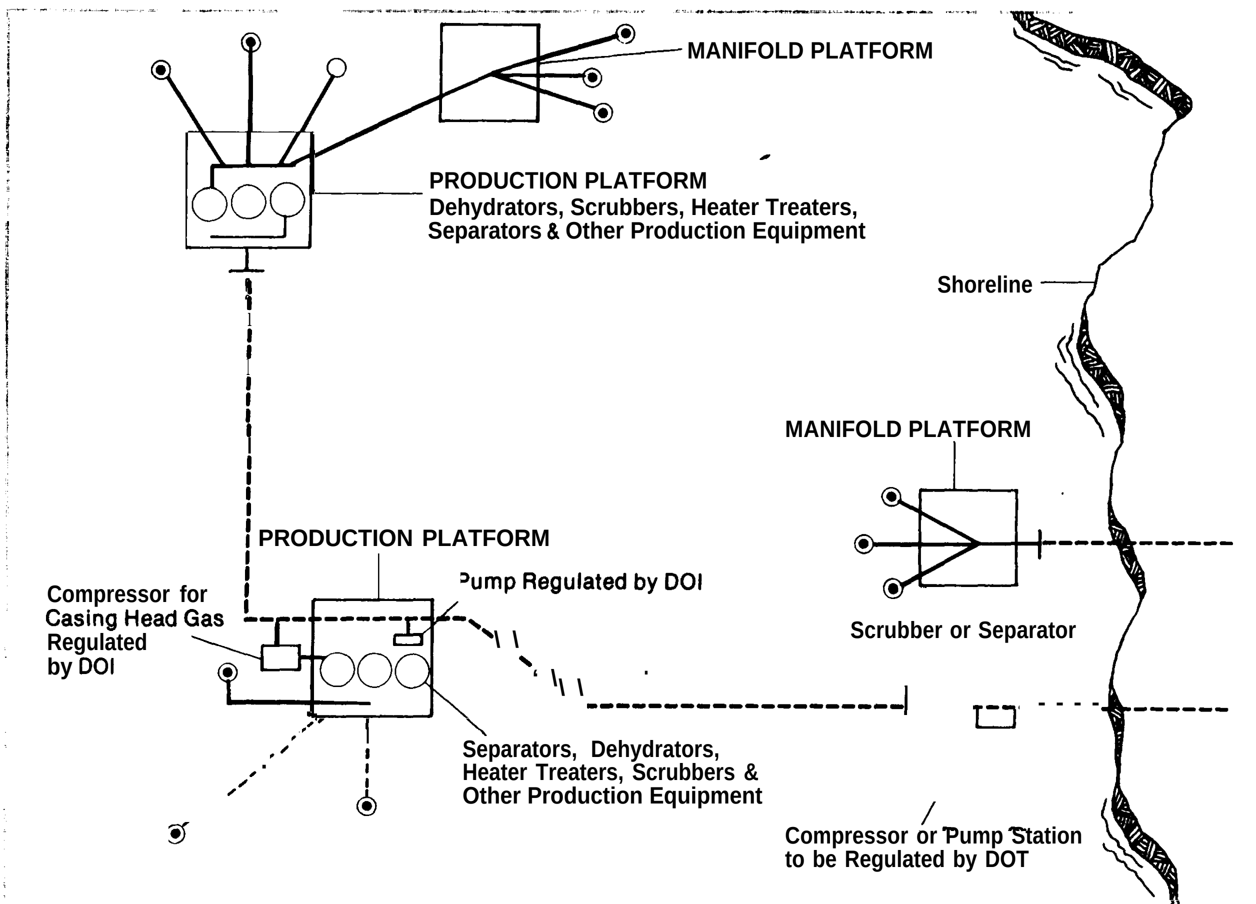
Oil coming ashore through pipelines probably would be stored temporarily in tank farms to provide a means of regulating the flow of oil to refineries. Natural gas would be piped ashore in separate pipelines to gas processing plants that probably would be located near tank farms.

The oil industry rule of thumb for such tank farms is that they would be able to hold 10 days production of oil or gas. At the median estimate of Baltimore Canyon Trough resources, this would translate to five storage tanks on about 50 acres of land which could be located close to shore or well inland. For the high recovery estimate, 75 acres would be required.

TANKERING

It is feasible and sometimes economical to transport oil produced at offshore fields directly to refineries by tankers rather than by pipelines. The practicality of such a system depends on many variables such as distance from the offshore field to the refinery, amount of oil produced, cost of pipelines, status of field development, number of wells and platforms producing, cost of offshore storage and loading terminals, gas mixture, and pollution potential. In the Gulf of Mexico all production from offshore wells is transported by pipeline

Figure IV-23. Responsibility of Federal agencies for pipelines



● Wellhead; — **Pipelines Regulated by the Department of the Interior (DO I);**

--- Pipelines Regulated by the Department of Transportation (DOT)

Source DOI/DOT Memorandum of Understanding to refineries along the coast and inland. A major reason for this is that offshore production has been a gradual extension of producing areas on the coast and many wells are spread overwide areas in relatively shallow water. In some other major offshore producing areas very large fields were discovered which justified major pipelines. In other special cases, such as some North Sea fields, it was determined that offshore storage and tankering would be the best method of transporting oil ashore at least for some initial period of field development.

In the case of offshore New Jersey and Delaware, the potential fields are a substantial distance seaward (more than 80 miles) and pipelines may not always be economically justified, especially during initial development stages. It would be feasible to start producing into a storage tank and using tankers to ship the oil ashore. Of course, if major gas discoveries are made a pipeline would be required.

There are some advantages to tankering nominal quantities of oil when compared to the disruption that pipeline construction may cause. It should be noted, however, that oil pollution from tankers may not be as easily controlled as that from pipelines.

Oil Spills

In all stages of OCS development, oil spills are a major concern and pose the possibility of major impacts.

RISK ASSESSMENT

The possibility of oil spills is usually described in terms of risk probability. An OTA oil spill risk assessment indicates that there probably would be at least one major oil spill during development of the Baltimore Canyon Trough.

OTA projects that it is unlikely that there would be more than two spills of more than 24,000 barrels of crude oil each during the 30-year life of the Baltimore Canyon Trough field. The projection of oil spill risk assumes the high recovery estimate of the USGS of 4.6 billion barrels.[50] For a median recovery estimate of 1.8 billion barrels, oil spill risk figures are roughly cut in half. (Only high and median recovery estimates were used in the risk assess merit.)

This risk assessment concludes that the odds of an oil slick, even from a major spi 11 at a Platform 50 miles offshore, reaching the New Jersey or Delaware shore would be one-in-ten after the spill had occurred. If oil slicks did reach Mid-Atlantic beaches, however, they could hit any point along the coastline. Vague and general as these conclusions are, they represent the outer limits of judgments that can be made in view of such variables as wind force and direction, wave action, ocean currents, and size and location of a spill.[51]

This estimate of the range of probable oilspills as a result of Baltimore Canyon Trough development activities has been made based on statistics from offshore oil operations over the past 10 years, principally in the Gulf of Mexico. The greatest volume of oil has come from a small number of major spills. None of these offshore spills to date has been contained and cleaned up on site. OTA's estimate of a probable range of large oil spills, given OCS development follows the high recovery scenario, is from 5,000 to 860,000 barrels resulting from 1 to 40 spill incidents, with the most likely amount being 140,000 barrels and 18 spill incidents.[52]

Should a major oil spill occur during Mid-Atlantic OCS operations it is doubtful that the spill would be cleaned up. Depending on the season, the size of spill, and prevailing conditions, the shoreline could be severely impacted. An independent study conducted for OTA by the Coast Guard, indicated that during a stagnant summer high pressure system, the probability of an oil spill from OCS sites reaching the shore is very high.[53] On the other hand, a Chevron representative at the January 1976 Atlantic City EIS hearings stated that "we believe that there is no chance of oil reaching shore from the proposed (Baltimore Canyon Trough) OCS lease area."[54]

it has been pointed out by local officials in the States that if an oil spill were to reach the coast during a tourist season, the affected area could lose an entire season receipts.[55] Economic losses would be sustained not only by those whose property was directly damaged by oil but also by those who depend for income on the seasonal tourist industry. These could include owners and employees of hotels, restaurants, charter boat operations, and other tourist -oriented activities.

Commercial fishermen also could be adversly affected—in the short run as a result of fish kills or contain i nation and in the long run if damage to spawning and feeding grounds were to reduce the yield. The surf clam industry, which is economically important to New Jersey, would be vulnerable to oil spill damage.

Severe oil spills can cause major damage to marshlands if the spill reaches inshore, to waterfowl if large quantities of oil reach their habitat, to bottom-dwelling marine life if quantities sink and smother them, and to most fish, plants, and other biota if the concentration is high enough. What is not known and cannot be measured at this time is the severity of damage related to amounts and concentrations, the effects on the food web and ultimate consumer and the long-term effects of chronic discharges. Also unknown are many specific environmental conditions of each OCS region which may affect the dispersion, trajectory, chemical corn posit ion, and ultimate fate of any spill, Environmentalists argue that with so many unknowns, coupled with potential dangers, all efforts should be directed toward preventing o i1 spills whenever technically possible.[57]

OIL SPILL REGULATION

At the same t i me, however, Federal regulatory agencies, principally USGS, do not appear to employ the best available system for establishing standards and enforcing regulations dealing with oil spill prevention and cleanup. Recommendations contained in a GAO report of June 1973 covered the need for trained inspectors, improved inspection systems and standards for enforcement. Although USGS has advised Congress that it is proceeding with programs to meet the criticisms, no detailed descriptions of changes in procedure has been published.

The Federal Government, principally through agencies such as the Coast Guard and the EPA, has invested substantial resources in the research and development of oil spill surveillance, containment, and cleanup systems. Many of the more advanced systems have been produced and are available in the Coast Guard inventory. These include airborne oil spill detection systems which can locate and "fingerprint" discharges as well as high-seas spill containment and recovery equipment.[58] But the Coast Guard has no statutory authority over oil and gas development activities on the OCS. The Department of the Interior, through USGS, regulates OCS development and has a memorandum of understanding with the Coast Guard which provides that a Coast Guard coordinator will be available in the area for emergencies.

Mid-Atlantic OCS Order No. 7, the pollution and waste control order which was published in the Federal Register on July 12, 1976, places most of the responsibility for oil spill control and removal with the USGS. According to the order, "The primary jurisdiction to require corrective action to abate the source of pollution and to enforce the subsequent cleanup by the lessee or operator shall remain with the (USGS) Area Supervisor pursuant to the provisions of this Order and the memorandum of understanding between the Department of Transportation (U.S. Coast Guard) and the Department of the Interior

(U.S. Geological Survey) dated August 16, 1971. "

According to Coast Guard instructions for implementing that memorandum of understanding, USGS has primary responsibility in any areas leased under the provisions of the Outer Continental Shelf Lands Act in recognition of USGS expertise with respect to abatement of the source of pollution at an offshore facility,

The instructions add, however, that the provisions of the memorandum of understanding will prevail only as long as removal of the pollutant is accomplished to the satisfaction of the Coast Guard on-scene coordinator. If cleanup is not satisfactory to the Coast Guard, the on-scene coordinator may take over under provisions of the National Oil Spill Contingency Plan.

In implementing its responsibilities, the USGS holds private offshore operators responsible for oil spill cleanup but has no check system to review the adequacy of the cleanup equipment available to operators.[59] OCS Order No. 7 requires only that operators inspect their own equipment regularly. Offshore cleanup is particularly troublesome because even the most advanced systems will perform only about 50 percent of the time in rough waters of the OCS.

The Coast Guard is responsible for a National Contingency Plan and has available a strike force for spill cleanup from any source. It appears that the Coast Guard would step in to clean up a spill in the Mid-Atlantic only after all other efforts failed.

On its own, the offshore oil industry apparently has developed a good safety record with regard to oil spill accidents, especially since the Santa Barbara spill in 1969.

Some oil companies have formed associations in active OCS regions for the purpose of providing oil spill cleanup systems and manpower. These are voluntary groups which are not required to use advanced technology which has been developed by the Coast Guard.

Sixteen oil companies interested in leasing tracts in the Mid-Atlantic have formed Clean Atlantic Associates and committed $1 million to purchase cleanup and containment equipment and to inventory existing equipment and expertise which could be used to supplement the group's resources.

By July, Clean Atlantic had named Haliburton as contractor for its cleanup operations and had contracted with Raytheon Corp. for studies to map coastal areas of unusual sensitivity, identify the bird population, and draw up a plan of action to be followed in the event of Mid-Atlantic spills.

Although a base of operations had not yet been formally chosen, O.J. Shirley, chairman of the group, said equipment and manpower would probably be located at Davisville , R.I., and at one of the oil company support bases which are expected to be located in either New Jersey or Delaware.

According to Shirley, Clean Atlantic would be procuring equipment throughout the summer and expected to be operational before exploratory drilling begins in the Mid- Atlantic. If commercial discoveries of oil are found, he said, additional gear may be purchasd.

Shirley has testified at hearings on the final EIS for the Mid-Atlantic sale that under normal conditions Clean Atlantic equipment could be operational at a spill site as far as 125 miles from its shore base within 12 hours.

POLLUTION RESEARCH

The OTA oil spill risk assessment also concludes that no less than 85,000 barrels of oil and no more than 1 million barrels of oil would be spilled as a total of major- platform or pipeline accidents, chronic discharge of oil from platforms, and inevitable leakage from

Figure IV-24. Clean Atlantic Associates initial equipment stockpiles

Item	Number
OPEN SEAS	
Fast Response Open Seas & Bay Skimmer Systems	2
Mini-Fast Response Units	2
Open Seas Containment Boom	2000 Ft.
Vikoma Sea Pack (1600 Ft. Open Seas Boom)	1
NEARSHORE/INLAND	
Helicopter Spray Units	2
Boat Spray Units	3
Dispersant	50 Drums
Collection Agent	10 Drums
BEACH PROTECTION & AUXILIARY EQUIPMENT	
Communication System	1
Automatic Propane Guns (Bird Scarers) Set of 12	2

Source Clean Atlantic Associates

Figure IV-25. Partial listing of presently available equipment in mid-Atlantic area

Item	Available
CONTAINMENT BOOMS	
Small (18" & Under)	62,600 Ft.
Large (19"-36")	28,000 Ft.
Extra Large (Over 36")	4,200 Ft.
SKIMMING APPARATUS	
Self-Propelled	1
Self-Powered & Other	141
OTHER EQUIPMENT	
Vacuum Barges	4
Vacuum Trucks	28+
Pumps	161 +
Boats (Over 15 Ft.)	93
Sorbents (Pillows & Bags)	35,000
(Boom)	10,000 Ft.
Storage	32+ Million Gallons
Ocean Going Barges	50
Automatic Propane Guns (Bird Scarers)	12
Bird Rehabilitation Units	2
Earth Moving Equipment	Readily Available

Source Clean Atlantic Associates

pipelines over the 30-year life of a field. All estimates were the result of a statistical extrapolation of experience in the Gulf of Mexico and may not apply in the Mid-Atlantic if improvements in pollution control equipment and procedures should occur before the development of this potential offshore oil field.

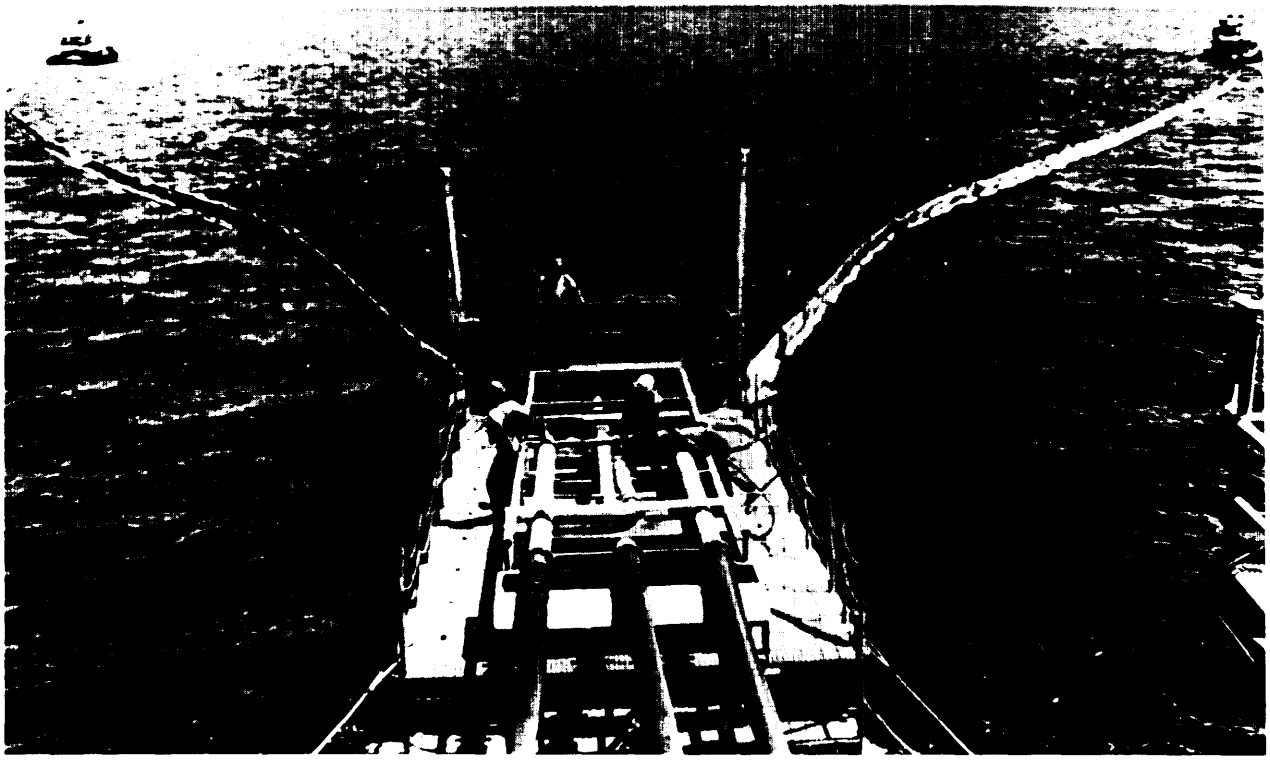
Oil companies state that the low-level discharge of hydrocarbons which result from chronic or routine discharges do not have a detrimental effect on the marine environment or the marine biota.[60]

The oil industry has sponsored a significant amount of research into the effects of oil pollution, including a study of the effects of oil operations on the marine environment off the Louisiana coast by the Gulf Universities Research Consortium.[61] In addition, the American Petroleum Institute, EPA, and USGS sponsor regular conferences on prevention and control of oil pollution at which many reports on research efforts are presented.[62] There appears to be no equivalent coordination of pollution research efforts among Federal agencies which share responsibility for OCS management.

The Report to Congress of the Secretary of Commerce on Ocean Pollution is one of the few examples of a coordinating effort.[63] The report describes oil pollution research efforts by the National Science Foundation, the Environmental Protection Agency, the Bureau of Land Management, the Fish and Wildlife Service, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, and others.

The Coast Guard has recently evaluated its

Figure IV-26. Oil cleanup equipment at work skimming spill from Gulf of Mexico



Source Clean Gulf Associates

Marine Environmental Protection (MEP) program which principally addresses oil pollution other than that related to OCS operations but which can serve as an example of analysis of causes and effects of spills. In this evaluation it is stated that oil exploration/production operations contributed only a million gallons out of the 15-million-gallon total discharges into U.S. waters during 1974. (See figure IV-27.) It is also stated that "the documented direct cost to society of all oil pollution incidents (from all sources) in the United States is about $50 million a year or in excess of $4,500 per incident. The estimate is undoubtedly low since it includes only the costs of cleanup and the value of the product discharged."

Processing and Refining and Their Impacts

Discovery of oil offshore would not necessarily y lead to the construction of new refinery capacity to process that oil. Because refinery construction and expansion decisions probably would depend more on regional demand than on local availability of crude oil supplies, it is likely that OCS oil would be processed in existing or expanded refineries and would replace higher priced crude from foreign sources by an equivalent amount. Throughput for refineries located in eastern Pennsylvania, New Jersey, and Delaware is projected to total 1.87 million barrels per day in 1985 compared with the current throughput of more than 1 million barrels per

Figure IV-27. Oil Spills in U.S. waters ranked by operation, calendar year 1974

Operation	Volume in Gallons	% of Total
1. Vehicle, Pipeline Transport	5,959,403	38.9
2. Vessel Underway	2,554,443	16.7
3. Vessel Facility Oil Transfer Operation	2,308,101	15.1
4. Unknown Operation	2,265,801	14.8
5. Natural Resources Exploration/Production	989,369	6.5
6. Vessel Mooring, Anchoring	385,487	2.3
7. Industrial Operations	290,643	1.9
8. Other Facility Operation	275,583	1.8
9. Vessel, Facility Fueling	113,037	0.8
10. Other Vessel Operation	47,104	0.3
11. Vessel Maintenance	36,658	0.3
12. Other Non Transportation Related Operations	34,130	0.2

Source U S Coast Guard, "Marine Environmental Protectlon Program Evaluation of Mission Per formance, " August 1975

day. Since this projected throughput exceeds the most optimistic estimate of peak Baltimore Canyon Trough oil production of 650,000 barrels per day by more than 1.2 million barrels per day, OCS crude could be processed in these refineries without further expansion.

If the rate of growth of existing markets for products of existing refineries in the New Jersey and Delaware areas were the controlling factor in decisions about building new refineries, then the demand could be handled by expansion of refineries already in place in the region. Refineries in the area now have a capacity of 1.3 million barrels of crude oil per day which could be nearly doubled without need for additional land. It is not clear, however, that growth in existing markets would be the controlling factor. For example, an oil company that had no regional refinery capacity might discover a significant deposit of OCS oil and choose to build a new refinery in the area to process it. Or, oil discovered in the Georges Bank area to the north could be tankered to the Mid-Atlantic refineries and lead to pressure for new construction.

If significant amounts of natural gas are found, the gas would be piped to processing plants where methane (the key ingredient of commercial natural gas) would be separated from ethane (which is used as a petrochemical feedstock) and other compounds. After treatment, natural gas would flow into gas distribution systems.

Gas processing plants would require about 100 acres of land each. For the high recovery estimate, seven plants and 700 acres would be required.

AIR QUALITY

The primary source of onshore air and water impacts (other than oil spills) associated with offshore oil and gas development would be new refinery capacity, if any refineries were built as a direct result of offshore discoveries. Analysis shows that the most important air quality impacts would result from hydrocarbon emissions while the most important water impacts would result from thermal pollution and from demands on regional water supplies.

Analysis of existing air quality in the study region indicates that environmental standards may be a significant constraint on either new or expanded refinery capacity. Under current regulations, these facilities are required to conform to the most stringent limits for each pollutant set by two basic types of standards imposed by Federal and State governments. Effluents emitted by each facility must meet certain quantitative standards with regard to pollutant content and, in addition, the ambient air quality must not be degraded below specific standards for the area by additional pollutant discharges.

Analysis indicates that in the study region the refinery pollutants of primary concern are nonmethane hydrocarbons, which react with nitrogen oxides in the presence of sunlight to form photochemical oxidant, an irritating secondary pollutant. It is estimated that a 250,000-barrel-per-day refinery emits about 40 tons of hydrocarbons per day (or 14,600 tons per year), of which 80 percent or more can contribute to the production of oxidants.

The area of study is, for the most part, at or over the oxidant and nonmethane hydrocarbon air quality standards. With any additional hydrocarbons from a new petroleum refinery or additional expansion of existing refineries, the air quality situation most likely would get worse. Even without the added pollutants, the New Jersey, New York, Connecticut, and Metropolitan Philadelphia Air Quality Control Regions total hydrocarbon emissions exceed air quality standards. In the first area, a reduction from 1971 levels of 67 percent, or 287,000 tons per year, is required. Therefore, if there is an air quality constraint on possible new or expanded refineries in the area, it would involve hydrocarbon emissions from refineries and tank farms.

WATER QUALITY

Analysis suggests that the concentration of waterborne pollutants from a new 250,000-barrel-per-day refinery effluent are relatively small and probably would not detrimentally affect the water quality of a receiving stream. The primary potential problem involves thermal impacts. The Delaware Bay and Newark Bay areas are both very close to the maximum permissible thermal load. Refinery cooling water would have some impact on these areas but technological alternatives such as the use of cooling towers could alleviate some of these problems.

As to water availability within the study area, potential problems could exist. If the various water supply regions within New Jersey are looked at in isolation and if the water demand increases up to 2,500 million gallons a day in northeastern New Jersey, a supply deficit could result. However, if the total region including the Hudson and Delaware Rivers is considered, the overall supply of water is more than adequate to meet projected demands. Ample potential supplies of water exist but control over the distribution system is fragmented and funds are not available to expand the system to take advantage of available supplies. Water from new sources would require the construction of transmission systems and water control facilities such as dams, may encounter considerable opposition.

Effects on Regional Energy Prices

Dramatic changes in regional energy prices are not expected as a result of OCS development. However, While no absolute price decreases are expected, the area receiving OCS oil and gas may have lower energy prices *relative* to some other regions which may pay premiums for higher transportation costs. Another factor would involve future policies on oil and gas price controls.[64]

The expected effects of natural gas discoveries in the Baltimore Canyon Trough on regional natural gas prices are highly dependent on assumptions concerning deregulation. In the case of complete deregulation, sales of intrastate gas in the Gulf Coast area suggest that prices of OCS gas would tend to follow the price of oil on a dollar-per-million Btu's basis, regardless of production costs. In the case of continued regulation, any price effects would depend on possible pass-through of relative cost savings resulting from reduced transportation costs compared to gas from the Gulf Coast, However, since transportation costs are a relatively small share of the delivered price of gas in the northeast, the possibility]' of offsetting increases in production costs makes large cost savings (relative to Gulf Coast gas) and price decreases unlikely.

Increasing curtailments of natural gas mean that increased availability of this clean-burning premium fuel from the OCS would be of greater importance than price savings to consumers. To the extent that deregulation is less than complete by the time that gas production begins from the Baltimore Canyon Trough, greater use of natural gas in lieu of higher priced oil would represent a cost savings to users due to a change in mix of fuel types.

Predictions of the effects of OCS oil discoveries on regional energy prices are more uncertain than for natural gas,

First, as is the case with natural gas, deregulation could have a major impact on the price of domestic oil.

Second, even under the high recovery assumptions, large quantities of imports will still be used in the region,

Third, OCS oil probably will tend toward a market price which is set by OPEC-controlled imports.

Fourth, the cost of producing Mid-Atlantic oil may be quite high, and

Finally, even if there were savings in costs, there would be little incentive to cut prices in order to achieve a larger share of a market because demand for secure sources of oil is greater than supply.

With this degree of uncertainty, any prediction of prices is necessarily contingent on assumptions concerning the future strength of the OPEC cartel and U.S. price controls.

Decommissioning

When production from a platform dropped after 15 to 30 years to levels that no longer justified its operation, the platform would be decommissioned. As the Baltimore Canyon Trough field became depleted, all platforms would be removed, pipelines would be abandoned, and tank farms and gas processing plants would be dismantled.[65]

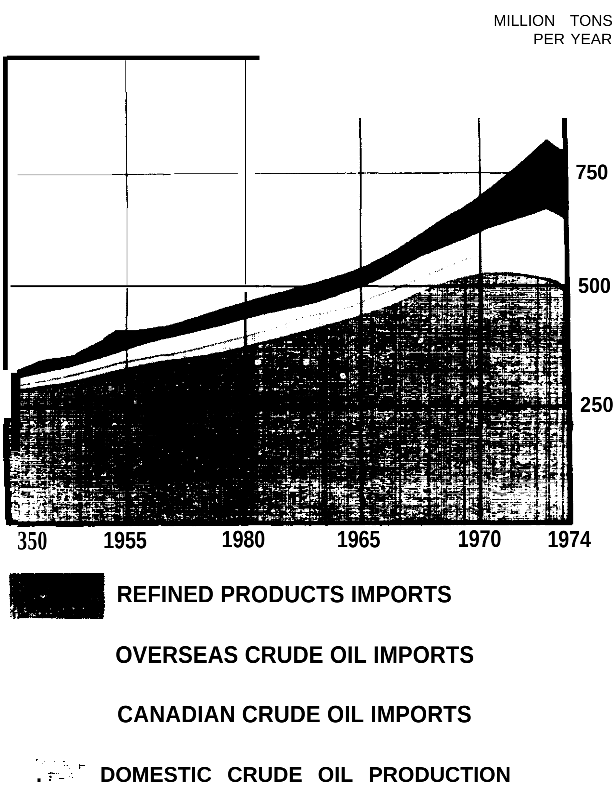
The Possibility of Deepwater Ports in the Mid-Atlantic

THE NEED FOR DEEPWATER PORTS

U.S. imports of crude oil nearly trebled between 1950 and 1970, reaching 1.3 million barrels a day just as domestic production began a steady decline from a peak of 11.2 million barrels per day of oil and natural gas liquids. (See figure IV-28.) To fill the increasing gap between demand and domestic supply, imports soared to 6 million barrels of crude and refined product between 1970 and 1973. Similar increases in oil imports took place in all industrial nations.

With the world oil industry seeking to cut the costs of moving increasing amounts of oil from producers to consumers, tankers grew in size through the 1950's and 1960's. Supertankers now in service range from 100,000 to 500,000 deadweight tons (dwt), which is a measure of their cargo capacity. Supertankers are among the largest ships afloat. Their cost advantage is demonstrated by comparison between a 250,000-dwt tanker and a 50,000-dwt tanker, which in the early 1950's was itself considered huge. Tankers of 50,000 dwt, a size that normally serves New York Harbor and Delaware Bay, average 750 feet in length, 100 feet in width, and 40 feet in draft. An average supertanker of 250,000 dwt is 1,100 feet long and draws 70 feet of water but it can carry five times as much oil as a 50,000-dwt tanker at about half the cost-per-barrel over long trade routes. [1] By 1976, supertankers of all sizes represented 55 percent of the world tanker capacity.[2]

Figure IV-28. U.S. oil supplies 1950/74



Source British Petroleum Statistical Review of the World 011 Industry

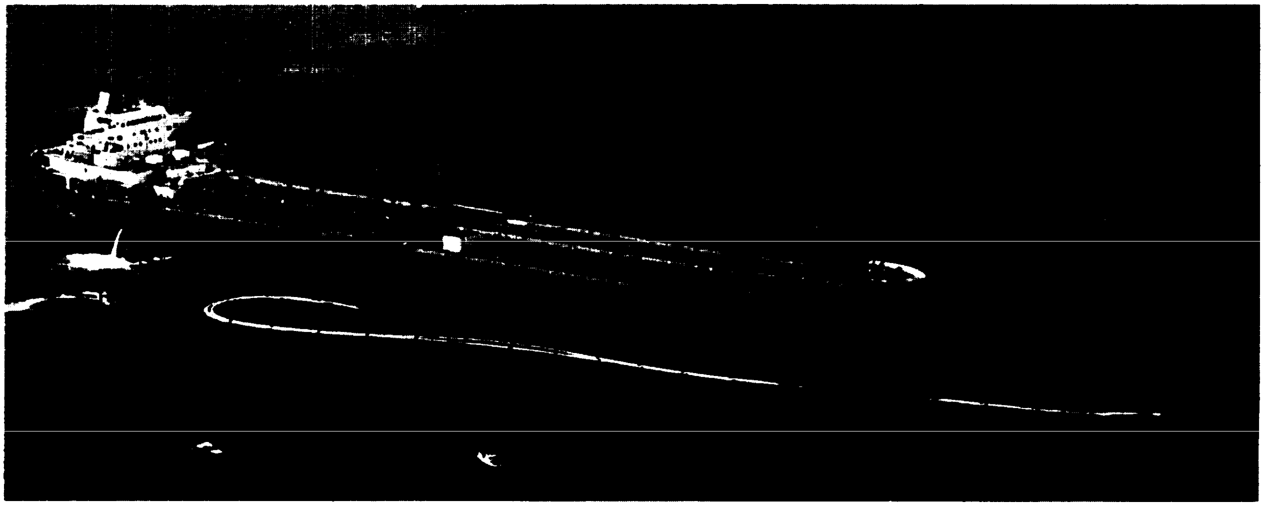
The growing dependence on super-tankers in the world distribution system in the 1960's prompted Federal officials and oil industry executives to press for deepwater ports in U.S. waters to handle this country's fast-growing imports.

Today only three U.S. ports can accommodate tankers of more than 100,000 dwt-Los Angeles, Long Beach, and Puget Sound. ? There are no deepwater ports in the Mid-Atlantic area where nearly all crude oil is imported by tanker, a degree of dependence on imported oil which is unique in the United States. (See figure IV-29.) Tankers presently deliver more than 1.2 million barrels of crude daily from the Middle East, Africa, and South America to nine Mid-Atlantic refineries.

The nine Mid -Atlantic refineries are clustered in two locations. (See figures IV-30 and 31.) More than two-thirds of the capacity is in Delaware and New Jersey where tankers

F gu e V 29 S

ANKER 252 000 DWT ESSO S NGAPORE DWP



CO

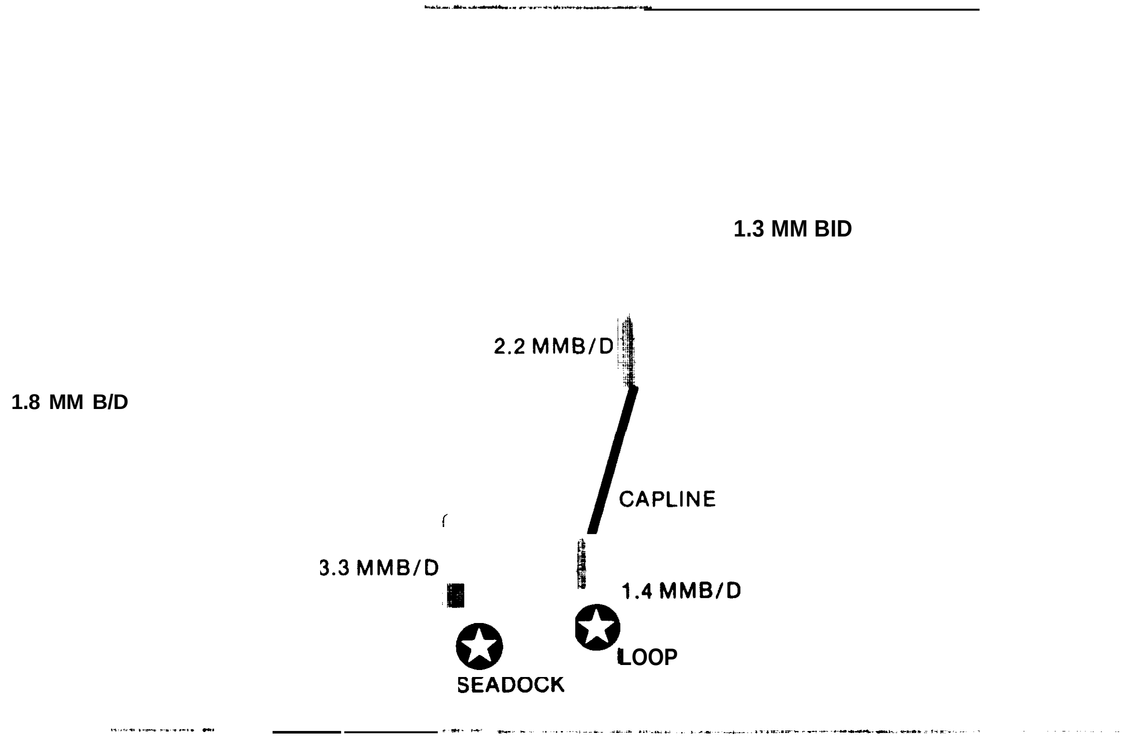
Under 50,000 Tons	50,000-75,000 Tons	75,000-100,000 Tons	100,000-150,000 Tons
San Francisco	Boston	Los Angeles	Long Beach
	New York	Portland, Maine	Puget Sound
	Delaware Bay		
	Baltimore		
	Norfolk		
	Houston		
	Galveston		

Source Office of Technology Assessment

must sail up the Delaware Bay and into the Delaware River to discharge their cargo. The other one-third of the capacity is in northern New Jersey near New York Harbor. Loaded tankers of more than 55,000 dwt—far smaller than supertanker class-draw too much water to reach the oil terminals at either location without being lightered. The controlling depth of the Delaware River channel is 40 feet. A fully loaded 100,000-dwt tanker requires 50 feet; the largest supertankers (480,000 dwt) require at least 100 feet of channel depth. Supertankers up to 150,000 dwt now anchor inside Delaware Bay, off Big Stone Beach, Del., and just outside of New York Harbor, to pump their oil into barges for final delivery to the refineries. Tankers can lighter their entire cargo, or when enough oil has been "lightered" to allow a tanker to ride higher in the water, the ship can proceed to a refinery terminal to discharge the remaining cargo.

In 1975, oil from 429 tankers was lightered to 1,055 barges in the Delaware Bay anchorage. Spillage reports on this lightering operation, run by Interstate Oil Transport Co. of Philadelphia, indicate it is exceptionally clean and free of accidents that lead to pollution. Officials of the lightening firm claim the operation was responsible for only 5 gallons of oil spilled into the bay during 1975. J This is not, however, an adequate measure of the

Figure IV-30. Major U.S. refining centers



Refining Centers

Deepwater Ports in Process of Licensing

Source Office of Technology Assessment

risks of the present system because lightening operations force a substantial increase in barge and small tanker traffic, and these vessels themselves often are responsible for serious polluting accidents in world harbors. s

One comparison of the lightening system with a deepwater port system was provided by the president of the Philadelphia Maritime Exchange several years ago during testimony before the Delaware General Assembly:

> “On April 28, 1974,” he said, “the largest tanker ever to enter the Delaware Bay, the 191,000-dwt Japanese tanker Yasutama Maru, arrived at the Big Stone Beach tanker anchorage and lightered her entire cargo of crude oil—1,283,865 barrels—using a small ship and barges to transport the oil upriver. The vessel sailed out of the bay in ballast on May 10, During the oil transfer operation, while in the bay, 15 separate lightening operations were needed. This involved a 25,000-dwt tanker which made 4 trips from the anchorage to the upriver refinery plus 11 barge voyages to and from Big Stone Beach anchorage. How much better and safer this could have been handled under the controlled conditions of a deepwater port which would permit a tanker to tie up to a platform, transferring its cargo into a pipeline, in a single operation, moving the oil via the pipeline direct to the refinery. ”

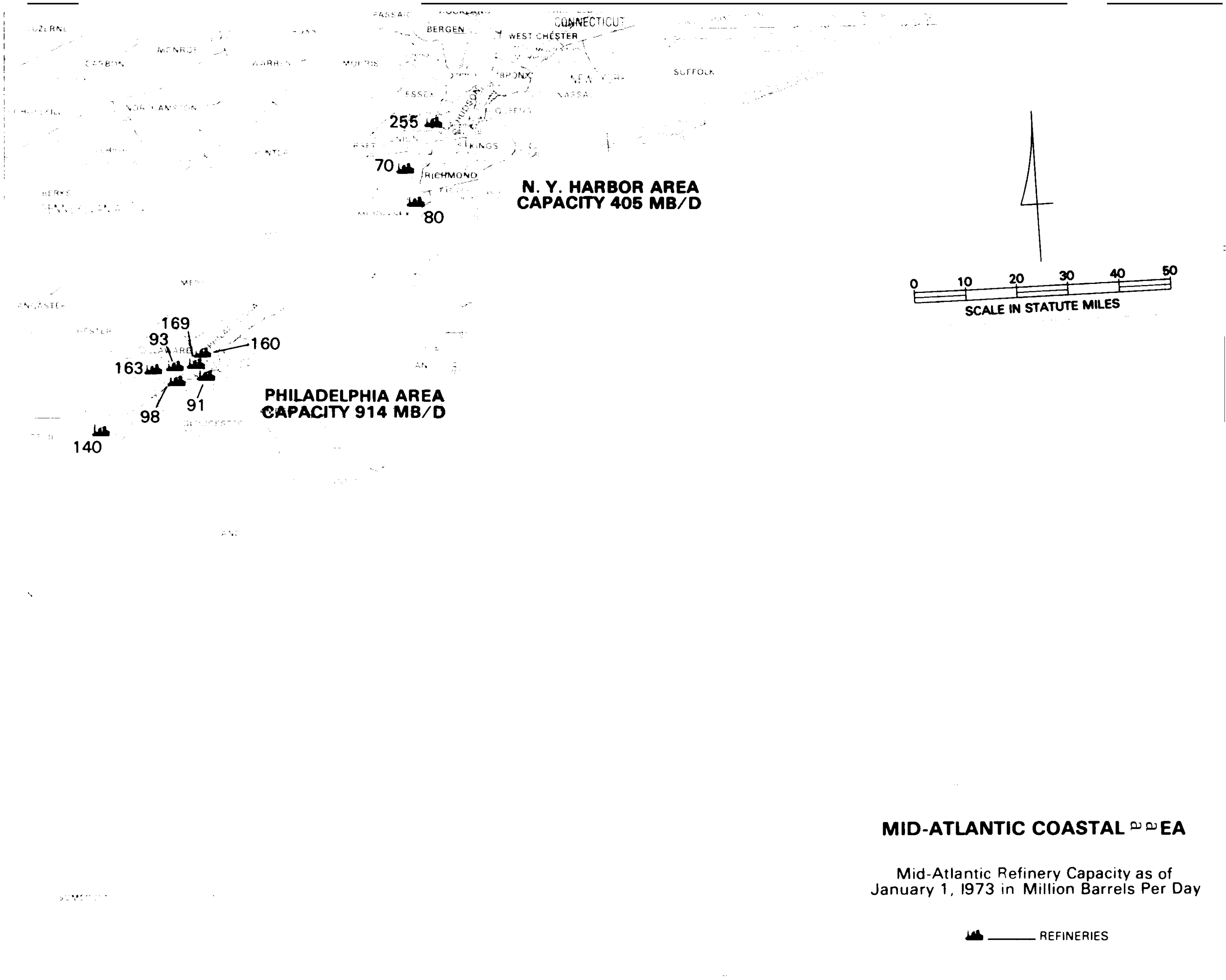


Figure IV-31. Mid-Atlantic refinery capacity as of January 1, 1973

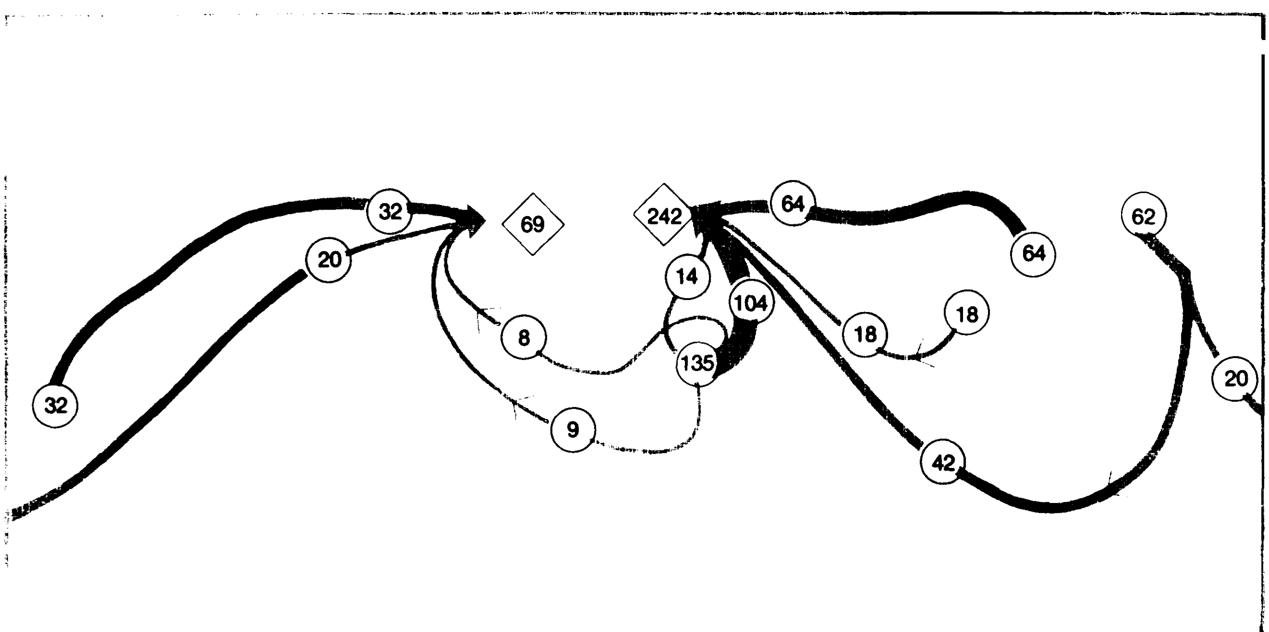
Source Office of Technology Assessment and EXXON Corporation

In 1973, tankers brought 870,000 barrels of crude oil a day to Delaware River ports and 410,000 barrels per day into New York Harbor.[6] The combination of increasing demand and dwindling domestic production in the early 1970's led the oil industry to plan new Mid-Atlantic refineries to be supplied by foreign crude. At that time, it appeared that crude oil demands could be met with relatively cheap and virtually unlimited supplies from the Middle East. (See figure IV-32.)

Several studies commissioned by the Federal Government and by private industry between 1968 and 1973 reached the general conclusions that:[7]

- Increasing volumes of oil shipped to the United States over the next 10 to 25 years would be carried by supertankers.
- Most of the crude imported by the United States would be shipped from the Middle East and Africa.
- The United States had a choice of installing deepwater ports to handle imports directly or relying on transshipment in smaller tankers from deepwater ports in Canada and the Caribbean.
- Transshipment would be more expensive than direct delivery of crude oil in supertankers to Mid-Atlantic deepwater ports.
- The economic and environmental costs of dredging existing channels in the Mid-Atlantic harbors to enable supertankers to reach existing dock facilities probably would rule out such an approach.
- Deepwater ports could be built in New England, the Mid-Atlantic, the South

Figure IV-32. Oceanborne crude petroleum to the United States— 1969 (millions of barrels per year)



O Imports
◯ Exports

Source Executive Summary, "Offshore Terminal System Concepts, " Maritime Administration

Atlantic or the Gulf of Mexico without modifying the technology already in use in deepwater ports off the shores of other industrial nations.

. The need was greatest in the Mid-Atlantic region.

In the early 1970's, industry and Government sources talked of moving 2 million barrels of crude a day into Delaware River ports, which would mean an average of five arrivals each day of 55,000-dwt tankers, the largest ships that could navigate the Delaware River channels. If the crude came in one 200,000 dwt to 250,000 dwt, it would require lightening into 15 smaller vessels or into a deepwater port.

Many studies between 1970 and 1973 stressed the economic advantages of deepwater ports for the Mid-Atlantic. In general, they concluded that it would cost less to ship oil from Africa or the Persian Gulf to east coast refineries with supertankers and deepwater ports than with the existing system. A range of sites and systems were proposed. Savings, when compared to such alternatives as transshipping thru Caribbean ports, were estimated to be 5–15 cents per barrel (less than one-third-of-a-cent per gallon).[8] While this is a small unit cost, it translates to major savings for a transport system carrying nearly half-a-billion barrels per year to the east coast—between $75 million and $225 million a year.

DEEPWATER PORT PROPOSALS

Studies sponsored by Government and industry in the 1960's and 1970's produced a variety of approaches to construction of deepwater ports at specific locations on the east coast and in the Gulf of Mexico. All of the studies drew on experiences abroad, where deepwater ports were developed in the 1960's, principally to handle supertankers in the Persian Gulf-to-Europe and the Persian Gulf-to-Japan trade. More than 100 such ports are in use today, as shown in figure IV-33.

The kind of deepwater ports contemplated for various locations around the United States will have their principal use as terminals for very large tankers carrying crude oil to major refining centers from distant major producing fields such as the Persian Gulf.

Other products also can be or are proposed to be transported through offshore terminals, including ore slurries, but most of those are very special situations.

Deepwater ports are not usually justified for transferring refined products because smaller tankers are used to carry refined products, the products are widely distributed through small, scattered terminals, and the present transport system is geared to the use of the smaller tankers within existing harbors and waterways.

A study for the U.S. Maritime Administration by Soros Associates Inc. in 1972, concluded that a 500-acre artificial island could be built inside Delaware Bay off the southern tip of New Jersey, creating a port that would handle 6 million barrels of crude per day. The port would have berths for six supertankers. Storage tanks would be located on the island with the port.

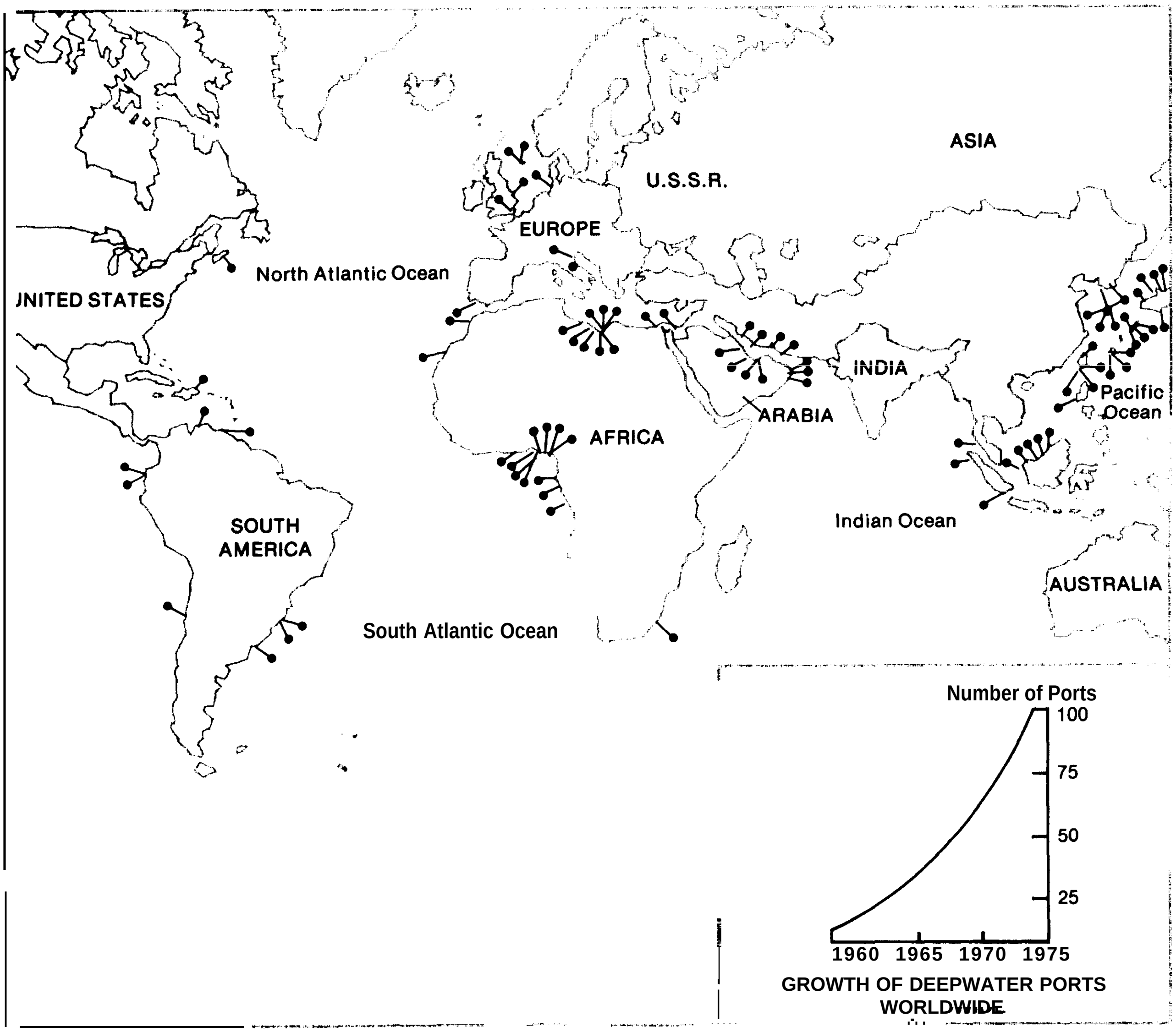
A study for the Council on Environmental Quality, prepared by Arthur D. Little Inc. in 1973, pictured a port in the Delaware Bay area transferring about 6.6 million barrels per day to new refineries in Cumberland and Cape May Counties of New Jersey. The report said that 14 square miles of the counties—which now are devoted to farming and resort activities—would be required for at least 9 new refineries and 13 new petrochemical plants. As a result of the port and associated industries, the two counties would become "a new industrial center" with employment doubling to 300,000 workers by the year 2000, the report said.

Industry's own private studies resulted in proposals for deepwater ports in the Atlantic off Long Branch, N.J., and in the Delaware Bay.

The Delaware Bay site was proposed by a consortium of oil companies which own refineries along the Delaware River.

The consortium, the Delaware Bay Transportation Co., purchased 1,800 acres of coastal land in Kent County, Del., for storage tanks, landside headquarters, and a supply base for the deepwater port. The companies planned to build their port 5 miles offshore but inside the bay. (See figure IV-34.) They planned a sea pier which could berth three super tankers of up to 250,000 dwt simultaneously and transfer crude oil into pipelines running first underwater to the tank farm and then overland to upriver refineries. The port capacity was to be 2 million barrels per day, an amount the consortium concluded would satisfy the needs of existing refineries (with expansion that was then planned) and one new refinery (which was then planned by Shell Oil Co.). The proposed port was to use a natural deepwater channel into the bay and require only "minimal" dredging to maintain a draft of 70 feet along the approaches to the

Figure IV-33. Worldwide single-point mooring installations—1 973



Deepwater Ports

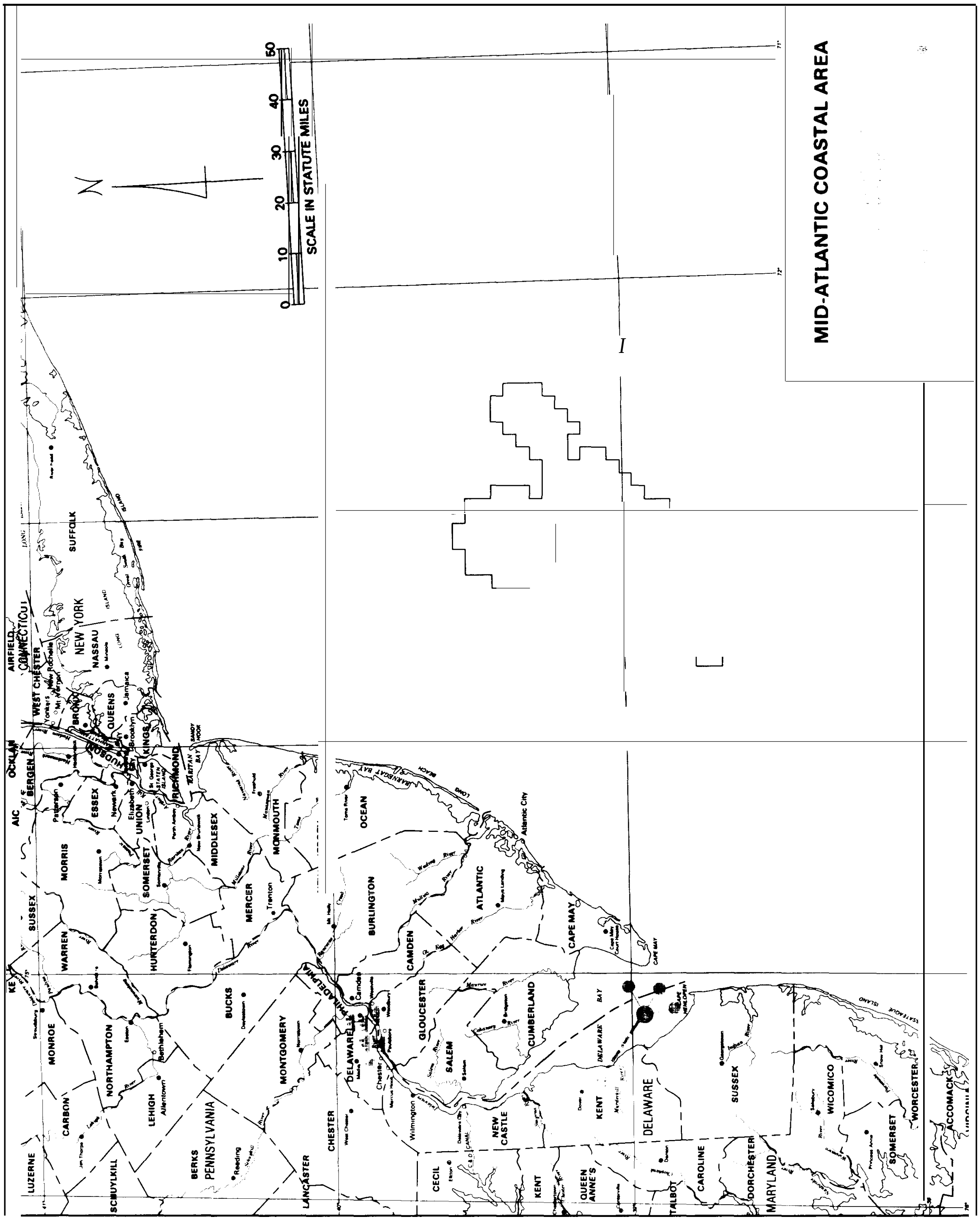
Source Off Ice of Technology Assessment

port and at the port itself. In the late 1960's, planners projected that construction would cost $193 million.[9]

Local opposition to the Delaware Bay port was strong. In 1971, Delaware's General Assembly approved one of the Nation's strongest pieces of land use and environmental legislation, the Delaware Coastal Zone Act, which prohibited the construction of any new heavy industry—including refineries, tank farms, pipelines, and bulk offshore unloading terminals—in the coastal area. Almost immediately after passage of the law, a campaign was organized to have the law repealed or amended. To date, those efforts have been unsuccessful.

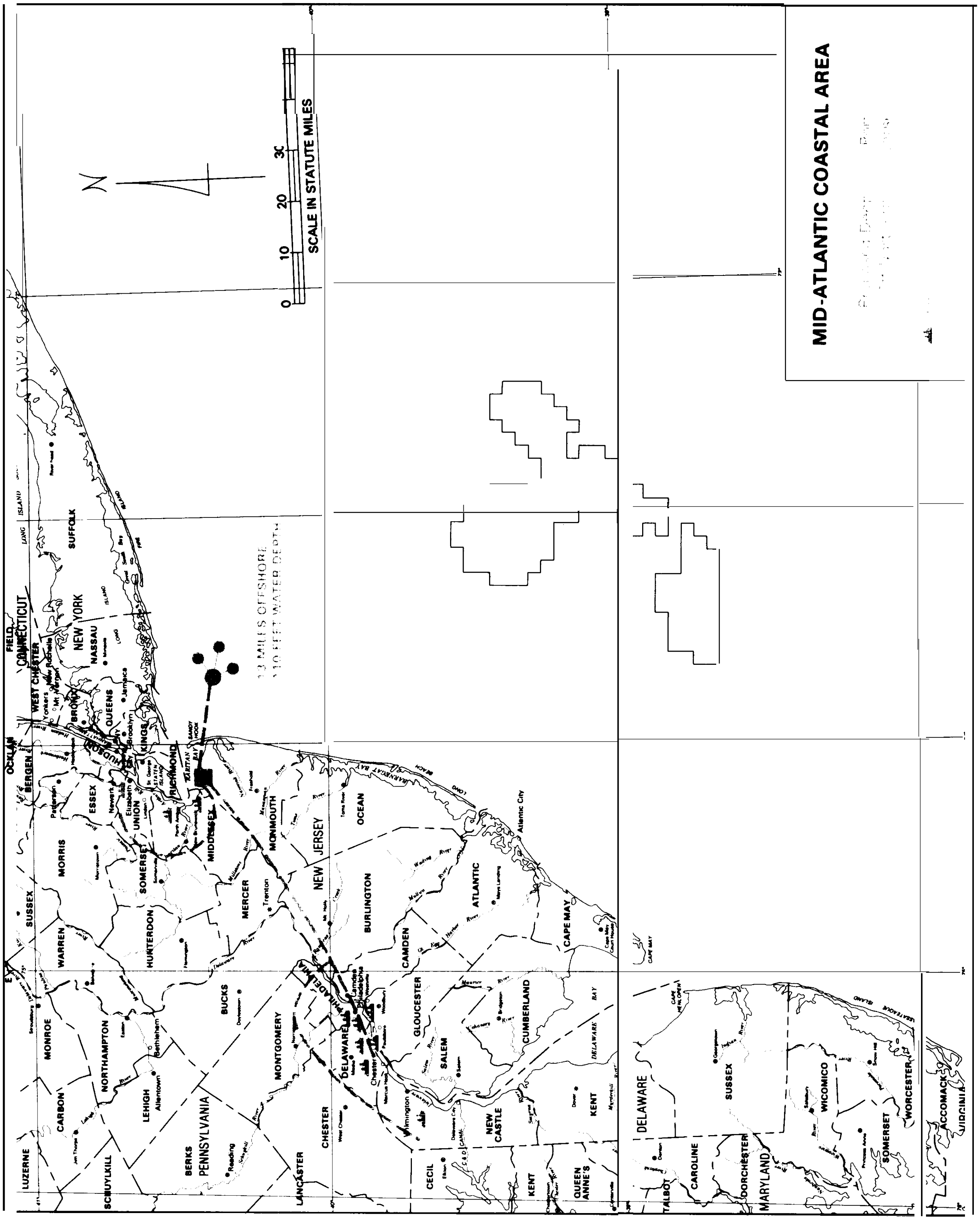
Before the 1973 Arab oil embargo, EXXON Corp. gave serious consideration to a deepwater port in 110 feet of water some 13 miles off the coast of Long Branch, N.J. (See figure

Figure IV-34. Proposed deepwater port site in Delaware Bay.



Source Of fice of Technology Assessment and Energy 011 and the State of Delaware

Figure IV-35. Deepwater port site offshore northern New Jersey, proposed by EXXON in 1973



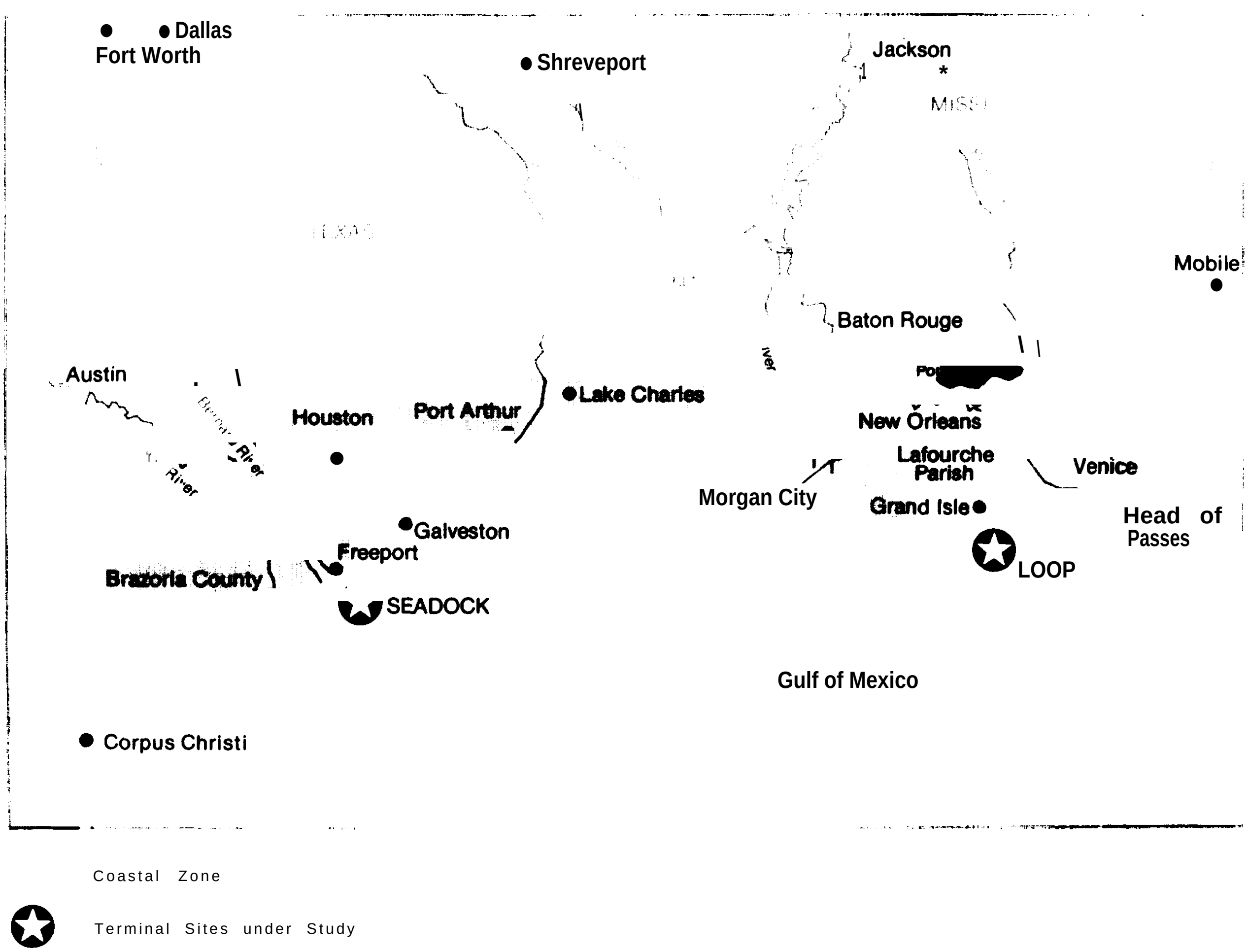
Source Off Ice of Technology Assessment and EXXON Corp.

IV-35.) The proposal no longer is an active plan. EXXON has chosen to expand its Baytown, Tex., refinery rather than its Bayway, N.J., refinery. Total refining capacity in northern New Jersey now is about 500,000 barrels, less than half of the capacity that one EXXON official said would be required to support a northern New Jersey deepwater port.

New Jersey residents, particularly in the south, opposed construction of deepwater ports off the southern shore and the massive industrialization which the Little study indicated might result. In 1973, the New Jersey Legislature declined to pass a formal ban on deepwater ports and related development, and instead made each energy facility proposed for the coastal area subject to individual review. The former Governor, Thomas Cahill, declared himself strongly opposed to plans for a deepwater port that would industrialize rural counties. The present Governor, Brendan Byrne, has taken a similar public position.[10]

Consortia of oil and petrochemical companies also proposed two deepwater port projects in the Gulf of Mexico off the coast of Texas and Louisiana. Both projects are still active. (See figure IV-36.)

Figure IV-36. LOOP and Seadock deepwater port sites in the Gulf of Mexico



Source Arthur D Little, Inc

Seadock, the Texas terminal, was planned by a company made up of nine oil and chemical firms with plants in the area. They propose a port of three monobuoys anchored in 100 feet of water 26 miles off Freeport. Capacity will be 2,5 million barrels of oil per day by 1980 with an ultimate expansion capacity to 4 million barrels per day. The port plan also includes offshore pumping stations which will move crude oil at the rate of 125,000 barrels an hour from the monobuoys to inland refineries. In 1976, the cost of the system is estimated at $659 million.11

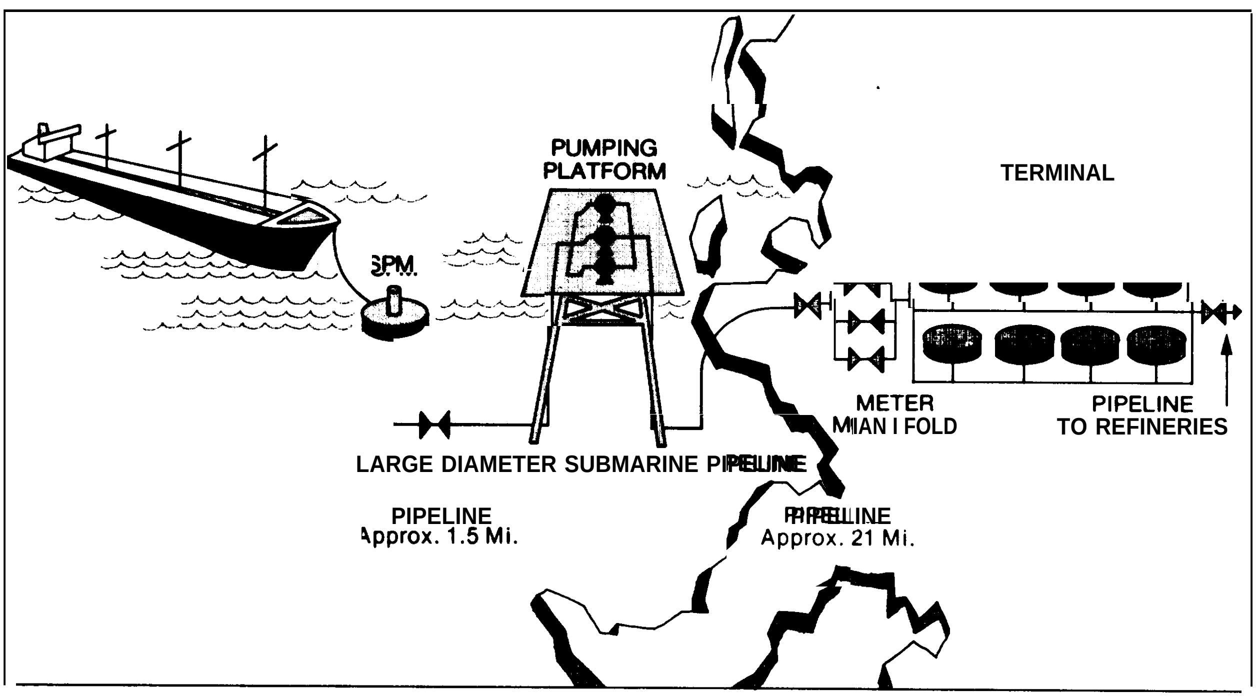
LOOP (Louisiana Offshore Oil Port, Inc.) plans a monobuoy port located in 100 feet of water 19 miles off the Louisiana coast. The port will start operation with a capacity of 1.4 million barrels a day and expand to a capacity of 3.4 million barrels a day by the year 2000. Cost of the LOOP system is put at $348 million for the early phase and $800 million for the expanded version. 12

It has been suggested that offshore deepwater ports could be utilized for mooring supertankers while offloading cargo into smaller tankers or barges for transport to refineries rather than through pipelines, as is a more common plan. It would be feasible to operate such a monobuoy lightening port and some advantages could be expected, such as employment of more small tankers and barges and a more flexible distribution to a variety of refinery locations.

The chief disadvantage is that the use of more small tankers and barges increases the risk of pollution.

It appears that industry plans for deepwater ports do not presently contemplate using the lightening system; however, offshore lightening has been used in the past and is part of a major project to supply the new 200,000-barrel-per-day "Ecos" refinery in Louisiana for the next 3 years. The plan is to offload super-

Figure IV-37. LOOP deepwater port layout



Source "Louisiana Offshore 011 Port, " LOOP, Inc , New Orleans, Louisiana tankers into smaller tankers of about 90,000 dwt while underway offshore. This system will be utilized until the LOOP deepwater port is ready to handle the oil.[13]

Faced with a growing number of specific proposals for deepwater ports, Congress enacted the Deepwater Port Act of 1974. The Act requires that the Secretary of Transportation license all ports located in Federal waters and that the Coast Guard write and enforce regulations for the construction and operation of the ports. Comprehensive Coast Guard regulations were published in the Federal Register on Nov. 10, 1975,11 along with proposed guidelines for developing design criteria for specific sites, guidelines for site-specific environmental impact statements, and guidelines for detailed operating procedures.

The Coast Guard is pursuing several research programs to develop design criteria on which to evaluate future port construction and operations. The principal concerns, which will receive priority research and development attention, are in the areas of oil spill response systems, oil spill consequences, inspection methods, and procedures. It appears that the Coast Guard approach to regulations and further research to improve regulations is reasonable and should provide for future contangencies.

Seadock and LOOP have both applied for licenses under the Deepwater Port Act. The Delaware Bay Transportation Co. would not need a license under the act because its proposed port is located in the State waters controlled by Delaware.

Deepwater ports in local waters require no license from the Transportation Department under the Deepwater Port Act, but they do require permits from the U.S. Army Corps of Engineers.

The Corps' jurisdiction over nearshore deepwater ports originates in two laws—the Rivers and Harbors Act of 1899, which prohibits obstructions to navigation and dredging in navigable waters without a permit from the Corps, and section 404 of the Federal Water Pollution Control Act of 1972, which requires a permit before dredged material can be deposited in navigable waters.

The Corps of Engineers is not bound by the Deepwater Port Act. It may issue permits on the basis of its own judgment of an applicant's design without regard to Coast Guard regulations for deepwater ports beyond the 3-mile limit. By the same token, the Corps could require ports under its jurisdiction to comply with construction and operation regulations promulgated under the Deepwater Port Act.

One port in local waters recently has been approved by the Corps. Permits for that port, a monobuoy facility to be located about 2 miles off the south coast of St. Croix in Canegarden Bay in water depths of 200 to 230 feet, were issued to the Virgin Islands Refinery Corp. on June 18. Construction of the port will begin immediately and completion is expected within 3 years.

The absence of any required coordination between the Corps and Transportation's Deepwater Ports Office could lead to problems in the future because there is no guarantee that ports in local waters would meet minimum safety and environmental standards set at the Federal level to protect the national interest and the interests of States other than the host State.

The Corps' Jacksonville division, which issued the permits for the Virgin Islands port, coordinated its activities with Transportation only by sending a public notice of the application to the Coast Guard and by contacting the Coast Guard on the environmental impact statement. The Jacksonville office also asked the Coast Guard to develop a vessel movement control system for the port, but made no effort to apply Federal safety or equipment standards to the port before approval of the permit.[15]

Presently another nearshore application is pending in the Virgin Islands, and at least two other ports in State waters are in early planning stages elsewhere off the east coast. These applications and the construction and operation of the ports will be useful in determining whether closer coordination of Corps and Transportation procedures and regulations is needed.

STATUS OF NEW JERSEY AND DELAWARE PLANS

A deepwater port probably will not be built to serve the Mid-Atlantic States during the next 10 years.

The Arab oil embargo and the cloud it placed over the reliability of imports was a major factor in the oil industry's decision to postpone deepwater port development. But it is only one of several factors, including State policies to discourage new refineries, Federal air quality regulations, which have the same effect, and sharply inflated construction costs. Another major factor is the oil industry's decision, faced with growing opposition to refineries and encouraged by Federal tax policies and import quotas, to develop an alternate system for supplying Mid-Atlantic oil products from Caribbean and Gulf Coast refineries. Industry is not likely to abandon the system as long as its costs are relatively close to the costs of refining oil on the Atlantic coast.

Oil consumption in the United States dropped in 1974 and then leveled off in 1975 at 16.3 million barrels a day, principally because of the 1974–75 recession. Recent forecasts estimate that consumption will climb to 20 million barrels a day by 1985.[16]

As much as half of the projected 1985 supply may be imported because domestic oil production has continued to drop since 1970. Even with production on Alaska's North Slope, domestic output is not likely to return to its 1970 peak of 11.2 million barrels, at least in the near future.

Oil consumption in New York, New Jersey, Delaware, and Pennsylvania is expected to climb to 3.8 million barrels a day by 1985, an increase of 1.1 million barrels a day over the 1975 levels. During that time, total imports of crude oil to refineries supplied through New York Harbor and the Delaware Bay may increase from 1975 levels of 1.2 million barrels a day to 2 million barrels a day only it there are expansions in refinery capacity,

Estimates in figure IV–38 were developed from a February 1976 forecast of demand by the Federal Energy Administration. Crude oil import figures assume that there will be some

Figure IV-38. 1976 projections of petroleum supply and **demand**

IN MILLIONS OF BARRELS PER DAY

A. UNITED STATES TOTAL

	1975	1985
Total Demand	16.3	20.0
Imports	6.0	10.0

B. MID-ATLANTIC REGION
(New Jersey, Delaware, New York, and Pennsylvania)

	1975	1980	1985
Total Demand	2.7	3.4	3.8
Total Imports	2.2	2.9	3.3
Crude Oil Imports°	1.2	1.5	2.0

'Likely to f low through any deepwater port

Source Federal Energy Administration, "National Energy Outlook, " 1976 (for 1965 reference case) and with present crude oil to total import ratio extrapolated refinery expansion so that area refineries will continue to supply about 55 percent of the region's petroleum products.

Increases in excess of refinery capacity in the Mid-Atlantic will be in product while crude oil moves to the Gulf Coast for refining and redistribution coastwise by small tankers or overland by product pipeline.

About one-third of all oil products used in the Mid-Atlantic in 1974 were residual fuels which were transshipped from the Caribbean for generating electricity. Although the Federal Energy Administration forecasts a shift of about 12 percent of electric power generation from oil-fired to nuclear or coal-fired plants over the next 10 years, its projections still imply a continued heavy reliance on residuals.[17]

In recent years, State land use and environmental policies have discouraged the construction of new refineries in coastal areas of New Jersey and Delaware.

The Delaware Coastal Zone Act flatly prohibits construction of refineries or pipeline landings in the coastal area. Existing Federal and State air quality regulations make construction of new refineries along the Delaware River and Bay unlikely in the foreseeable future although existing refineries may be expanded without exceeding pollution standards.[18]

Since 1970, an Amerada-Hess refinery in the Mid-Atlantic region has been closed; plans to double the capacity of a Mobil Oil Co. refinery in New Jersey have been canceled; and construction has not begun on a Shell Oil Co. refinery, originally planned for a site in Delaware and then for a site in New Jersey.

Because a decision to build a deepwater port would logically follow—and not force—a decision to build new refineries, a port is likely to be postponed at least until the Mid-Atlantic refinery picture changes.

Inflation also has worked against construction of a deepwater port, pushing the costs of a port inside Delaware Bay from $193 million to more than $400 million. The estimated cost of dredging some 15-million to 20-million cubic yards of bay bottom for a channel to the port that would handle 250,000-dwt tankers has increased in that time to more than $40 million.[19]

In 1971, the Delaware Bay Transportation Co. estimated that oil could be transferred through its proposed port for 12 cents a barrel. At the inflated construction costs, the price in 1975 would be closer to 25 cents and possibly as much as 39 cents if Delaware were to tax incoming oil at 1 percent of its market value.[20]

At those prices, most of the cost advantage of using supertankers would be lost and the port would provide an economic advantage only for tankers on the longest trips between the Persian Gulf and the Mid-Atlantic region. Even on that route, savings would be significant only with tankers of 250,000 dwt or more. There would be little or no cost advantage over lightening for tankers between 100,000 dwt and 200,000 dwt. Deepwater port transfer costs actually could be higher than lightening for small tankers or for large tankers on shorter runs from Africa or South America.

The increased transfer costs would eliminate much of the economic advantage which was perceived by New Jersey and Delaware residents to be a prime argument in favor of a deepwater port.

Citizens responding to OTA questionnaires said they believed the port would reduce the cost of petroleum products by providing a more efficient transportation system.

Not all oil industry officials agree with the cost figures cited in this study, which were generated by the PenJerDel Corp., an affiliate of the Philadelphia Chamber of Commerce, in a 1975 study. Industry officials do agree, however, that a Mid-Atlantic deepwater port would be marginally feasible in the near future,[21] particularly when its costs are compared with the 1975 lightening charge of 8 to 11 cents per barrel.

However, one change in the existing Delaware Bay system could revive interest in a deepwater port—for environmental rather than economic reasons.

There never has been a major lightening accident in Delaware Bay. One accident or a series of accidents could provoke political action to build a deepwater port not only to eliminate lightening but to reduce the number of tankers that will be required to carry growing supplies of imported crude oil to docks in the Delaware River.

Many people responding to the OTA public participation questionnaire said a reduction in the risk of lightening accidents is a major argument in favor of building a deepwater port.

DESCRIPTION OF DEEPWATER PORT TECHNOLOGY IN THE MID-ATLANTIC

If a deepwater port were constructed in the Mid-Atlantic, it would probably be a monobuoy port located off southern New Jersey.

The OTA study investigated a range of technical and siting options for a port under several demand assumptions. Because the capacity to expand refineries is substantially greater in the Delaware Bay area than in northern New Jersey, the study assumed the port would be oriented toward the Delaware Bay refineries and located 30 to 32 miles off the New Jersey coast. At such a site, the port would be in waters under Federal jurisdiction and would be located far enough from the coast to serve the largest supertankers in the world fleet, the 480,000 dwt, which require 110 feet of water depth for maneuvering. (See figure IV-39.)

Because of uncertainties about import projections and the low level of industry interest in any near term project, this description of port technology is confined to one logical-sized port and its impacts.

It should be emphasized that the site and type of port selected relate only to technical feasibility y. Basic changes in Government policy, the economics of oil distribution, and standards governing air pollution would be necessary before the events described in this report could actually take place.

Several general categories of deepwater ports now operating around the world could be adapted to the east coast, including the integrated, bulk cargo, island port—which would require much more detailed planning than has been done to date—and the structural pier built for alongside mooring of tankers—which would be a likely design for use inside the Delaware Bay.

The OTA study assumed that the choice would be a monobuoy, the least expensive and most versatile system in the present world network of more than 100 deepwater ports. This is essentially the same technology proposed for LOOP and Seadock in the Gulf of Mexico.

The technology for monobuoys has been m use since 1960. Foreign ports have demonstrated safe operations over several years of intensive use. Although it is true that the United States has no experience with the ports

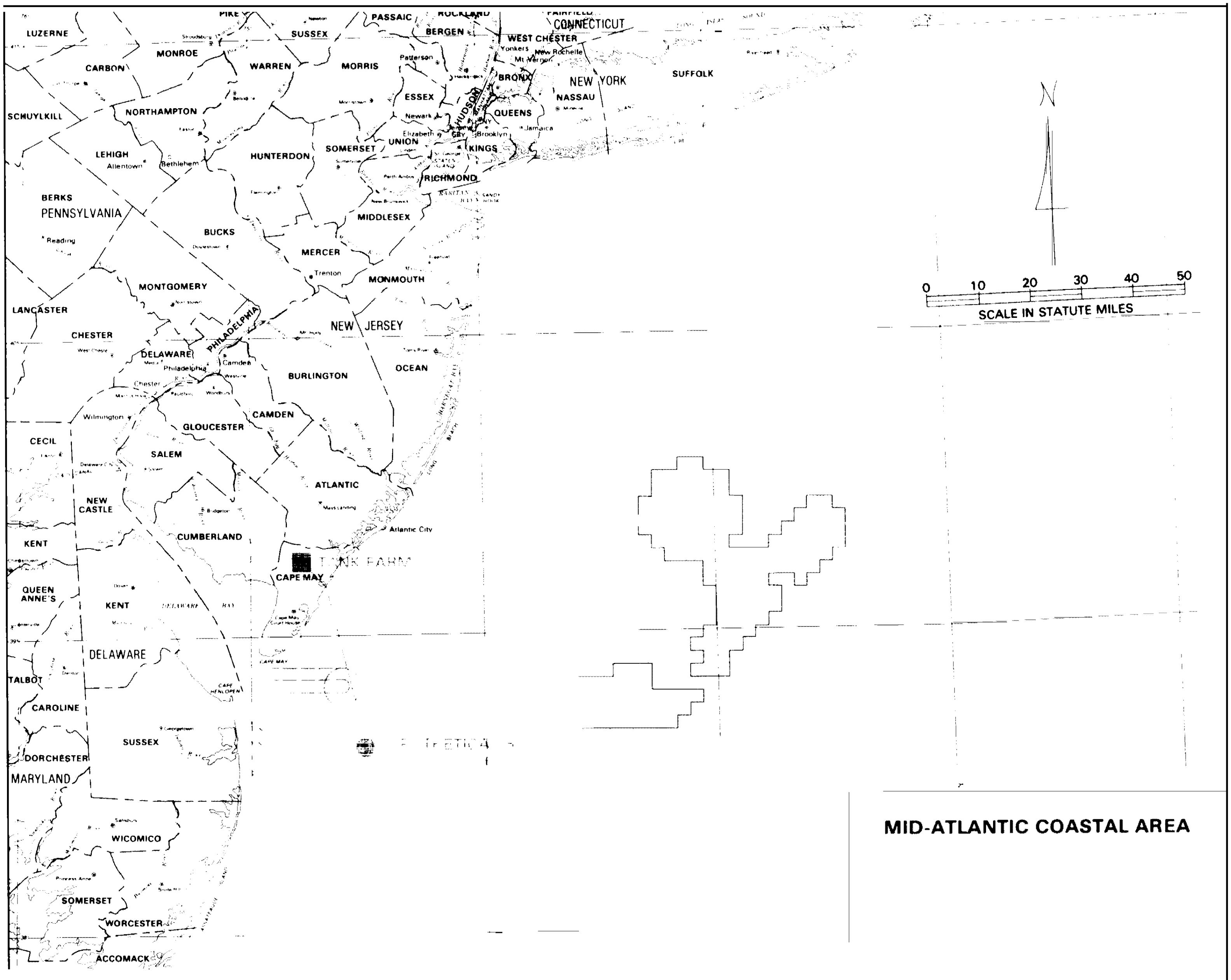
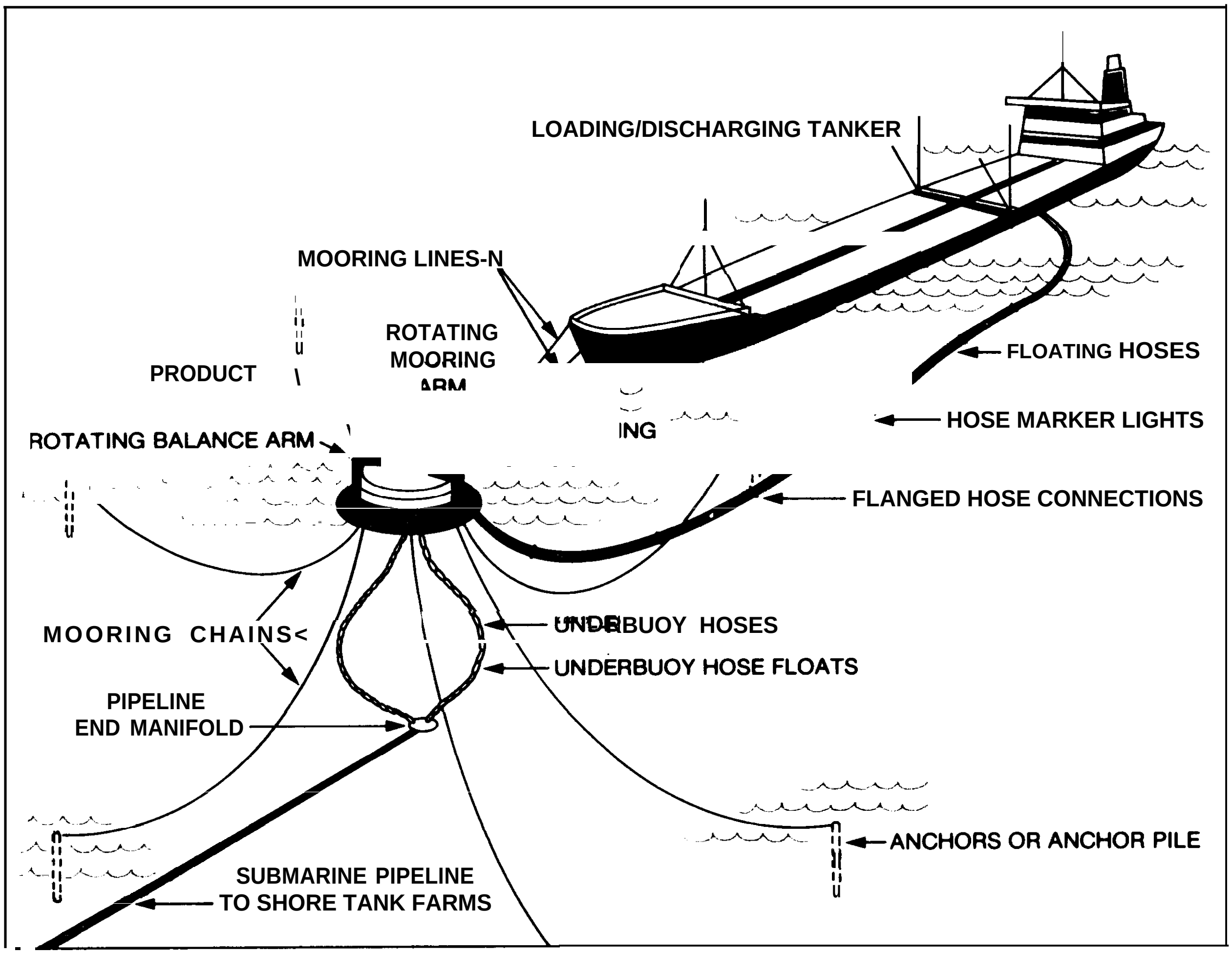


Figure IV-39. Hypothetical deepwater port site offshore New Jersey coast

Source Office of Technology Assessment

Figure IV-40. Catenary anchor leg mooring (CALM)



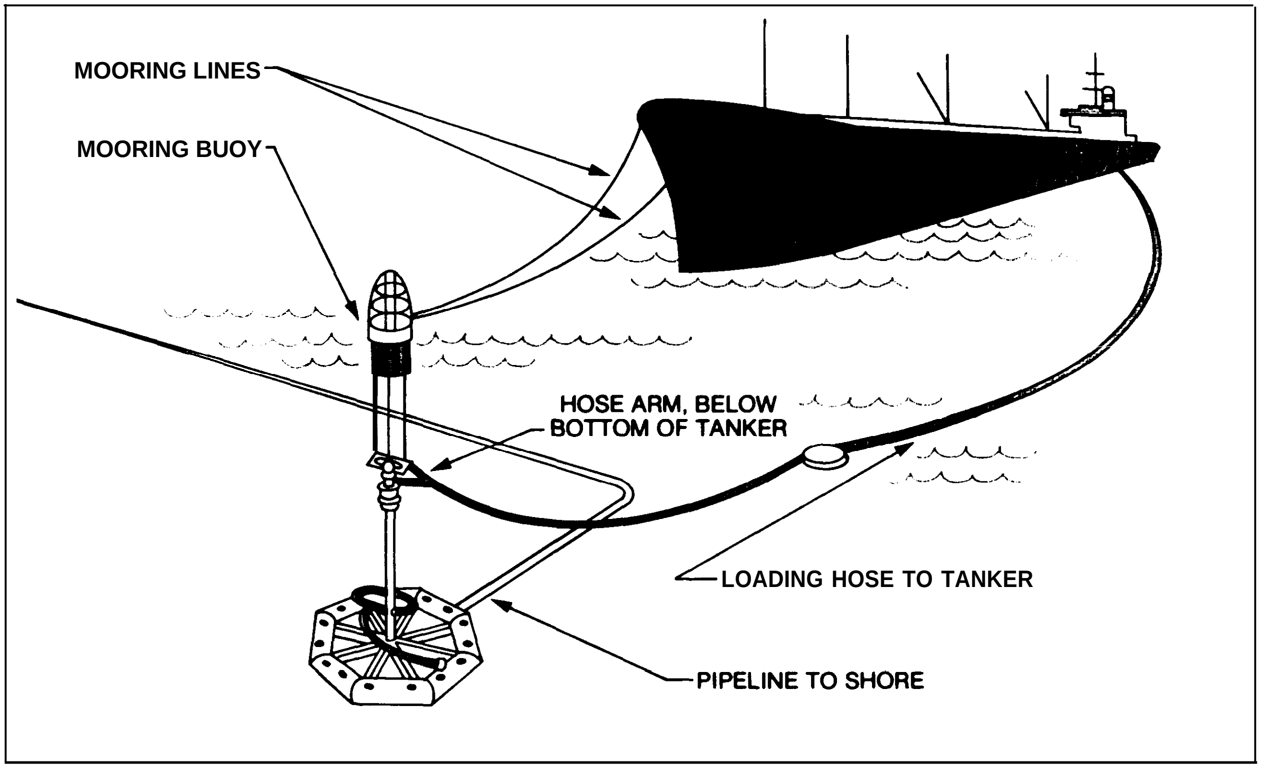
Source "Tankers and the U S Energy Situation, " Poricelli and Keith.

in its waters, many of the ports in the worldwide system are owned by the multinational oil companies which would be able to transfer their knowledge to American sites. In addition, the technology for component parts of the monobuoy system—the platforms, hookups, pumps, pipelines, and storage tanks—has been in use in offshore exploration and production, shipping, lightening, and distribution of oil in the United States for several decades.

Two types of monobuoys are presently in use and could be adapted to the Mid-Atlantic. The most common is the Catenary Anchor Leg Mooring system (CALM). (See figure IV-40.) The other, more recent, design is the Single Anchor Leg Mooring system (SALM). (See figure IV-41.)

The CALM is a floating steel cyclinder 30- to 50-feet across and 15 feet thick which is tethered to the sea bottom by 6 to 8 anchors and chains. Rubber hoses rise from a connection with a pipeline buried under the sea floor through the center of the buoy and float on the ocean surface. Tankers tie up to the CALM and launch crews guide floating hoses to the tankers, hoist the hoses aboard, and secure them to discharge manifolds. Crude is then

Figure IV-41. Single anchor leg mooring (SALM)



Source “Tankers and the U S Energy Situation, ” Poricelli and Keith

pumped through the hoses, into the pipeline and on to shoreside storage tanks.

Because tankers can weathervane around the CALM and maintain a heading into wind and waves, there usually is no need for protective breakwaters even offshore. But because launches are required to help secure hoses to a tanker’s manifold, mooring operations cannot be conducted in seas higher than 6 to 8 feet. Once moored, however, a tanker can discharge crude oil in waves as high as 10 to 12 feet and winds of up to 40 knots.

One drawback to the CALM is that there is a danger of tankers overriding the buoy and tearing the hose connections which are mounted on top of the buoy. The newer SALM system reduces that danger. In the SALM design, the steel buoy is tethered by one vertical anchor chain. Instead of rising through the buoy, the rubber hoses connect to a pipeline below the water at a point deep enough that the danger of a break in the hose-pipeline connection is reduced in the event a tanker collides with a buoy.

In addition to the monobuoy, the port complex would include one or more pumping stations to force the crude through the pipelines to shore. The stations would be mounted on structural-steep platforms fastened to the sea floor with pilings similar to those that support offshore oil platforms. One or more decks would be mounted to support pumps, a helicopter pad, and crew quarters. The pumping station would be located at least 8,000 feet from the monobuoy to reduce the danger of having it rammed by a tanker entering or leaving the port proper.

If a port off New Jersey were planned to handle 1.6 to 2 million barrels per day initially, it would consist of two monobuoys situated about 5,000 feet apart. (See figure IV-42.) The port could be expanded at intervals of 5 years to increase capacity to 3.5 million barrels per day to satisfy the area's needs for at least 20 years.

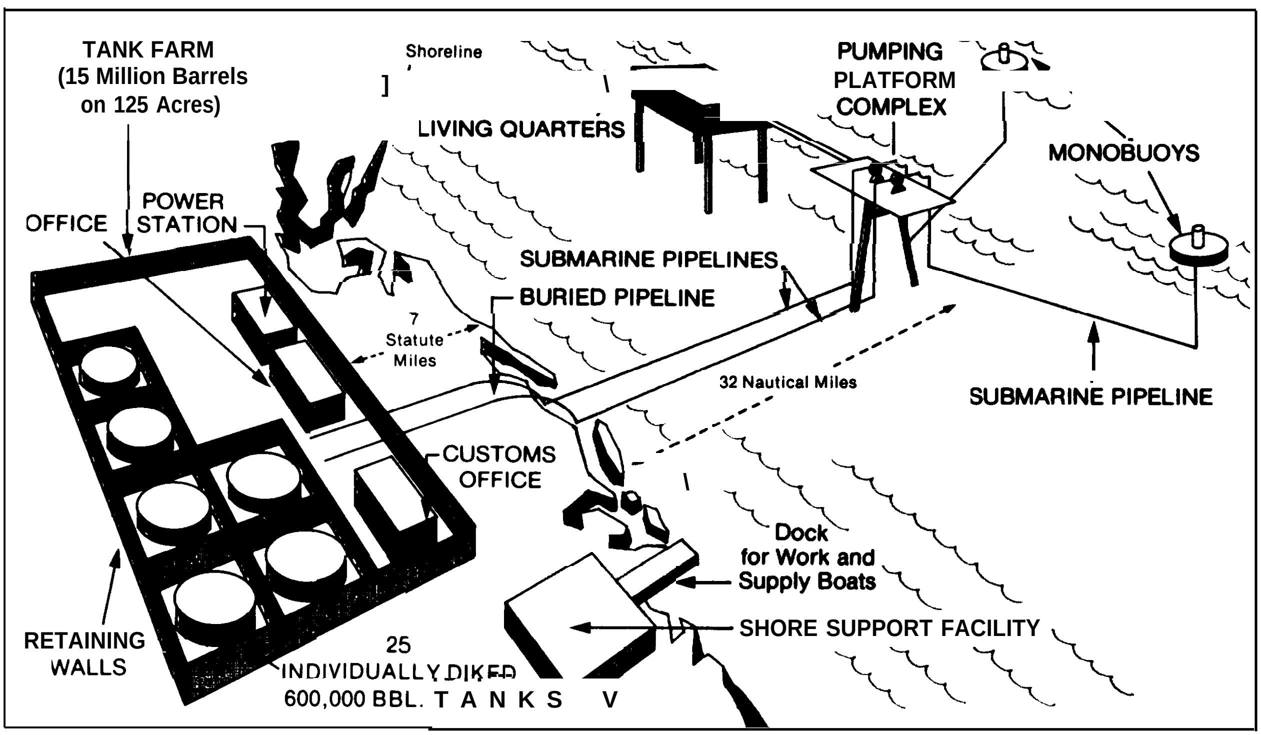
Several firms already supply monobuoys, which would be constructed at existing yards and towed or carried on barges to the Mid-Atlantic site to be anchored in place. Pumping platforms and other equipment are also supplied by existing specialty firms and shipyards so that, except for pipelines, the production of equipment probably would not generate employment for the Delaware/New Jersey region. Pipe could be fabricated on the east coast,

Construction of the offshore portions of the deepwater port would require about 2 years after a license was granted.[22] During the construction phase, about 20 acres of waterfront land would be required for support. Such support includes construction crew and equipment staging, repair, and pipeline supply. This land could be used for headquarters operations after the port was completed.[23]

Pipelines from port to shore would be put in place by lay barges using procedures identical to those for laying pipes for Outer Continental Shelf oil and gas production. The pipeline from a port off New Jersey could come ashore between Townsend's Inlet and Sea Isle City, N.J. If that occurred, a tank farm would be built in central Cape May County with the pipeline continuing overland to the Camden area and to the refineries,

Typically, tank farms for deepwater ports will store 10 times the port's daily capacity to assure refineries of a continuous supply of crude even if the port is shut down because of bad weather or an accident. A typical storage

Figure IV-42. Hypothetical deepwater port layout including onshore facilities



Source Off Ice of Technology Assessment

tank holds 600,000 barrels of crude; therefore, the initial two-buoy port discussed here would require 25 tanks on 125 acres of land to store a 10-day supply of 1.6 million barrels per day. If the port were expanded to 3.5 million barrels per day capacity, 58 storage tanks on 250 to 300 acres of land would be required.

If new refineries were built, distribution pipelines to these could be added from the tank farm.

There is substantial public concern over potential oil spills associated with deepwater ports, especially large spills which may reach New Jersey and Delaware beaches. But an oil spill risk analysis prepared for this study indicates that the likelihood of spills in rivers, harbors, and coastal waters out to 50 miles is reduced by about one-half if a supertanker/deepwater port system, rather than small tankers, is used to move oil.[24]

Two principal factors make the risks of oil spills from deepwater ports lower than the risk from small tankers., First, a deepwater port reduces the number of tankers that must be used to move a given quantity of oil. Second, if oil is spilled at a deepwater port, the distance between the port and the shoreline may reduce damage to the coastal areas.

The OTA oil spill risk analysis for a deepwater port of 1.6 million barrels per day capacity located about 30 miles off the New Jersey coast was based on data from regional and worldwide spills from ports and tankers of all sizes. The results of the analysis indicate that over a 15-year period there is a 50 percent chance that 150,000 barrels of oil will be spilled within 50 miles of shore by a deepwater port/supertanker system. During the same period, there is a 50 percent chance that small tankers will spill 310,000 barrels in the same area. Total spillage from the port system in the same time period and area could range from a low of 50,000 barrels to a high of 720,000 barrels. Total spillage from the small tankers could range from a low of 32,000 barrels to a high of 1.4 million barrels. The high estimates include the pessimistic assumption of a major tanker accident. (See figure IV-43.)

The statistical average of these estimates gives deepwater ports a two-to-one advantage over small tankers based on total spillage within 50 miles of shore.

When spills in the seas beyond 50 miles are considered, there is less difference between the two systems. This is because of two factors which are common to both systems: 1) most discharges from routine tank cleaning occur far at sea; and 2) most spills from major accidents such as structural failures have occurred far at sea.[25]

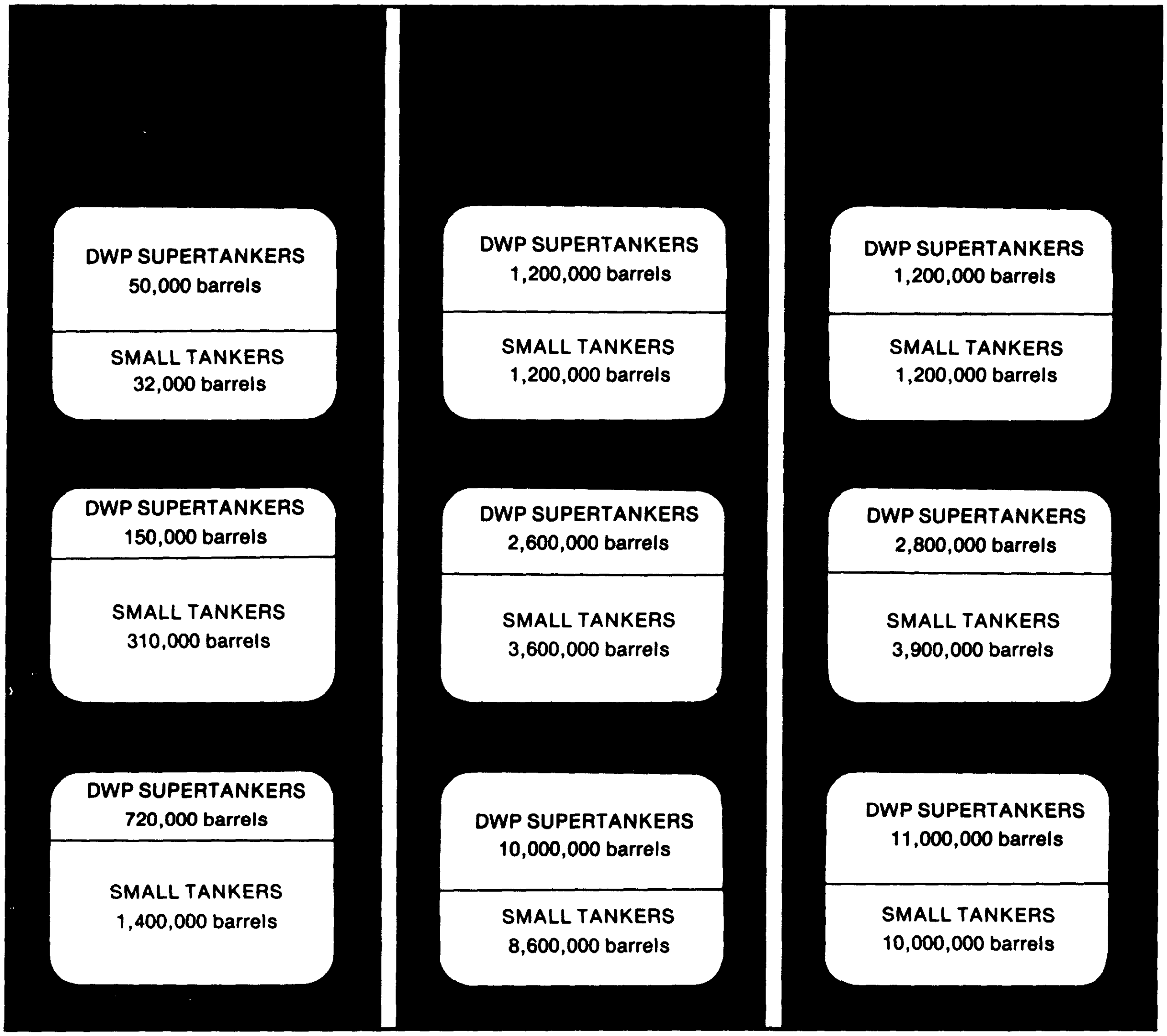
Because there are fewer supertankers and they have been in use a shorter time, the maximums used for the deepwater port/supertanker figure are higher and more uncertain than those for small tankers.

The OTA Working Paper on oil spill risk assessment describes the data and basis for estimating this potential oil spillage. From these spillage estimates, the study concludes that a deepwater port system would offer environmental advantages over small tankers in existing ports. This study assumes that pollution control technology and the tankers themselves utilizing deepwater ports will have safety features equivalent to the smaller tanker alternative.

The Coast Guard has prepared for OTA an analysis of potential oil spill movements should a spill occur at the deepwater port. The data indicates that with a stagnant summer high pressure system producing steady south to east winds, a spill could be expected to move ashore within 3 days.[26] Such projections are subject to great uncertainties because the state of knowledge about the movement of oil at sea is limited and little data is available.

Regulations recently issued by the Department of Transportation (DOT) for deepwater

Figure IV-43. Fifteen (15) year totals of oil spills from one 1.6 million barrel per day deepwater port compared to small tanker alternative



Source Off Ice of Technology Assessment, Working Paper #3

port operations require an operator to provide onsite oil spill containment and cleanup equipment for spills of less than 1,000 barrels which might result from malfunctions in port operations. In addition, the operator must have "readily accessible" equipment to clean up larger spills on a scale that might result from a tanker accident.

Equipment will be subject to approval based on port capacity, operating conditions, weather, experience of the operator, and availability of equipment. The operator will be required to prepare an operations manual describing procedures for use of his own resources as well as possible use of the National Contingency Plan.

The National Oceanic and Atmospheric Administration (NOAA) deepwater ports project office is responsible for evaluating environmental risks associated with deepwater ports and for relating those risks to specific States. A recent NOAA attempt to assess environmental risks to Florida, Mississippi, and Texas from the proposed LOOP and Seadock terminals, however, confirmed the shortcomings of existing data for use in quantifying and forecasting damage and costs. NOAA is exploring methods to improve both the data base and analytical techniques.

The situation off Florida, Mississippi, and Texas also surfaced another problem—the apparent confusion over which States should share in the benefits and protections of the Deepwater Port Act when a port is located offshore.

The. Deepwater Port Act gives "adjacent" coastal States a role in approving a license and benefiting from the protections and provisions of the law. But, except for those States directly connected by pipeline, the Secretary of Transporation makes the final determination of which States are adjacent to a proposed deepwater port.

Because of the benefits of adjacent status and the fact that there are a large number of States close together on the east coast, several States may ask to be designated as adjacent coastal States if a deepwater port should be considered for licensing off the coast of New Jersey and Delaware.

Recently, Florida asked to be declared an adjacent coastal State in connection with the licensing of LOOP and Seadock deepwater ports off Louisiana and Texas. The Florida case brought attention to an ambiguity in the law which may also figure in any applications for adjacent status made by Mid-Atlantic States.

Florida asked for adjacent status because it felt its beaches and coastal wildlife preserves and parks would be subjected to an added risk of oil spills as a result of tankers moving through the Florida Straits to and from the deepwater ports. The Florida request was denied by the Secretary of Transportation on a question of statutory interpretation.

The Secretary ruled that tankers in transit to and from the port should not be considered in determining the risks to States. That ruling has now been appealed in the courts.

Citizens who participated in the OTA study seemed satisfied that the existing technology and regulations for deepwater ports are adequate for safe operation. But there was concern that the supertankers using a deepwater port would be major sources of pollution,

A recent OTA report, "Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures, " examines the evolution of tankers and the pollution and safety problems they cause.[27] It presents approaches for reducing pollution and improving the safety of operations and reviews the international and domestic regulation of these operations. The world fleet of tankers spill about 11.1 million barrels of oil into the seas every year: 7.5 million barrels during routine operations such as cleaning tanks and dumping ballast, 1.6 million barrels as a result of accidents, and 2.0 million barrels during drydocking operations. [28] This spillage accounts for nearly one-third of all ocean oil pollution.

Both the Coast Guard and international organizations are attempting to solve some of the problems of oil pollution of the seas by implementing stricter tanker standards.

In 1973 the International Conference on Marine Pollution drew up a treaty which required new tankers of 70,000 dwt or more to have a segregated ballast capability but the requirement has not been approved by all member nations. The concept of segregated ballast is that a tank vessel must have sufficient spaces set aside for carrying ballast water separately so that in all but unusually rough weather conditions it will not be necessary to introduce ballast water into cargo tank spaces. The concept has gained worldwide acceptance as offering major environmental benefits. [29]

The Coast Guard has implemented a similar requirement for U.S. tankers in domestic service and proposed the same for U.S. tankers in foreign service and foreign tankers visiting U.S. waters.

In addition, the International Conference on Marine Pollution recommended that governments undertake concerted efforts to reduce the discharge of oil from ships into the sea with a view to complete elimination of international pollution by the end of this decade.[30]

To follow up on that recommendation, the Coast Guard is now considering an extension of the segregated ballast concept to make it mandatory for all existing U.S. tankers of 70,000 dwt or more. The Coast Guard has asked for comments on the feasibility and economic impact of retrofitting U.S. tankers and has publicly said that the agency believes the retrofit is possible. According to a notice published in the *Federal Register* on May 13, 1976, the Coast Guard favors the change now because: 1) the present tanker tonnage surplus is expected to last for at least 5 years, allowing time for necessary shipyard alterations without much disruption in the transportation system; 2) most vessels will require only minor changes to the cargo and ballast piping systems; and 3) increases in consumer cost of oil as a result of the change will have only a minimum impact on the present inflationary trend because transportation costs are a relatively small part of the price consumers pay for oil products.[31]

The Proposal for a Floating Nuclear Powerplant in the Mid-Atlantic

BACKGROUND

The need for vast amounts of cooling water has ruled out many potential sites for nuclear powerplants around the Nation. Late in 1972, New Jersey's largest public utility company concluded that the answer to its own siting problems would be floating nuclear plants, moored off the coast where they would have virtually unlimited amounts of seawater for cooling. The company also concluded the floating plants could be built for less money and be less environmentally damaging than land-based plants. Access to cooling water was crucial to Public Service Electric and Gas Co., which generates more than 60 percent of the State's power. Its customers were using electricity at rates that meant doubling Public Service's generating capacity every decade or so and water supply problems were ruling out many potential sites for new generating capacity.

Today, after 3 years of analyzing the offshore power concept, staff members of the Nuclear Regulatory Commission (NRC) and some other Federal agencies have come to the same general conclusion about floating nuclear powerplants. These staff judgments are tentative and are not in any sense formal endorsements of the concept or the construction plans. The Public Service proposal still must work its way through a series of reviews, public hearings, and decisions by State and Federal agencies and meet challenges from environmental groups, New Jersey beach communities, and some nuclear scientists and engineers who say that the systems are unnecessary and may be unworkable or unsafe. Before an offshore nuclear plant can start generating power it must clear three separate stages of licensing. The first of these probably will not come before 1977.

The preliminary NRC staff reviews nevertheless have provided enough encouragement to the companies involved in the floating nuclear powerplants—the Atlantic Generating Station Units 1 and 2—that they have spent more than $120 million thus far for plans, environmental studies, and in tooling-up for production.

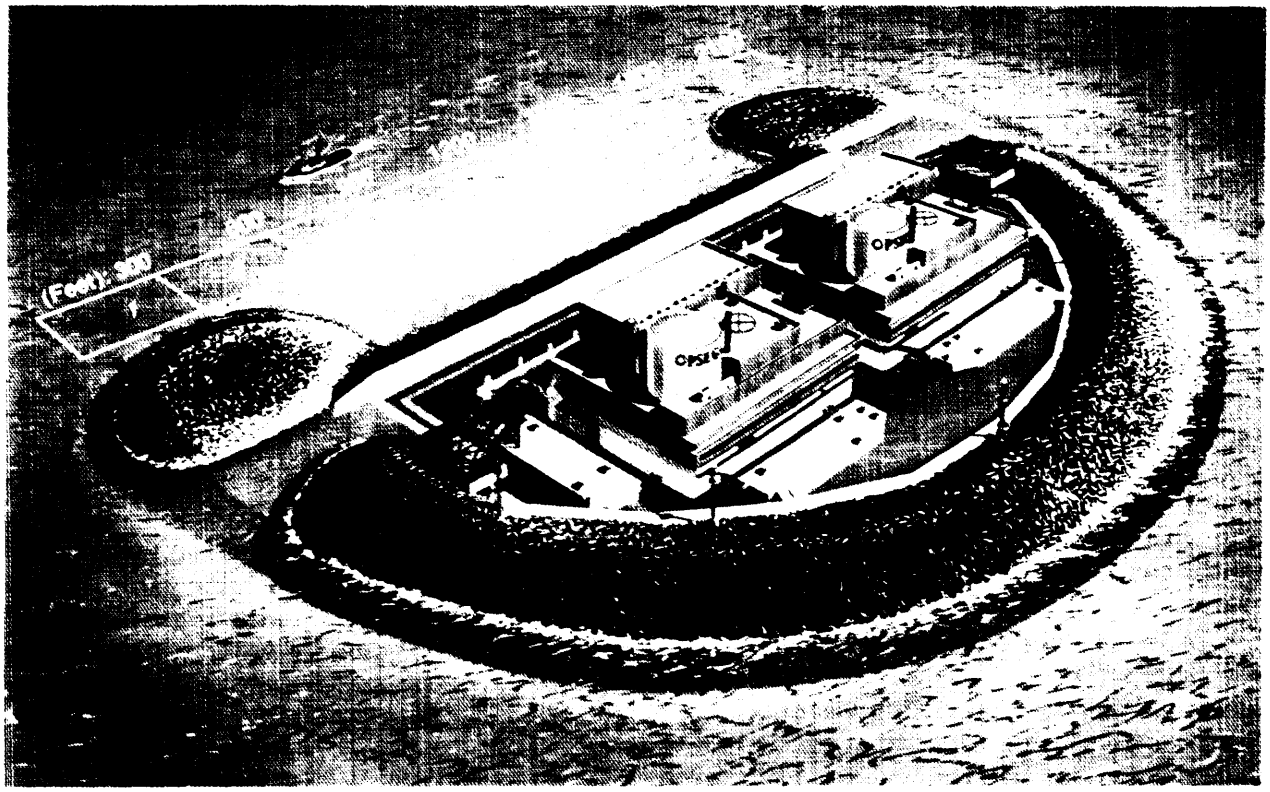
Nothing on the scale of the offshore complex of floating plants and protective breakwater has ever been built in ocean waters anywhere in the world. More cubic yards of rock and concrete will go into the breakwater that will create a lagoon of calm water for the plants and shield them from the pounding of ocean waves than went into many major dams in the United States. The gantry crane in the Florida shipyard where the plants will be built could straddle the dome of the U.S. Capitol.

The powerplants will be assembled by Offshore Power Systems, a subsidiary of Westinghouse Electric Corp., at a shipyard on a manmade island near Jacksonville, Fla., 8 miles up the St. John's River from the east coast.

The platform for each plant will be a steel barge measuring nearly 400 feet square and 44 feet deep, reinforced with bulkheads to form a honeycomb of watertight compartments. A pressurized water reactor (PWR) similar to Westinghouse reactors now operating in land-based powerplants will be mounted on each barge inside a 17-story domed containment structure with steam turbines, generators, and office buildings clustered around it.

The domed containment structure will rise nearly 18 stories above the ocean surface and from the shore will look much like the distant skyline of a small city.

Figure IV-44. Size comparison of proposed Atlantic Generating Station



Source Public Service Electric& Gas Company and Off Ice of Technology Assessment

While the floating plants are being built, construction workers will build the largest structure ever placed in ocean waters-a massive, curving breakwater of 5.6 million tons of stone and cast concrete that will span 49 acres of ocean floor and rise 64 feet above the water surface.

Powerplants will be towed at intervals of 2 years from Florida, moored, sealed in the breakwater with a wall of concrete caissons, and connected to 4 miles of underwater cable leading to shore and the power distribution grid, Public Service plans are to have the first plant operational in 1985 and the second in 1987.

Each plant is designed to generate 1,150 megawatts (MWe) of power, a supply that Public Service estimates will provide about one-third of the additional power it must be generating each year by 1987. The plants have a design life of 40 years, after which they may be shut down and decommissioned.

When Public Service began exploring the offshore plant concept in the late 1960's, electrical energy consumption in its service area had been increasing at an annual rate of nearly 8 percent.[1] The eastern blackout of 1965 still was a recent memory and there was strong pressure not only to keep up with rising demand but also to maintain reserves of power to prevent future blackouts and brownouts,

There were counterpressures as well. Public Service customers are in the most densely populated wedge of land in the most densely populated State in the Nation and the company had to compete with homes and other industries for both land and water.

By the early 1970's, environmental restric-

Figure IV-45. Visualization of a floating nuclear powerplant in comparison to the USS Franklin D. Roosevelt

Visualization of a floating nuclear powerplant

USS Franklin D. Roosevelt

Source Public Service Electric & Gas Company tions on air and water pollution also were taking effect, making the search for sites even more difficult and adding months and, in some cases, years to the lead times for powerplant construction.

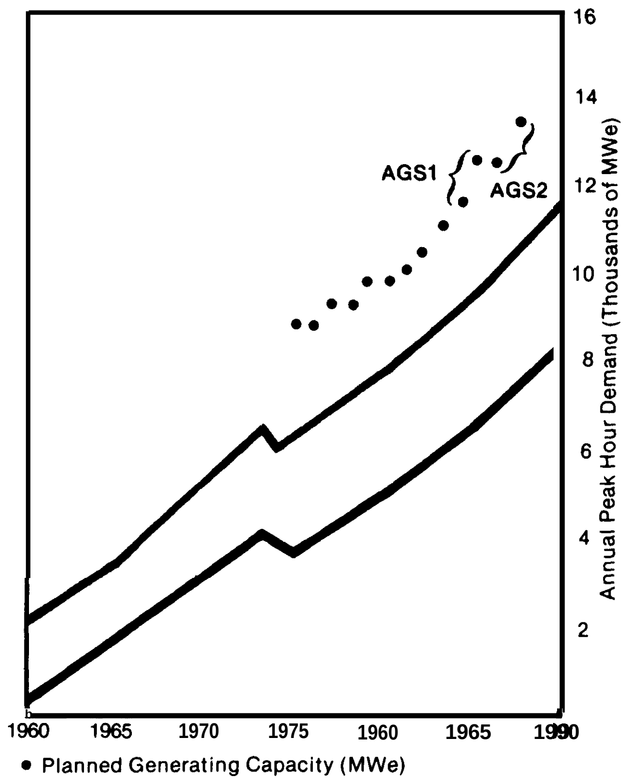
The 1973 oil embargo and four-fold rise in prices that followed the embargo took some of the pressure off Public Service. The price of electricity rose sharply with the price of oil, which was then being used to generate 77 percent of New Jersey's power. Higher energy prices coupled with a recession drove down consumption so that by 1976, Public Service estimated that the growth in consumption in its area would be only slightly more than 4 percent a year through 1985, about two-thirds of the preembargo growth rate. z

Even at this slower growth rate, New Jersey will need the equivalent of four new 1,150 megawatt powerplants for baseload power generation by 1995 in addition to the Atlantic Generating Station (AGS) and other new plants that are scheduled for operation by 1987.[3]

During the period of steep growth in demand in the late 1960's and early 1970's, the offshore plant was a critical element in Public Service's long-range plans for providing new generation facilities. Its construction schedule called for having large amounts of new generating capacity in place by the early 1980's. Two land-based nuclear plants near Salem, N.J., were running 5 years behind schedule. Construction of two more nuclear units was delayed when objections to the use of Newbold Island in the Delaware River forced Public Service to relocate the project to Hope Creek, just north of the Salem plants. Lead times for land-based plants elsewhere in the State were running between 8 and 12 years.

The sharp drop in electricity demand in 1974 and 1975 allowed the company to slip its construction schedules. But by 1976, with lead times for land-based plants expanding rather

Figure IV-46. Annual observed and forecast values for energy consumption and peak-hour demand, 1963-1987, for Public Service Electric & Gas Company area. The planned generating capacity is also shown for 1975-1987.



Source Draft Environmental Statement—Atlantic Gas Service

than shrinking, the AGS was seen by the company as its best hope of meeting projected demands for electricity with nuclear power.

The first design for a floating nuclear powerplant was commissioned in the mid-1960's by the Atomic Energy Commission (AEC) which was searching for a way to insulate nuclear plants from earthquakes.[4]

The concept was endorsed by the Energy Policy Staff of the President's Office of Science and Technology in August 1970. s The staff, in cooperation with an interagency task force, stated that, "The use of offshore siting adjacent to coastal cities would circumvent the problems of land availability, objections on esthetic grounds, and assure the adequacy of cooling water. "[6]

Public Service adapted the concept and asked the Nation's four reactor manufacturers to test its feasibility. Westinghouse, General Electric Co., and Babcock & Wilcox Corp. responded with proposals. In December 1970, a Westinghouse study team concluded that the floating plant could be built and the next year Offshore Power Systems was created as a joint venture of Westinghouse and Tenneco Inc. to manufacture floating plants. Tenneco withdrew from the venture in early 1975. In September 1972, after conducting its own site surveys off the New Jersey coast, Public Service contracted to buy the first two floating plants to be produced by Offshore Power Systems. In 1973, Public Service signed a contract for two more floating plants.

Several advantages of supplying electricity from offshore stations have been advanced in recent years by supporters and some analysts of the concept. Promoters of offshore plants take the position that:

- Unlimited supplies of cooling water are available at ocean sites and the environmental consequences of discharging heated water into the ocean will be minimal compared with the consequences of discharging heated water into rivers, lakes, and bays.

- Offshore construction eliminates the disruption of coastal marshlands and estuaries to a great extent.

- The floating powerplant concept moves in the direction of standardized nuclear plant designs, [a] goal the Nuclear Regulatory Commission (then the Atomic Energy Commission) set in 1972.

- Shipyard construction of plants will shorten the time required to put a nuclear plant in operation after a decision is made to build it.

- Volume production can cut costs and improve quality control.

Federal and State agencies have been reviewing the offshore powerplant proposal informally since late 1971 and formally since July 1973, when the AEC docketed an Offshore Power Systems application for a permit to build eight floating nuclear powerplants.

During that time, the AGS has received encouragement from the staff of the Council on Environmental Quality, which views the proposal with "guarded optimism."[7] The NRC's Office of Nuclear Reactor Regulation has declared the project "generally acceptable" as to environmental impact and risk. [8] The same office concluded in a Safety Evaluation Report published in September 1975 that with some modifications in design "there is reasonable assurance that . . . (the reactors could be installed) without undue risk to the health and safety of the public."[9]

On June 7, 1976, the NRC's independent Advisory Committee on Reactor Safeguards (ACRS) issued an interim report on the floating nuclear plant saying that if a number of issues were resolved "the floating nuclear plant units can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public."[10]

Several major contentions challenging some of these claims have been raised by intervenors[11] in preheating conferences since 1974. Among those admitted by the Atomic Safety and Licensing Board (ASLB) for further consideration are:

- The plant will be vulnerable to external hazards such as ship collisions, airplane crashes, and severe storms, and damage to the plant could result in dispersal of radioactive materials injurious to human health and aquatic life.

- Transportation and handling of radioactive fuel and wastes involve risks to human safety and health and to the marine and coastal environment.
- Evacuation in case of an accident will be difficult, especially in summer months, and there are no adequate plans or procedures for such emergencies.
- Fear of nuclear accidents will reduce the appeal of the area for recreational uses and have a detrimental effect on the region's tourist -based economy.
- Inadequate consideration has been given in the environmental cost-benefit balance to the adverse somatic and genetic consequences to marine, animal, and plant life.
- Inadequate attention has been given to the radiological impact on humans who may boat or swim in the vicinity of the facility and to the cumulative effects of radioactive substances injected along the food chain from plankton through humans.
- Operation of the plant will cause thermal pollution and under some circumstances could result in fish kills and other damage to marine life.
- The breakwater may cause changes in wave and tidal patterns and adversely affect the shoreline.
- Other impacts that could be adverse include industrialization of the ocean around the site, onshore support facilities, dredging, and defects in underwater electrical transmission lines.
- NRC should prepare a comprehensive, programmatic EIS on the construction of floating nuclear powerplants located offshore on or above the Continental Shelf.

Among other contentions raised by the intervenors but not admitted by the ASLB are:

- Radioactive discharges during the normal operation of the plant or from an accident would pose a risk to public health and safety and cause damage to marine organisms.
- The floating nuclear powerplant is an untested technology and the coastal area of Atlantic County will be a virtual testing ground near major population centers. One intervener urged full-scale prototype testing before any plant is installed.
- There is uncertainty as to the reliability of the safety systems, including the containment structure.
- There are risks from the corrosive effects of the marine environment on the plant's structure, and the effects of erosion and shifting of the ocean floor on the stability of the breakwater.
- The plant will be vulnerable to sabotage.
- There should be more thorough studies of alternatives to the plant.

The State of New Jersey, which has not sought official intervener status, has raised the following points in a May 4, 1976, letter to the NRC by Environmental Protection Commissioner David J. Bardin:

- The possible consequences of a "severe" accident should be considered in the licensing process.
- All safety risks from the plants should be addressed.

New Jersey and Delaware residents who took part in a public participation program carried out as part of this study are generally well aware that advantages and disadvantages must be weighed in deciding whether to build floating nuclear powerplants.

Information gathered in two regional

workshops, from 1,000 responses to an OTA questionnaire, and from press reports and statements at public hearings show that the public sees the disadvantages as involving questions of safety, environmental degradation, and high construction costs. The advantages include increased energy supplies with resulting economic expansion and cheaper power than would be possible with continued use of oil-fired generating plants. Safety concerns include a perception that floating nuclear powerplants are experimental and that there is limited experience on which to base estimates of risk and reliability.

Among the advantages cited in questionnaires and workshops are that nuclear powerplants are less polluting generally than fossil-fueled plants. In turn, participants saw advantages in floating plants over land-based plants in their distance from shore and the elimination of pressures on New Jersey water supplies for cooling water.

In this study, OTA has analyzed available information on costs, benefits, environmental impact, safety, waste disposal systems, transportation, and decommissioning activities associated with the floating plants, The study does not attempt to evaluate general controversies about the safety and performance of nuclear plants; these are beyond the scope of the coastal effects analysis. It concentrates, instead, on exploring differences between the designs of floating and land-based plants and comparing the advantages and disadvantages of each.

As a result of this comparative analysis, the study finds that:

- Although the costs of the first two floating nuclear plants, AGS 1 and 2, are about the same as the costs of a similar land-based plant, volume production and standardization eventually could slow down the rapid escalation of capital costs of nuclear powerplants.
- Offshore siting of nuclear plants would reduce thermal pollution and eliminate disruption of marshlands and estuaries that would be associated with land-based or shoreline nuclear installations.
- Routine operations would produce less air pollution than would routine operations of a coal-fired plant equipped with flue gas desulfurization and other advanced pollution control equipment.
- The NRC has not evaluated and does not plan to evaluate risks from accidents in floating nuclear plants comprehensively enough to permit either a general comparison of the relative risks from land-based and floating plants or an assessment of the specific risks associated with deploying Atlantic Generating Station Units 1 and 2.[12]
- Several technical problems of design and operation remain to be resolved, including procedures for transporting nuclear fuel to a floating plant and carrying radioactive wastes to shore, the process of decommissioning a floating plant, and the techniques of towing plants from Florida to the Mid-Atlantic coast.
- There do not seem to be any significant differences between land-based and floating powerplants as to releases of radioactive material and other pollutants during routine operations.
- Although the nuclear reactor steam supply and turbine generator systems and the floating barge are, separately, proven technologies, the combination is not. In addition, there are unique features including the barge-to-cable connection, the breakwater, and the mooring system that have not been tested by experience.

TECHNOLOGY

The operating principle of all steam electric plants is similar, whether the source of heat is coal, oil, gas, or a nuclear chain reaction. In all such plants, heat turns water to steam which powers turbines to drive electric generators. The steam is recondensed to water and pumped back through the steam-generating system.

In an AGS plant, the process will begin inside a reactor vessel, a steel tank five stories high and weighing 550 tons. When thousands of thin metal rods packed with uranium dioxide are clustered at the bottom of the reactor vessel, atoms of uranium-235 begin splitting in a chain reaction to produce the plant's heat source.

A closed loop of pipes—the coolant system—in which water is pumped under pressure through the reactor vessel and around the fuel rods serves two purposes. The water moderates the fission process and at the same time draws off the heat energy and carries it through tubing in four steam-generator tanks. The average temperature of water in the cooling circuit is about 600°F. The system is pressurized to prevent the water from boiling at that high temperature.

If all cooling systems failed, the core would rapidly overheat, reaching temperatures near 5000°F at its center within 30 minutes and falling in a molten mass to the bottom of the pressure vessel within hours. An emergency core cooling system (ECCS) is designed to prevent such a core-melt, which could produce an accident with large public consequences.

A second closed loop of water turns to steam when it flows along the hot tubes inside the generator tanks which are some seven stories tall and 22 feet in diameter. There are four steam-generators in the AGS plants.

In the final phase of the process, steam expands through turbines to drive generators and into a chamber where a stream of water, flowing through condensor tubes at a rate of 1 million gallons a minute, cools the expended steam and condenses it to water which then is pumped back through the steam-generating cycle.

The open ocean provides a virtually unlimited supply of water for cooling at least small numbers of offshore plants.

Nuclear Reactor

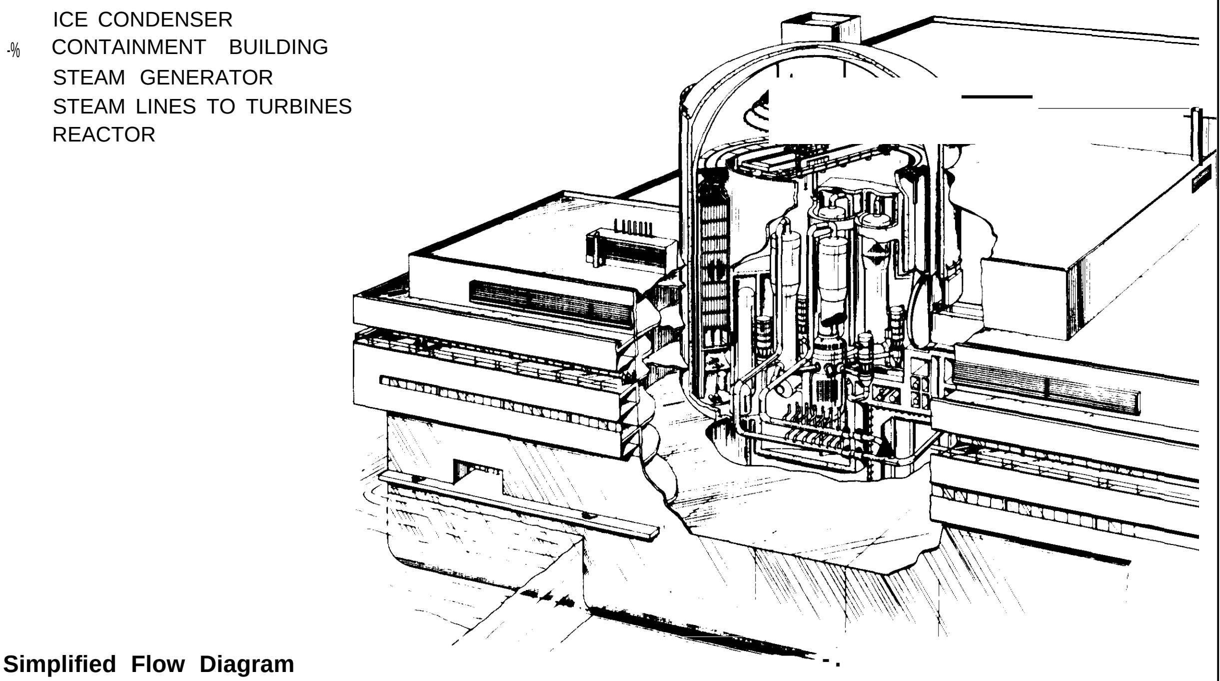
The reactor vessel and steam-generating tanks are enclosed in a steel-lined cylinder of concrete 3 feet thick that has a domed top and stands 169 feet tall—the containment structure. The domed containment building is designed primarily to prevent steam and radioactive materials from escaping into the atmosphere as the result of a major accident that might involve a rupture in the coolant-water loop or the steam-generating system. Each AGS containment building will hold 2.5 million pounds of ice designed to condense steam rapidly and reduce pressure on the walls of the containment building in the event of a major accident. One ice-condenser system already has been installed as part of an operating land-based plant; ice condensers will be used in nine other land-based plants now under construction. Between the reactor vessel and the containment building, steel and concrete shields are used to prevent the escape of radiation produced in the fission process.

Steel buildings will be mounted on the platform around the containment structure to house turbines, generators, power-transmission circuits, the reactor control center, and office and living space for 120 plant personnel.

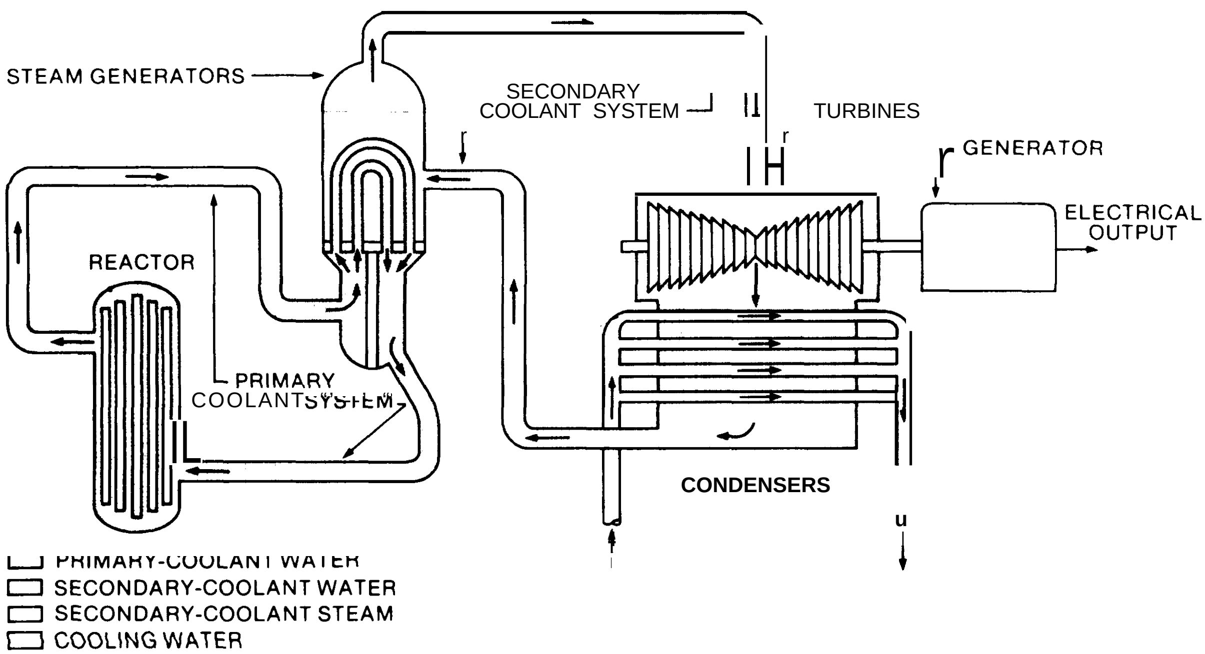
Platform

The powerplant is mounted on a steel barge nearly 400 feet square and 44 feet deep with watertight compartments, some of which

Figure IV-47. Cutaway diagram of a floating nuclear plant containment building



Simplified Flow Diagram of the Steam-electric system



Source (Top Diagram) Offshore Power Systems

(Bottom Diagram) Pages 3-7, Part II, Draft Environmental Statement on the Manufacture of Floating Nuclear Powerplants can be filled or drained for use as trim tanks to keep the huge platform level,

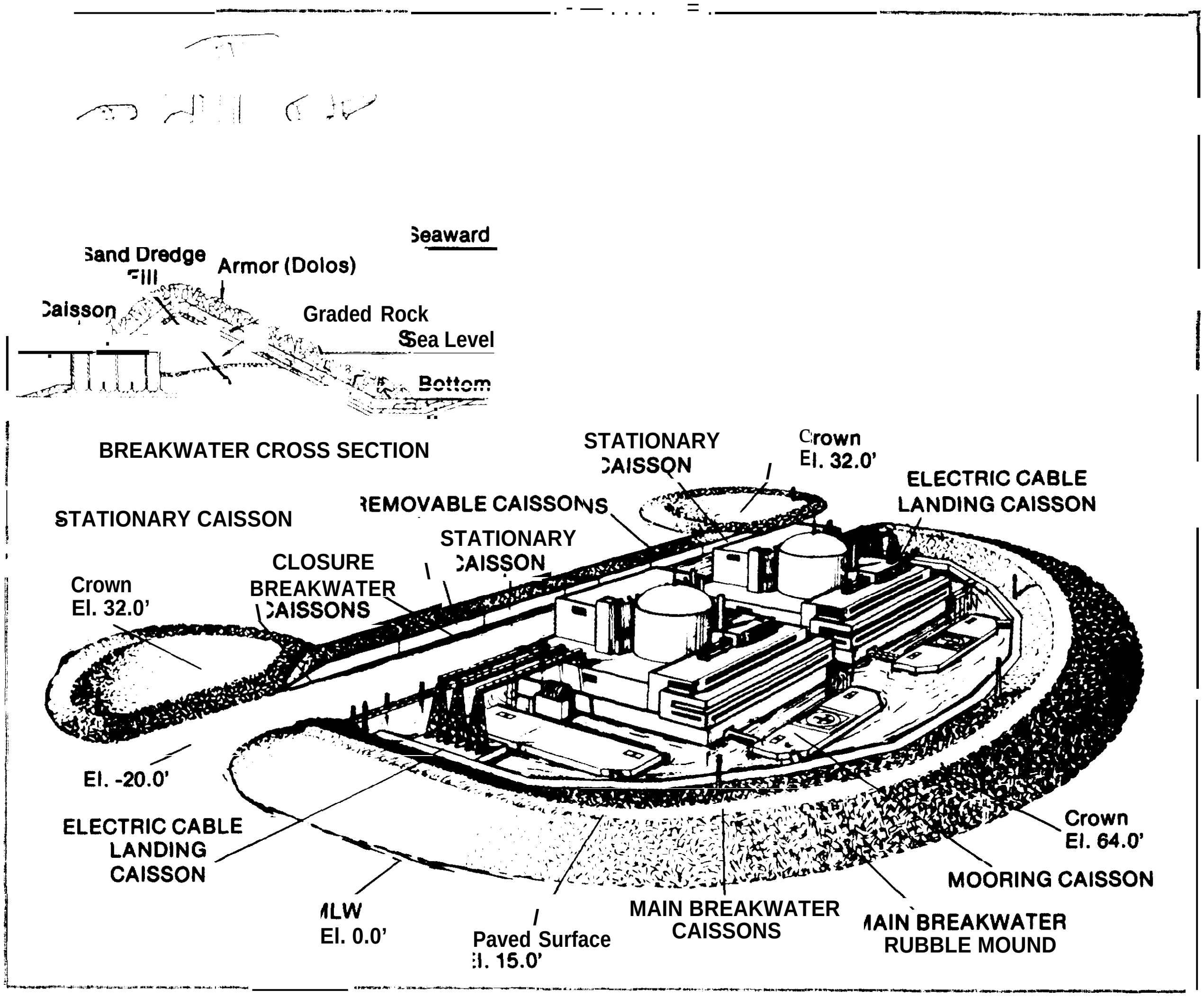
Cooling water is drawn through six intake screens on the landward side of the platform-each measuring 27 feet by 15 feet. A corrosion-prevention system using sacrificial anodes on the floor of the mooring basin will be installed.

Breakwater

One massive, D-shaped breakwater will shield both floating plants from ocean movement and from ships and will provide a basin of calm water in which the platforms will float.

In the first phrase of construction, 10 empty concrete caissons about 200 feet long, 100 feet wide, and 50 feet deep will be floated into a semicircle and filled with sand to sink them to the ocean floor. The caissons provide a base against which some 3.5 million tons of rock and a covering layer of 17,000 cast-concrete forms called dolos will be piled to form the seaward protection for the powerplants. Most

Figure IV-48. Offshore siting rubble mound breakwater, Atlantic Generating Station



Source Public Service Electric & Gas Company of the dolos weigh 42 tons; some range up to 62 tons. Before the powerplants are moored inside the semicircle, a straight line of seven caissons will be sunk to the bottom on the landward side of the mooring basin to complete the protective shield. Two of these will be removed to float each barge into place and then repositioned.

Power Transmission

The generating station's combined output of 2,300 megawatts of electricity, enough to meet the needs of a community of more than 1 million people, will be transmitted to shore through oil-cooled copper cables sheathed in plastic and a lead-alloy casing and buried 10 feet beneath the stable ocean floor.

DEPLOYMENT

The Public Service schedule for the AGS calls for one powerplant to start producing electricity in 1985 and a second to be online in 1987. Between now and then, eight Federal agencies and the State of New Jersey must approve one or another aspect of the project. The crucial clearances are those required from the NRC and the New Jersey Department of Environmental Protection.

The NRC will make three separate licensing decisions on the project. Clearance for construction of the barge-mounted plants will be shared by the Commission and the U.S. Coast Guard, which have signed a memorandum of understanding under which approval of both agencies will be required before a floating plant may be moved to a generating site. Approval also will be required from the U.S. Army Corps of Engineers, the Environmental Protection Agency, the Federal Aviation Administration, the National Oceanic and Atmospheric Administration, the Department of Justice, and the Department of the Interior at successive stages of the project.

Site

The minimum water depth for the floating plants of the AGS is 45 feet. Some dredging will be done to level the bottom to obtain this depth. With less than 45 feet of water, there is not enough clearance between the platform and the basin bottom to assure the barge will not be grounded in hurricane waves, a tidal wave, or a tornado.[13]

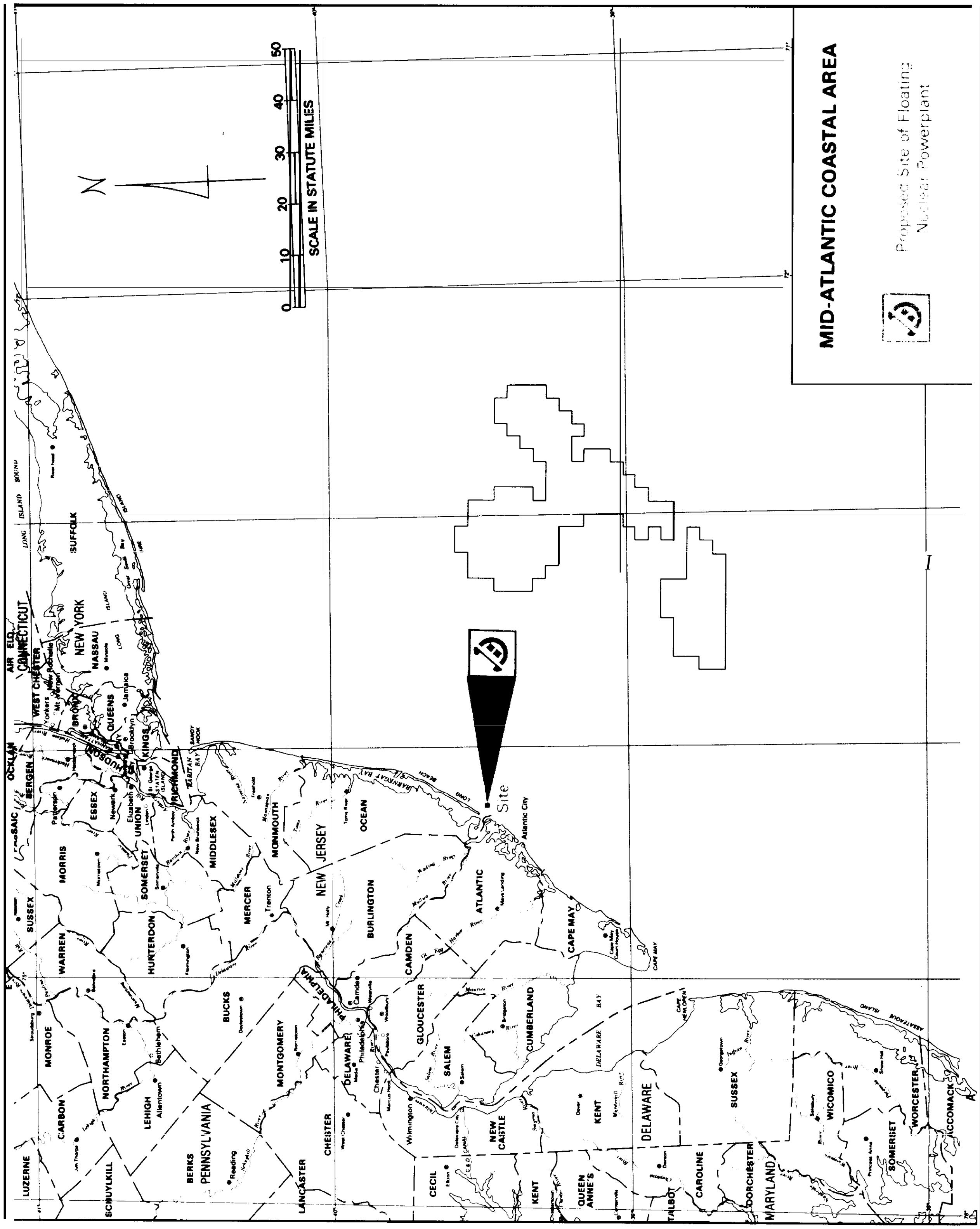
The AGS will be inside the 3-mile limit, which places the plants inside U.S. territorial waters and under Federal jurisdiction, and within the legal jurisdiction of the State of New Jersey. Both powerplants will be relatively close to existing transmission grids, which both limits the costs of new transmission facilities and reduces the amount of power lost in transmission. The generating station will be about 15 to 20 miles from major ship traffic in the Atlantic coastal shipping lanes. (Figure IV–49.)

Licenses

A series of more than 70 Federal, State, and municipal licenses and permits will be issued for the AGS in a review and decision process that will span 12 years.

A steering committee of Federal agencies, chaired by the NRC, has been created to monitor the licensing process and exchange information on various aspects of the project.[14] Represented on the committee are the Commission, the Coast Guard, the Corps of Engineers, the Council on Environmental Quality, the Department of the Interior, the Environmental Protection Agency, the Federal Aviation Administration, the Federal Energy Administration, the Federal Power Commission, and the National Oceanic and At-

Figure IV-49. Proposed site of floating nuclear plant



Source: Office of Technology Assessment and Public Service Electric & Gas Co.

mospheric Administration.

The first-and the most important—Federal license is a permit to manufacture the floating powerplants. The Office of Nuclear Reactor Regulation has been reviewing environmental and safety aspects of the plants at the staff level since mid-1973. The ACRS, an independent panel of scientists and engineers appointed by the Commission, is conducting an independent appraisal of the project and reviewing the work of the reactor licensing staff. When these safety and environmental reviews are completed, an Atomic Safety and Licensing Board, also appointed by the Commission, will hold public hearings, review the record on the project and recommend for or against a license. The decision is subject to appeal before an Atomic Safety and Licensing Appeal Board and may ultimately go before the Commissioners for a final decision.

A license for Offshore Power Systems to manufacture eight plants would be issued under a policy adopted in April 1972 by the Atomic Energy Commission, now the Nuclear Regulatory Commission.[15] Before that time, all nuclear powerplant designs were reviewed in detail, even in cases where a new plant would be identical to designs that already had been cleared by the Commission. The 1972 policy was adopted to move the nuclear power industry toward a pattern of standardized powerplants to shorten the planning and review process and, in turn, the lead time for construction of nuclear plants. Under the policy, a design for a plant that has been approved by the Commission can be used repeatedly during at least a 5-year period without further detailed review. Twenty-one applications for approval of plants that duplicate earlier designs were on the Commission's docket as of December 31, 1975.[16]

The Coast Guard will review those aspects of a floating plant design that relate to the barge and must certify the barge as seaworthy before a completed plant can be moved from the Jacksonville shipyard to a permanent installation. Under a memorandum of understanding between the NRC and the Coast Guard, a floating plant will not be cleared to leave the shipyard without both Coast Guard and NRC approval.[17]

A second round of Federal permits is required for Public Services Electric and Gas Co. to construct a breakwater and prepare the site, The NRC must approve the site for a nuclear installation. The U.S. Army Corps of Engineers must approve dredging and other aspects of the project under the Rivers and Harbors Act of 1899 and other acts.[18]

The NRC site-review process is similar to that for a manufacturing license. A decision will be made by an Atomic Safety and Licensing Board after staff analysis of the plants and public hearings in the Atlantic City area. A decision is subject to appeal before an Atomic Safety and Licensing Appeals Board and—in some cases—to a final review and decision by the Commission itself. A Commission decision can, in turn, be appealed in Federal court.

A third Federal permit, an operating license, is required before fuel can be placed in a reactor vessel to prepare a plant for operation. Public Service will initiate this final review for the AGS about 3 years before its first plant is scheduled for completion by submitting a Final Safety Analysis Report (FSAR) and an Environmental Report. The Office of Nuclear Reactor Regulation will conduct one more analysis of the project, as will the Advisory Committee on Reactor Safety. A public hearing is mandatory if one is requested by citizens in the construction region, The Atomic Safety and Licensing Board will approve or disapprove startup of the plant if there is a hearing. If there is no hearing, NRC staff issues the operating license. The same avenues of appeal are available in the operating-license process as in the site-approval process.[19]

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More than half of the licenses and permits for the AGS must be issued by State and local government in New Jersey.

The State of Florida must approve dredging the St. John's River that would link the shipyard to the sea. It has approved water and air quality control systems for the manufacturing plant site. The City of Jacksonville already has issued permits for construction of the manufacturing facility, which was underway in 1976.

Permits for construction of the AGS breakwater and burying of transmission cables to shore must be issued by the Department of Environmental Protection in New Jersey which administers New Jersey riparian lands, the State's Wetlands Act, and the Coastal Area Facilities Review Act.

The Department also must issue permits for transmission lines that cross streams and for any construction of onshore facilities in the State's coastal area.

The New Jersey Department of Labor and Industry must issue a permit for construction of the breakwater and installation of floating powerplants. Local governments must approve onshore support facilities and laying of underground cable between the coast and a Tuckerton, N. J., switchyard. The State must grant riparian rights to PSE&G for the site, which may require the passage of special legislation.

The New Jersey Department of Environmental Protection also must issue a permit as part of the final licensing process for loading nuclear material into the floating plant's reactor vessel.

Public Role in Licensing

Any citizen or group of citizens who can demonstrate economic, environmental, or other interests in the outcome of a licensing case may petition for status as interveners. Intervenors, who also may include government agencies, may petition either to support or oppose an application, and are present throughout formal hearings, cross-examining witnesses and presenting expert testimony of their own. Interveners are selected from the list of petitioners by the ASLB after a series of preheating conferences on the basis of specific areas of concern which they describe in their petitions. A rejection of a petition to intervene may be appealed to the Atomic Safety and Licensing Appeals Board or to the courts.

Six interveners were chosen for hearings on the Offshore Power Systems manufacturing license after preheating conferences that lasted from February 1974 to December 1975.

Formal hearings began in March 1976, in Jacksonville, Fla., the site of the shipyard where the floating powerplants would be built. Because the licensing process for floating plants is unique in that plants will be built in one location and installed in another, the hearing was continued the following week in Atlantic City, N.J.

In all formal hearings, the general public is permitted at the outset to make brief statements either for or against a license. After these opening statements, public participation is limited to formal interveners.

Although the Atlantic City hearings were technically confined to the environmental effects of building floating plants in Florida, Board Chairman Thomas Reilly opened the Atlantic City hearings to a broad range of questions and statements by the general public.

Hearings on the manufacturing license will proceed in four stages. The first hearings were held in Jacksonville in late March. These hearings covered environmental aspects of the manufacturing facility. Following the hearings in Jacksonville, two days of special hearings were held in Atlantic City to enable the citizens of that area to make limited appearances before the ASLB.

The second phase of hearings was in progress in Bethesda, Md., in mid-1976 covering radiological, safety, and health issues. The third phase will also cover safety issues and will follow the Nuclear Regulatory Commission's publication of its final Safety Evaluation Report. The final hearings will cover general environmental questions, including the findings of a Liquid Pathways Generic Study in which the NRC will discuss the environmental impacts of a severe accident at the Mid-Atlantic Ocean sites which include the Atlantic Generating Station. These hearings will begin in late fall of 1976 or early the following year after the Liquid Pathways Generic Study has been released.

A similar series of hearings will be held in or near Atlantic City on the Public Service application to prepare an offshore site for two floating nuclear plants (the Atlantic Generating Station). These hearings will probably not begin before June of 1977.

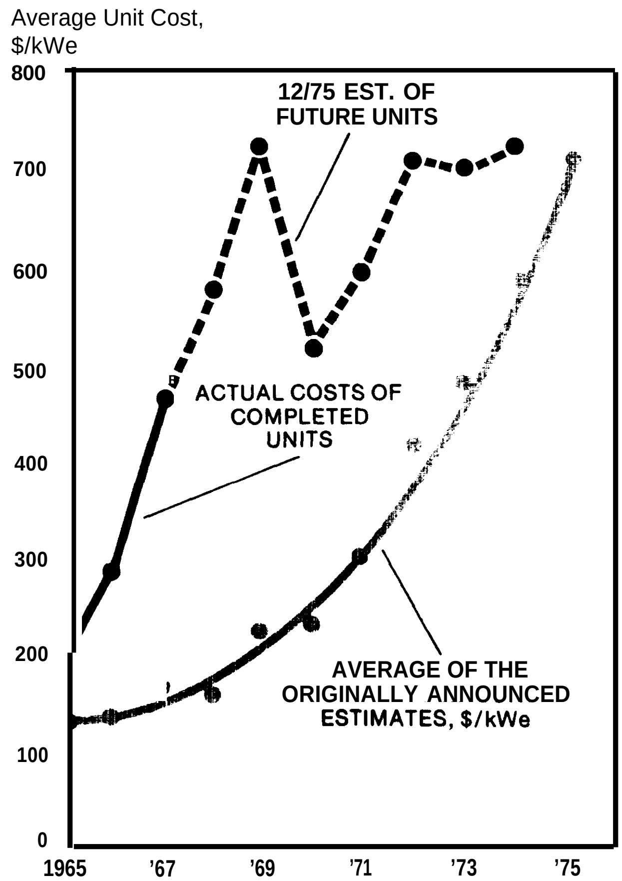
Interveners in the manufacturing license hearings are the Natural Resources Defense Council, the Atlantic County Citizens Council on the Environment, Atlantic County, N. J., the city of Brigantine, N.J., the State of New Jersey, which so far has not adopted a position for or against the license, and Ken Walton, a resident of Brigantine.

Interveners in the application by Public Service for a license to prepare a site off the New Jersey coast will include the six intervenors in the manufacturing license case as well as a seventh, Ocean County, N.J.

costs

One argument in favor of floating nuclear plants has been that the use of standardized design and a centralized work force could reduce the capital cost of floating plants below that of land-based plants. However, any cost advantages will be offset to some extent by the additional expenses associated with a floating plant, most importantly the massive break-

Figure IV-50. Cost estimates of nuclear units at time of order vs. actual finished cost or estimate as of December 1975



Source F.C Olds, "What Happened to the Nuclear Plant Program in 19757, " *Power Engineering, 4/76,* pp 83-85

water and buried transmission lines required for an offshore site. Since the costs of constructing a land-based plant and of siting an offshore plant depend heavily on specific sites, it is difficult to make generalizations about the possible overall cost advantages of the floating plant.

An analysis for OTA concludes that the capital costs of the AGS and a land-based plant of identical capacity would be comparable.[20] Assuming no unforeseen delays or overruns in either case, the AGS is expected to cost $1.9 billion and a 'comparable land-based plant to cost $2.0 billion—a difference of about 5 percent in a floating plant's favor. The possibility of error in forecasting could change either or both of these figures as well as the floating plant's cost advantage.

The analysis also concludes that because of the fixed-price contract that Public Service has signed with Offshore Power Systems, delays or overruns in construction costs would widen the price advantage for the floating system to about 10 percent.

About 80 percent of the total cost of the AGS is represented by the floating plants. Offshore Power Systems, and not Public Service, will be responsible for cost overruns in plant construction. In the standard land-based construction contract, a utility company has only about 20 percent of its total costs fixed by contract and is responsible for any overruns in the remaining 80 percent of the total cost.

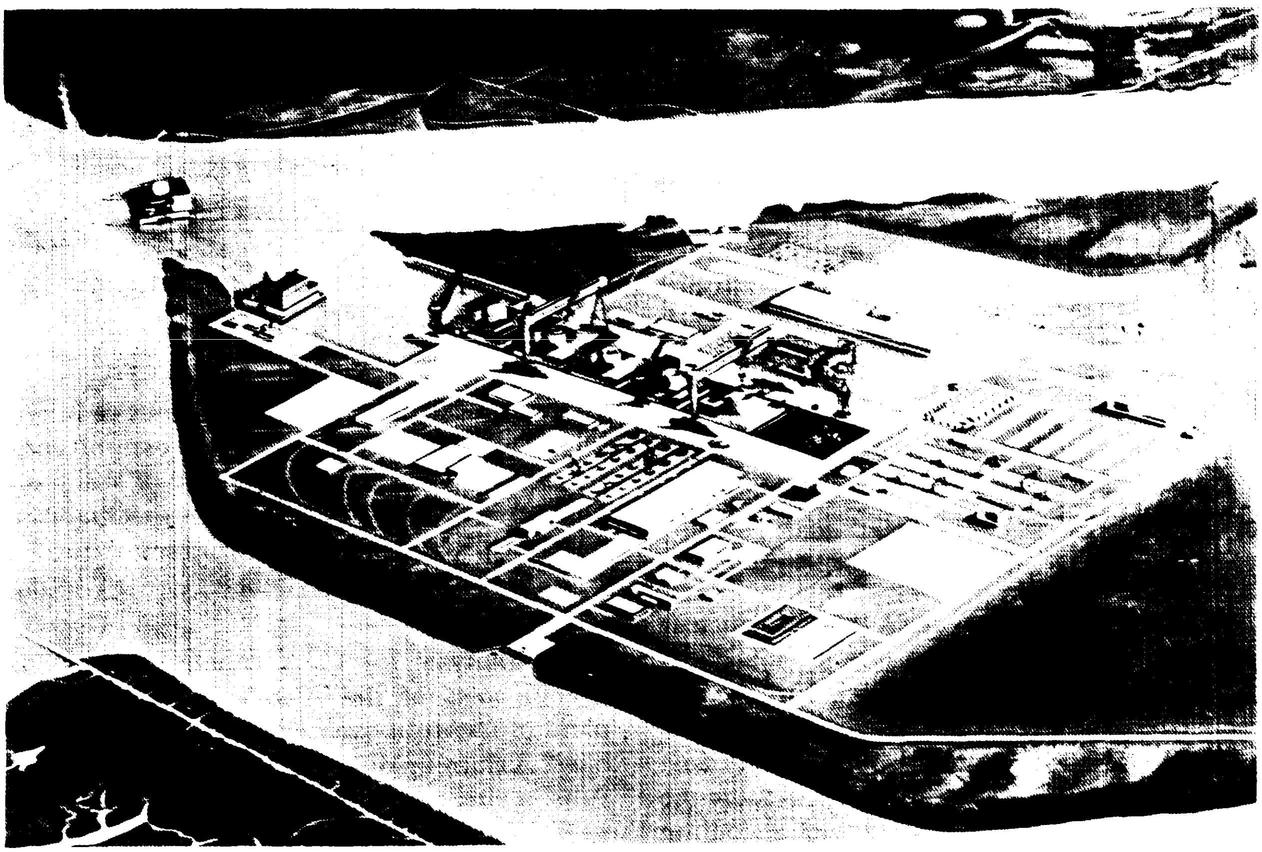
The largest additional costs that could be associated with the AGS are for the breakwater and underwater power cables, which are now estimated at $250 million without escalation or overruns. Public Service would be responsible for overruns on these items. However, the floating plants would compare favorably with land-based plants even if the costs of a breakwater were to exceed the budget by 50 percent.

Under the worst circumstances, the analysis shows, the costs of the AGS probably will not be higher than the costs of a comparable land-based plant.

Assembly

Offshore Power Systems has completed

Figure IV-51. Floating nuclear powerplants manufacturing facility, Jacksonville, Florida



Source Offshore Power Systems, Inc

several buildings at its Jacksonville, Fla., shipyard and begun dredging a graving dock or drydock and a slipway some 415 feet wide which will be the center of the assembly procedure for floating nuclear powerplants,

Fabrication of each floating plant begins with construction of a barge in the graving dock at the upper end of the slipway that runs between a series of production shop areas. When the barge is completed, it is floated, towed along the slip, and moored at successive production areas where workers assemble and mount elements of the powerplant on the barge. The final stage of construction takes place at the lower end of the slip where the powerplant is tested, certified, and towed down the St. John's River.

Offshore Power Systems estimates that the first plant will take about 4 years to build but that at peak production the facility could turn out four to five plants a year with an average construction time of 27 months per plant and a peak work force of 13,800.[21]

Before a floating plant leaves the Jacksonville shipyard, it will be tested under NRC supervision to verify that it meets design standards. Coast Guard inspectors will inspect the barge to certify its seaworthiness. Electrical systems, controls, and steam-generating systems will be tested under simulated operating conditions. No nuclear fuel will be placed aboard a floating plant until it is moored inside its breakwater.

Breakwater Construction

It will take a crew of about 350 offshore workers 4 years to build the breakwater, working around the clock in 8 hour shifts. Less than half of these workers will actually work at the site. On an average, two barges will arrive each day from quarries in New Jersey or New England, carrying rock for the breakwater.

Dredges will prepare the breakwater site by cutting away nearly 1 million tons of ocean floor to expose more stable sediment than now exists at the site, A layer of rock over the dredged area will form the bottom of the mooring basin. Mooring caissons will be placed inside the breakwater before the first floating plants are installed. To complete the shield, a line of seven concrete caissons—ranging in length from 100 to 300 feet—will be floated into position behind the first powerplant and filled with sand to settle them to the bottom. Two caissons later will be emptied, refloated, and moved out of the way to allow installation of the second floating plant.

A gap of about 180 feet between the rock breakwater and the landward line of caissons will permit a flow of cooling water to the powerplant intakes and access for service ships.

Transmission System

About 100 workers will be involved over a period of more than 2 years in building a link between the breakwater and Public Service's distribution network.

Fifteen cables will be laid between the breakwater and the shore, buried 10 feet beneath the stable ocean floor with jetting devices that carve a trench in bottom sediment with high pressure streams of water and compressed air directed through nozzles. Jetting is a device commonly used in burying communication cables and pipelines. Between the coast and a switchyard at Tuckerton, N. J., a distance of about 7 miles, the cable will be buried under Great Bay Boulevard. Overhead transmission lines will carry the AGS power from Tuckerton to Forked River where it will be directed into the distribution network.

Plant Installation

After the breakwater and transmission system are completed, the first floating plant will start north from Jacksonville, towed by four seagoing tugs at a speed of about 3 knots. The trip, which will take 10 to 14 days, will be supervised by the Coast Guard in consultation with the National Weather Service to reduce the risk of encountering storms.

The final phase of preparing plants for operation will involve mooring them to concrete caissons inside the breakwater with metal struts about 72 feet long which have double-action hinges at each end. Eight struts run between the sides of a barge and the caissons. The hinges permit the struts to hold the barges in position but still accommodate a rising and falling motion inside the breakwater.

When the barges are moored, six outfall pipes-each nearly 8 feet in diameter and curving at right angles to the barge platform— will be positioned over catchment basins built inside the breakwater. Cooling water will be discharged through the pipes, into the catchment basin, and will flow into the open sea around the breakwater through a culvert built through the central closure caisson.

Operation

The procedures that will be followed in putting the floating plants into operation will be similar to those used for land-based nuclear plants.

Nuclear fuel will be placed aboard floating plants after they are secured inside the breakwater and after final clearance from the NRC and the New Jersey Department of Environmental Protection. Arranging fuel rods to produce a critical mass of uranium within the reactor vessel takes 4 to 6 months and is monitored step-by-step by NRC inspectors.

During operations, two full crews, totaling 87 employees among the two plants, will be aboard the floating plants for periods of 3 days, one manning the plant and the other on standby, Personnel normally will commute from shore by boat, although the breakwaters or an adjacent site may have helicopter pads to permit shuttling personnel or equipment by air,

Key powerplant personnel are licensed by the NRC and any member of the plant crew who will manipulate any of the reactor controls must pass a written NRC examination before being licensed.

Fuel Supply

About 30 metric tons of fresh fuel will be carried to each floating plant annually to replace some 30 metric tons of spent fuel, which will be temporarily stored on the plant platform, and then carried to shore to be stored until U.S. reprocessing plants are back in operation.

The fission process which powers a nuclear plant occurs when an atom of uranium-235 is split apart (fissioned) by a slow neutron, discharging an average of 2.5 new neutrons, which can in turn split other U-235 atoms to continue the chain reaction and produce heat for steam generation. Plutonium is created as a byproduct of fission when slow neutrons are captured by U-238 atoms rather than U-235 atoms, the only fissionable uranium isotope.

Over a period of a year, the fission process in a reactor core depletes the U-235, much as a burning coal becomes encased in ash, to the point that one-third of the rods must be replaced. The spent fuel rods are removed and replaced with fresh rods.

Because a fuel rod continues to generate heat, even after removal from a reactor core, spent fuel is kept in storage pools of circulating water for several months until radioactive isotopes have decayed enough to reduce the output of heat. Spent fuel rods then should be packed and shipped to reprocessing plants where residual uranium-235 and plutonium are removed for recycling into new fuel pellets.

As of early 1976, no reprocessing plants were operating in the United States. A new plant in Barnwell, S. C., was nearing completion. A second plant in West Valley, N. Y., had been closed since 1972 for modification and expansion and was not scheduled to reopen before 1978.[22] Future operations depend on a final decision on whether to recycle plutonium.

Recent practice has been for nuclear plants to hold spent fuel in storage basins at the plant site until such time as the Barnwell and upstate New York reprocessing plants are open. In its 1975 annual report, the NRC said that as many as 10 nuclear plants would fill their holding areas to capacity by 1978.[23] Land-based plants generally have the space to expand storage facilities, but a floating plant would have limited space for expansion even though storage pool capacity can be trebled if storage racks are placed closer together.

An implicit assumption appears to have been made in planning for floating nuclear plants that the reprocessing system will be in operation by 1985 and that the question of space for long-term storage of spent fuel from a floating plant will be moot. If, on the other hand, no central storage area has been approved by the time the floating nuclear plants are in operation, the storage question could present an obstacle to operational licensing.

Waste Handling

Waste handling practices aboard a floating nuclear plant will be similar to those required by the NRC at land-based plants.

In addition to spent fuel, a nuclear powerplant with a capacity of 1,150 MWe will produce about 1,000, 55-gallon drums of other radioactive waste a year. Bombardment of a reactor vessel and its coolant system with neutrons creates radioactive isotopes, particularly in material that enters the coolant through wear or corrosion and is carried through the fuel core. Radioactive gases also are created in the coolant cycle. Other radioactive particles lodge in tools, laboratory glassware, and protective clothing.

Radioactive particles are continuously filtered from the coolant and steam-generating systems. Radionuclides with long lives are separated from waste water and mixed with cement and vermiculite to form a sludge which is packed into 55-gallon drums for shipment to shore and storage underground.

Figure IV-52. Annual shipments of radioactive materials to and from the two-unit Atlantic Generating Station

OPERATION	APPROXIMATE NUMBER OF SHIPMENTS PER YEAR	
	Barge	Land
Fresh (unirradiated) fuel:[a]		
1. Fuel fabrication plant to shore transfer point.		12 trucks[b]
2. Shore transfer point to offshore powerplant.	2 to 4 barges[c]	
Spent (irradiated) fuel:[a]		
1. Offshore powerplant to shore transfer point.	4 to 10 barges[c]	
2. Shore transfer point to fuel reprocessing facility.		120 trucks or 20 rail cars
Solid radioactive wastes:		
1. Offshore powerplant to shore transfer point.	4 to10 barges[c]	
2. Shore transfer point to licensed radioactive waste disposal facility.		92 trucks or 22 rail cars

[a]The shipment of empty fuel casks and casks for irradiated fuel will require essentially the same number of shipments as when loaded. However, the radioactivity hazard will be negligible.

[b]Initial loading of reactor requires about 18 truckloads of unirradiated fuel. Shipment of unirradiated fuel by rail is usually ruled out because of length of transit time.

[c]Number depends on capacity of barge.

Source Atlantic Generating Station, Draft Environmental Statement

Water containing radionuclides with short lives is stored in holding tanks until the particles have decayed and then is discharged into the sea. Contaminated gases go through a similar filtering and holding process. Contaminated clothing and other solid material also are packed into 55-gallon drums for shipment to storage areas ashore.

Even with these filtering systems, trace amounts of radioactivity remain in some of the liquid discharged from nuclear powerplants. For example, tritium, a radioactive form of hydrogen, is released from nuclear facilities after it combines with oxygen in the form of water.

Tritium has a half-life of 12.3 years. It is extremely difficult to separate out from ordinary water because water formed with tritium is chemically indistinguishable from ordinary water.

Nuclear fuel will be loaded into the floating nuclear powerplants after each unit has been towed to the AGS site, properly installed within the protective breakwater, prepared for operation and licensed to operate by the NRC. All handling of fuel and radioactive waste material within the plant and transportation to and from the plant is the responsibility of Public Service Electric and Gas Co. and regulated by NRC.

The potential environmental impact of transporting fuel and radioactive wastes to and from land-based nuclear powerplants has been evaluated by NRC.[24] As a result of that study, major emphasis is placed on packaging of radioactive materials because radioactive materials could be involved in accidents between shore and an offshore plant. All packaging must meet the regulatory standards established by NRC, DOT, and State government. There are memoranda of understanding between NRC and other government organizations, drafted to avoid unnecessary duplication of standards.

The potential environmental impact of transporting fuel and radioactive waste to and from the floating nuclear plant site is evaluated in similar language in environmental impact statements for both the manufacturing license of Offshore Power Systems and the construction permit of the AGS.

The standards and tests required by NRC for shipping containers are both rigorous and exhaustive. However, NRC has not specified unique design and test requirements for casks and drums for floating nuclear powerplants in particular. Nor has it outlined special procedures for handling these casks and drums. A sample survey of environmental and safety operating license documents issued by NRC for land-based nuclear powerplants finds that hardware design criteria and procedural requirements are not described in more detail than language in the NRC study of transport of radioactive materials, which states that:

> Safety in radioactive materials transport is achieved through design standards on packaging and implementation of a quality assurance program, including proof-testing and independent reviews, to assure conformance, to correct problems, and to help assure continued satisfactory (design) performance over the lifetime of the package under normal and accident conditions.[25]

The draft environmental impact statement for the AGS describes a most likely pattern for the fuel and waste handling system.[26] The casks and drums will be similar to those currently in use with land-based nuclear powerplants. Each shipment to or from AGS is expected to be by barge or ship. Current Coast Guard requirements mandate that irradiated fuel be carried in a type-A, or double-walled and “less likely to sink” vessel. Casks must be secured aboard a vessel so they will be easier to find and recover in case the vessel sinks. Ships and barges carrying radioactive wastes are restricted—to the extent possible—to operations where water depths do not exceed 150 meters. NRC regulations require a cask design that will withstand an external pressure equal to the pressure at a water depth of 50 feet, but most designs will withstand pressures at greater water depths.

About 30 metric tons of fresh nuclear fuel, 30 metric tons of spent nuclear fuel, and several hundred drums of solid radioactive wastes must be transported annually either to or from each floating reactor. The transfer of nuclear fuel and radioactive materials to and from floating plants will involve the transfer of loaded casks to a barge or ship. A shore facility or transfer point also will be required. These transfer conditions are different from those at land-based nuclear powerplants where transportation is by truck or rail. Except for the transfer, shipments to a fuel reprocessing plant or to a waste disposal facility will follow the same pattern as those for land-based nuclear powerplants.

The estimated number of shipments annually to and from AGS appears in figure IV-52. The total number of shipments by vessel range from 10 to 24 per year, depending on the capacity of the vessel. The number of truck and/or rail shipments depends upon the method of transportation. Coast Guard statistics are used in the NRC reports to estimate the probability of a barge accident, but it is unclear how these may apply to the open ocean site because those accident statistics are based largely on inland waterways traffic. However, the NRC conclusion is that there are only small differences in the accident probabilities among truck, train, and barge. The radiological impact on the general population of transporting fuel and waste from the AGS is expected to differ little from that associated with a land-based plant.

OTA supplemented the NRC analysis by making a detailed comparison of fuel-handling operations between AGS and two 1,150 MWe land-based nuclear powerplants—the D.C. Cook and Sequoyah plants—that are similar in many respects to the proposed offshore plants.[27] Topics included in the comparison were fuel type and radioactive inventory, transportation of new and irradiated fuel, fuel handling in the plant, new fuel storage, spent fuel storage, and fuel handling accidents. No differences were found among the three plants in terms of the amounts of fuel handled or general fuel handling procedures. There are specific differences in fuel and cask handling associated with the transfer of a shipping cask from land to a transfer boat or barge and between a barge and a nuclear platform. There are differences, too, in handling fuel on a floating plant under a condition of one-half degree combined pitch and roll.

There is insufficient information to verify whether loading and unloading features unique to the floating plant pose significantly greater risks than fuel handling at a land-based nuclear plant, However, engineering judgment suggests that cash transfers and the other fuel-handling operations can be designed and performed without undue risk.

Transportation of materials to and from land-based nuclear plants involves trucks and railroads. With a floating nuclear powerplant, barge transportation will be added to the logistic pattern.

There appears to be no inherent reason why water transportation would involve greater risks than truck or railroad transportation provided that handling procedures are analyzed and specified in advance. However, no detailed procedures or system designs have been prescribed for the segment of transportation of materials for floating nuclear plants that will involve barges. The Department of Transportation has responsibility to formulate regulations for transportation of radioactive materials.

This study concludes, however, that the

step-by-step analysis of transferring materials from truck to barge or boat at a waterfront site and the precautions that might be necessary to protect a barge enroute to a floating nuclear plant has not been made. By the same token, there are no procedures that specify steps to be taken, for example, in transferring spent fuel from a floating plant to a barge and from a barge to a truck or railroad car on shore.

Decommissioning

Earlier studies of methods for decommissioning a floating nuclear powerplant suggested that a plant might be sunk or mothballed for 50 years until highly radioactive elements of the plant could be removed manually.

The OTA analysis indicates that neither of these options would be workable under present guidelines and that the plant's radioactive elements probably would have to be removed with remotely controlled equipment on the site.

The fuel elements are the only radioactive material in a nuclear reactor when it begins operations. However, bombardment by the neutrons released in the nuclear fission process make other components of the reactor, particularly the reactor vessel and its internal parts, highly radioactive during the course of operation. Because these levels of induced radioactivity are dangerously high, the owner of a nuclear powerplant must take steps to ensure that public health and safety are protected after the end of the plant's useful life.

Forty years is the maximum period for which a license to operate a nuclear plant is issued by NRC.[28] An operator then must renew the license for an additional period or apply for termination of the license and for permission to dismantle a plant and dispose of the radioactive components.[29] If technical, economic, or other factors dictate, the operator may elect to terminate operations earlier than the expiration of the operating license. The applicant must demonstrate when he applies for the original operating license that he possesses "or has reasonable assurance of obtaining the funds necessary to cover the estimated costs of permanently shutting the facility down and maintaining it in a safe condition.''[30] The activities of shutting down operations and dismantling the plant-or maintaining it in a safe condition—are referred to as "decommissioning."

Current NRC positions also require maintenance of a "possession-only" license for as long as there is significant residual radioactivity in a decommissioned facility.[31] The conditions of the license require plant protection for public health and safety.

The NRC now acknowledges three basic modes of decommissioning—mothballing, entombment, and dismantlement.[32]

Mothballing is sealing to prevent radioactive releases from the pressure vessel, the biological shield, or other buildings. Protective maintenance is required as long as levels of residual radiation within the plant exceed specified criteria.

Entombment is a much more complete sealing, accomplished by encasing the pressure vessel and all other residual activated materials within a poured concrete structure integral with the biological shield. The primary difference between mothballing and entombment is the degree of protection needed. The mothballed plant may require a full-time protective force until residual radiation no longer poses a health and safety hazard. The entombed plant may or may not require a protective force.

For dismantling, activated components are cut up within the biological shield (including the pressure vessel and its contents) and deposited in a licensed burial site. A completely dismantled facility has no licensing requirements because it no longer contains radioactive materials that could pose a hazard

Figure IV-53. Probable actions to be taken in decommissioning a floating nuclear powerplant by various methods

PLANT COMPONENT	METHOD 1. Permanent lay-up[a]	METHOD 2. Dismantling and onshore disposal[b]	METHOD 3. Decontamination and sinking[b]
Barge	Seaworthiness must be maintained	Seaworthiness must be maintained until plant is at dismantling site	Seaworthiness must be maintained until plant is at sea dumping site
Biological shield	Sealed to prevent access and loss of radioactive materials and to reduce deterioration of contents	Sealed during transit from offshore-site to dismantling site	Surfaces coated where necessary to prevent loss of radioactive material[c]
Equipment within biological shield	Pressure vessel sealed with inert gas or other means to prevent corrosion; all other equipment treated to prevent corrosion and deterioration	Sealed during transit from offshore site to dismantling site	Pressure vessel probably filled with concrete and sealed to prevent exposure to seawater at depth; all other equipment treated to reduce corrosion rate and deteriorate ion
Rest of plant on the barge	Individual buildings sealed with provisions for maintenance access; equipment treated to reduce corrosion and deteriorate ion	Some equipment may be salvaged or scrapped at offshore site; remainder of plant tied down for transit to dismantling site	All salvageable material removed while plant is in breakwater; nonsalvageable material likely to float made sinkable

[a] If lay-up is at offshore site, the entrance to the breakwater would probably be closed. Additional structures might be installed on the barge to protect the plant from sea and storm action

[b] Breakwater has to be partly dismantled to permit barge egress

[c] Adequate protection against loss of radioactive materials after dumping may require extensive modification of the biological shield and will have to be balanced against the almost negligible hazard of radioactivity released by rusting reinforcing steel in the shield

Source Atlantic Generating Statlon, Draft Environmental Impact Statement.

to the public health.

Three primary alternatives for decommissioning the floating plants have been proposed: permanent layup (mothballing), dismantling (with onshore disposal of the radioactive materials), and decontamination and sinking. A fourth option—a 50-year layup followed by dismantling—also has been suggested.

Figure IV–53 summarizes the NRC's view of the actions that might be taken for each of the three basic options, which are subsequently discussed in turn.

Decommissioning Alternatives

NRC studies suggest that all of the decommissioning options listed here may be possible. However, OTA's brief analysis discloses uncertainties about all alternatives except that of dismantling and removing the radioactive components on-site. It is the most expensive of the options. The NRC environmental impact statement is based on an Offshore Power System analysis which did not directly calculate the radioactive inventory that would be found in the plant at the end of its life. It simply used estimates derived by extrapolating the results from decommissioning small (less than 50 MWe) power reactors.

PERMANENT LAYUP

A floating plant could be decommissioned by placing it in permanent storage, either within its breakwater or in an estuary or river. A possession-only license would be required as long as radioactive parts posed a public health and safety threat. If the internal equipment were sealed and not entombed, this option would require protective custody for the duration of a possession-only license.

If layup were undertaken at the original breakwater site, the cost would include maintenance of the breakwater as well as a protective force. However, if the barge were seaworthy at the end of the life of the plant, it could be towed to a specialized shore facility (perhaps the original construction facility modified to handle radioactive materials) where the plant could be permanently stored under surveillance.

Simple layup of a plant would not be reasonable under present guidelines because some long-life isotopes could be present which would require guaranteed plant security for not only the several hundred years required by Ni^{63}, but possibly for as long as the 500,000 years that Ni^{59} would pose a health hazard.

Layup with in-place entombment of the internals does not appear feasible either because the integrity of the entombment structure containing the radioactive materials for such extended periods cannot be assured.

Past experience indicates that 200 years may be the limit for structural integrity of an entombed plant. For example, in entombing one reactor that had been active for far less than 40 years, a portion of the core internals had to be removed and disposed of at a burial site due to excessive Ni^{63} activity which would have required structural integrity of the entombment for a period exceeding 200 years. Consequently, some degree of dismantling appears necessary for decommissioning power reactors of the size scheduled for floating plants.

DISMANTLING AND ONSHORE DISPOSAL OF RADIOACTIVE MATERIALS

Unlike the layup option, dismantling would entail removal of radioactive components, their disposal at a licensed burial site onshore and salvaging or scrapping the remainder of the plant. The NRC environmental impact statement suggests that this could be done for a floating plant at less cost than for a land-based plant if a specialized onshore disassembly facility were available and if the floating barge were seaworthy enough. However, it also appears technically and economically. feasible to dismantle and remove radioactive components at the original plant site inside the breakwater before towing to a drydock for disassembly, this option probably would not cost less than decommissioning a land-based plant.

Immediate dismantling and removal of radioactive components for disposal at a licensed burial site appears to be a viable alternative for decommissioning floating plants. It would require the same type of tooling development as required for any land-based light water reactor—the development of remotely operated equipment such as a plasma torch manipulator for cutting up the pressure vessel and its internal parts. There appear to be no unique risks or engineering requirements associated with dismantling an FNP as compared to a land-based plant. Equivalent land-based disposal sites would be required. OTA has compared recent cost analyses for this option and concluded that the cost of dismantling each floating nuclear plant would be under $50 million.[33]

Technically speaking, dismantling could be done either at the original plant site, or at a specialized shore-based facility, as suggested by the Offshore Power Systems. However, dismantling at a location other than the plant site would require towing the radioactive plant which would, in turn, entail the risk that the plant might sink enroute with all the radioactive components in place.

The plant would be sealed before towing, but even a completely entombed plant could pose a hazard if sunk because of the long half-lives of some elements in the radioactive inventory. Thus, there may be some risk associated with any of the options in which the radioactive plant is towed. However, the NRC environmental statement on the AGS concludes that it is most likely that decommissioning would be done at a site other than the operating site.

The risks involved in towing a plant to a nearby shore site may be small, but they could be much greater if it were towed back to the original construction facility in Jacksonville, as has been suggested. The removal of the radioactive components in place before towing the barge elsewhere for salvage appears to be the most viable option until the level of risk is properly assessed.

DECONTAMINATION AND SINKING

One possible option for decommissioning floating plants not available for land-based plants has been suggested by Offshore Power Systems. It involves on-site salvage of all materials of value and removal of all radioactive materials except the pressure vessel and its internals. All remaining radioactive piping and vessels then would be sealed and the plant would be towed to a deepwater site and sunk. Projected costs for this option are by far the lowest, and land-burial site requirements are much lower.

The problem of guaranteeing the integrity of an entombed plant long enough for radioactivity to decay to safe levels applies to the sinking option as well. The problem may be more severe with sinking because of the additional corrosive effect of seawater on the entombment structure.

NRC has not yet established any special decommissioning criteria for the FNP. It is not clear whether integrity would have to be maintained as long for a sunken plant as for an onshore plant. The plant would automatically be isolated from human contact and would be shielded by the water, but other problems may result from corrosion of radioactive components if the seals were breached. These uncertainties would have to be resolved before sinking could be considered a viable option.

FIFTY-YEAR LAYUP FOLLOWED BY DISMANTLING

A combination of mothballing and later dismantling could reduce the overall decommissioning cost by cutting dismantling costs. The plant would remain intact in the breakwater or at another site for about 50 years by which time Offshore Power Systems projects that induced radioactivity would have decayed enough to considerably reduce the difficulty in dismantling.

The Offshore Power Systems analysis indicates that a 50-year layup period would allow the levels of radioactivity in the reactor to decay enough to simplify the process of dismantling which would, in turn, reduce the cost of decommissioning.

OTA's analysis, based on the study of the actual end-of-life inventory that could be expected in a reactor of the size used in a floating plant, indicates that dismantling would be a relatively simple operation only after a layup period of about 110 years.

Under the combination layup-and-dismantling, the plant would be moved from a storage site at the end of the layup period to a facility where the barge and nonradioactive parts of the plant could be scrapped or salvaged (after dismantling the radioactive components).

The extended layup period may present a problem because of the difficulty of maintaining the barge in seaworthy condition for a total of 150 years (40 years of operation plus 110 years of storage). Consequently, it appears that immediate dismantling may be more feasible, even though the cost is somewhat higher.[34]

In summary, there is doubt about some of the principal options proposed for floating plant decommissioning because of the size of the end-of-life radioactive inventory of the reactor and the very long half-lives of some of the particular isotopes in the inventory. The extremely long protective storage period that is required before radioactive pressure vessel internals decay to safe levels rules out permanent storage. Intentional sinking or alternatives that run the risk of accidental sinking of the activated plant during towing may not be acceptable because of the difficulty of guaranteeing the structural integrity of seals for more than 200 years or so, far less than the time required for radioactivity to decay to acceptable levels. However, the option of simply dismantling the radioactive internals at the plant site and disposing of them appears to be technically feasible and economically viable.

River and Bay Sites

A floating nuclear powerplant can be located in a river, lake, bay, or inland lagoon as well as at sea as long as there is a channel to the site. An access channel must be at least 500 feet wide and 35 feet deep. This could require dredging that would cause more environmental damage than would installing a plant in the open ocean.

Installing a barge-mounted powerplant near shore or in a lagoon would mean giving up the advantage of unlimited supplies of cooling water that an ocean site provides. If cooling towers are required for a land-based plant, they will be required for a floating plant in the same general area.

Dredging will be necessary to tow a floating nuclear plant to any near-shore site in Delaware Bay.

A breakwater probably would be required, but it will cost substantially less than a breakwater off the Atlantic coast. In many areas, a causeway can provide access to a near-shore floating plant as well as a base for overhead transmission cables.

Licensing procedures for a near-shore or lagoon-based plant are similar to those for an offshore plant. One exception in Delaware Bay is that the Delaware River Basin Commission will be added to the list of licensing agencies. EPA guidelines may require cooling towers for all nuclear steam-electric plants in Delaware Bay estuaries.

Conventional Nuclear Plants

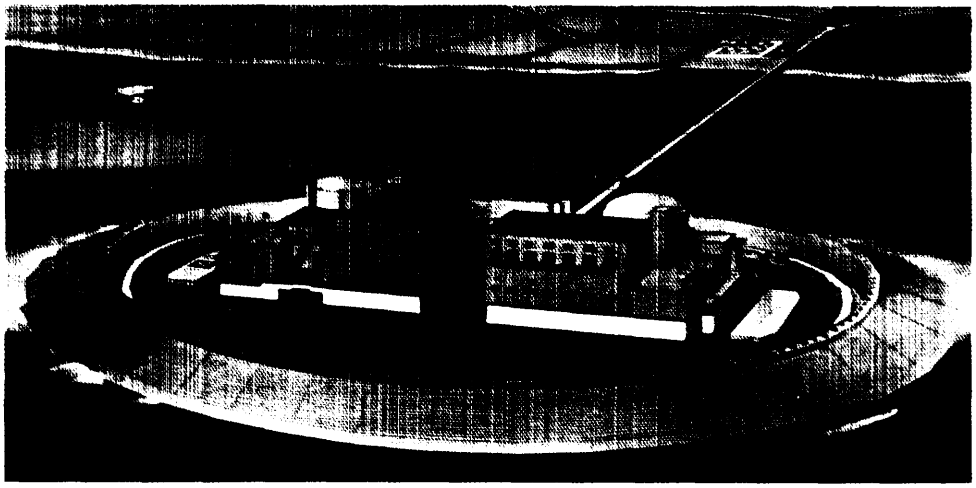
New Jersey's three major public utilities are building or awaiting approval of six land-based nuclear powerplants, the last of which would come on-line in 1984.

Two Salem County plants are scheduled for completion by 1979. Two other plants are to be built at Hope Creek, near the Salem plants, the second plant to begin generating power in 1984. Jersey Central Power and Light Company is building one nuclear plant at Forked River, N.J., on the Atlantic coast north of Atlantic City. It is sharing the cost of building a plant at Three-Mile Island in the Susquehanna River near Harrisburg, Pa. Both are scheduled to start operating in 1982.

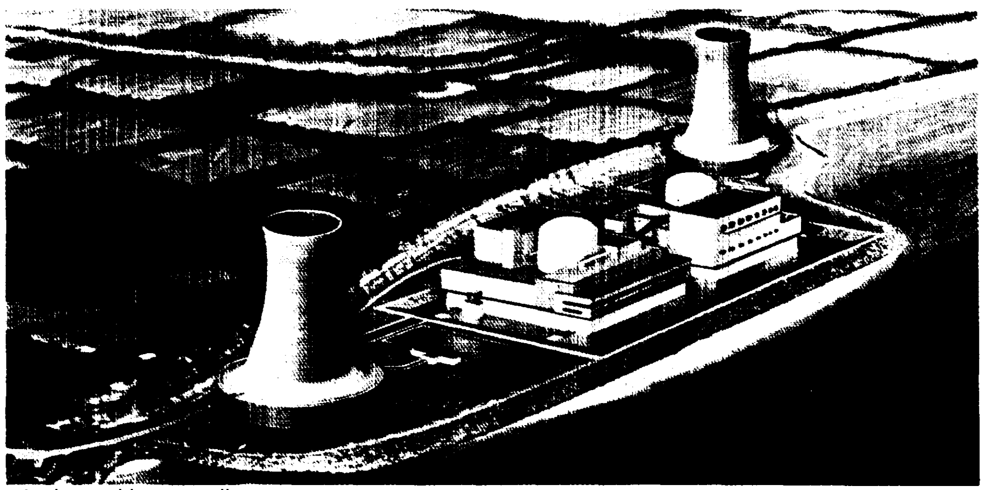
Population densities and limited water supplies in northern New Jersey probably will dictate southern sites for any nuclear plants built in addition to the six already planned.

Public Service and Atlantic City Electric jointly own 5,400 acres of land near the community of Bayside about 10 miles south of the Hope Creek site. In theory, the acreage could accommodate at least four, 1,500 megawatt, nuclear generating Plants.

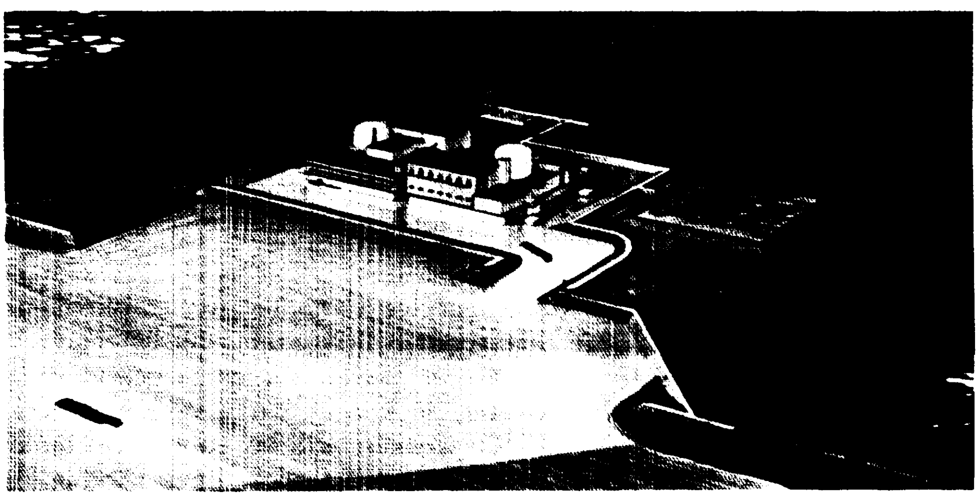
Figure IV-54. Three siting alternatives for floating nuclear plants



1. Nearshore siting-open-cycle cooling



2. Inshore siting—cooling towers



3. Riverine siting-open-cycle cooling

Source Offshore Power Systems, Inc

COASTAL EFFECTS

During this study, OTA analyzed the technical, safety, and environmental reports on offshore nuclear plants published by Offshore Power Systems, NRC, Council on Environmental Quality, Public Service Electric & Gas Co., and others, and the comments of intervenors in the licensing process.

This critical review has been supplemented by additional research on issues which earlier studies did not explore in sufficient depth or about which there were substantial differences of opinion between interveners and nuclear specialists.

This section discusses the effects of installing and operating offshore nuclear plants in two categories: 1.) areas in which there seems to be general technical agreement about the con sequences o f installing offshore powerplants, and 2.) areas in which OTA research raises questions about some aspects of published studies.

The first category includes such areas of concern as the effects of an AGS on land use, water supply, job opportunities, the ocean environment, traditional uses of the ocean, and the New Jersey energy supply. It also includes economic benefits which may occur from the floating nuclear plant concept.

The second category includes issues of safety, fuel handling, decommissioning, and the particular relationship between AGS and the coastal communities that depend heavily on tourists for their livelihood.

NRC published a draft environmental statement in April 1976 covering the proposed AGS project. The environmental statement includes a comprehensive analysis of energy and economic benefits, monetary costs, and environmental costs of the proposed projects. The statement concludes that the project "will have accrued economic and social benefits that outweigh the economic, environmental, and social" costs. " Figures IV–55 and IV–56 are reproduced from this environmental statement,

Direct Benefits

The direct benefits estimated by NRC from the proposed AGS include the production of 15.7 billion kilowatt-hours of electricity annually, divided about equally among residential, industrial, and commercial users.[35] Indirect benefits include employment of about 850 local workers with a $100 million payroll during construction and 250 with a $5 million payroll annually during operation of the plants, taxes of about $80 million annually distributed to municipalities, and about $10 million annually of local material purchases.

Construction of barge-mounted nuclear plants offshore will provide substantially fewer direct construction jobs in the New Jersey region than would land-based plants. As with any new generating plant, however, the additional electricity would support existing jobs and make new job opportunities available in the State.

The NRC uses a peak-employment figure for land-based plants of slightly more than 2,000 employees.[36] Peak local employment for a floating nuclear station off Atlantic City estimated by Public Service is about 500 workers, few of whom will be the kinds of skilled workers, like welders and electricians, who are needed for construction of a land-based plant.

Public Service estimates for employment are that about 350 workers will be required over a 4-year period for construction of a breakwater, including barge crewmembers. About 100 workers will lay cables and build the overhead transmission lines. About 50 workers will be required to build a staging

Figure IV-55. Benefits from the proposed Atlantic Generating Station

, DIRECT BENEFITS	
, Electrical energy generation	
Capacity	2300 MWe
Annual electrical energy generation (millions of kilowatt-hours)	
At 0.78 plant factor	15,700
At 0.6 plant factor	12,100
Proportional distribution of electrical energy	
PSE&G	
Residential	27%
Industrial	4170
Commercial	31 %
Other	1%
State of New Jersey	
Residential	32%
Industrial and commercial	66.570
Other	1.570
INDIRECT BENEFITS	
Employment	
Construction (excluding FNP manufacture)	850
Operation	200-300
Payroll, millions of dollars	
Construction (total)	100
Operation (annual)	5
Taxes collected by State and distributed to municipalities annually, millions of 1995 dollars	69-90
Local material purchases, millions of dollars	
Construction (total)	15
Operation (annual)	10

Source Table 104, Draft Environmental Statement on the Atlantic Generating Station

area. Other workers will be required to work in a dolos casting yard which may be also located in New Jersey.

If all of the expanded generating capacity of New Jersey were to be provided by offshore powerplants between now and 1995, the State could lose workers of certain skills to other States in which land-based plants were being built. On the other hand, there is presently a shortage of certain skills such as welders in New Jersey and other States today.

Economics

Figure IV–56 displays NRC's estimates compared to Public Service estimates of capital and operating costs for the AGS. The economic consequences of these costs compared to those of an equivalent land-based plant were analyzed by OTA and are discussed in staff working paper No. 10. The conclusion of this analysis follows.

An absolute reduction in electricity prices from nuclear reactors remains a hope rather than an accomplishment because of continuing increases in the capital costs of nuclear powerplants. The trend of actual capital costs of land-based plants as the units come into operation is consistently much higher than original estimates. Costs of three times original estimates have not been uncommon.

Cost increases for nuclear plants have consistently exceeded overall inflation rates. Although the nuclear industry and even recent Government publications maintain that this trend will not continue, there is no evidence that the constant dollar costs of nuclear

Figure IV-56. Monetary costs of construction and operation of the Atlantic Generating Station

IN MILLIONS OF DOLLARS

	Applicant [a]	Staff [b]
Capital costs, 1985	2285	2300
Annual operating and maintenance costs (O&M)[c]	15.6	26.7
Annual fuel costs[c]	53.4	149
1985 present worth of fuel and O&M costs	649	1659
Total 1985 present worth	2934	3959

[a] Computed by the staff from data in the Environmental Report
[b] Derived independently by the staff
[c] Operation at 0.78 plant factor

Source Table 105, Draft Environmental Statement on the Atlantic Generating Station

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powerplants have begun to stabilize. In fact, all available evidence points clearly to further constant dollar increases in nuclear plant capital costs.

As noted earlier, the floating plant concept may help resolve the problem of escalating costs if the pattern of fixed-price contracts that has been established for the AGS is extended to all floating plants. By the same token, some fixed-price contracts could probably be applied to all nuclear plants. They have in the past, by means of turn-key projects, but vendors lost a great deal of money because of cost overruns.

Environmental and Social Effects

The NRC summary of environmental effects is displayed in figure IV–57. These effects include the categories of land use, water use, impacts on marine ecology, impacts on land ecosystems, local community impacts, and radiological impacts on man and other life.

LAND USE

The largest requirements for onshore land are for a 100-acre switchyard at Tuckerton, N.J., and for 1,870 acres[37] for rights-of-way for overhead transmission lines through the Pine Barrens between Tuckerton and Forked River, some 22 miles to the north. However, Public Service plans to build both of these transmission facilities to move power from its Salem and Hope Creek nuclear plants and the land would be needed whether or not the AGS is built.

Public Service anticipates that a 4-acre waterfront site will be required for a staging and support area during construction of the offshore facility and for office space after the plant is in operation.

A corridor through about 5.5 miles of salt marsh between Great Bay Peninsula and Tuckerton will be required for buried cables to transmit power from the offshore plant to the switchyard. Most of this land, however, will be under Great Bay Boulevard and will not involve additional disturbance of the marsh area.

WATER USE

The once-through cooling system proposed for the AGS will circulate more than 2 million gallons of seawater per minute through the two plants.

All 1,150-MWe plants run roughly 1 million gallons per minute through their condensers. Cooling towers make it possible to recycle the cooling water and reduce thermal pollution, but about 10,000 to 20,000 gallons per minute is lost in cooling towers through evaporation. [38]

Discharge of cooling water at 16.1 degrees above the intake water temperature will heat surrounding ocean waters above normal in a plume extending 200 or 250 feet from the breakwater. Beyond 1,750 feet, mixing that results from jet diffusion as well as wind and wave action will dilute the plume to three degrees- or less above normal temperatures.

The NRC's draft environmental impact statement estimated that under the worst plausible conditions of wave and current, a plume could reach the Great Bay Estuary at temperatures 1 degree higher than ambient water temperatures.

WATER USE CONFLICTS

The most important conflict which the breakwater will pose with present ocean uses is for shipping. Although Public Service estimates that there is only slightly more than 1 chance in 1,000 that a large ship would ram the breakwater in any year, the breakwater does represent a new potential for collision. The Public Service estimate is based on comparisons of ship collision data in the Gulf of Mexico near offshore oil platforms and traffic in the New York area.[39]

The area in which the generating station is to be built is a popular sport and commercial fishing area. Because the breakwater will preempt a relatively insignificant amount of waters available for fishing and because reefs tend to attract fish, the area around the breakwater eventually may increase fishing opportunity.

The NRC analysis (see figure IV–57) concludes that increased water surface traffic associated with construction results in minor constraints on other users.

The NRC summary estimates of environmental and community impacts from construction and normal operation of the AGS are also given in figure IV–57.

Routine discharges of radioactive gas, liquids, and solids are similar for both barge-mounted and land-based nuclear powerplants. As has been noted, the filtering systems are the same for both designs.

Chlorine, chromates, phosphates, acids, hydroxide, hydrozine, and morpholine would be used in various parts of floating plant systems, but discharges into the open sea would be at levels within standards imposed by EPA regulations.

MARINE LIFE

The NRC environmental impact statement estimates that about 287 tons of fish production will be lost each year—roughly 0.3 percent of the New Jersey catch—as a result of zooplankton and larvae being caught (or entrained) in the cooling water system.

Breakwater construction will destroy about 100 acres of burrowing marine life, and the laying of transmission cables will disrupt marine life over a 127-acre corridor of the ocean floor. The NRC estimates that about 0.2 percent of the New Jersey commercial surf clam fishery for 1974 will be destroyed but that recolonization will take place 12 to 18 months after construction is completed. The NRC reported that samples in the area showed that the lowest density of surf clams was at the breakwater site.

OTA has prepared an independent analysis of the environmental effects of floating plants, particularly the effects on marine life. The purpose of this analysis was to determine whether floating plants would have environmental effects significantly different from those of shore-based plants with ocean, lake, or river cooling. This analysis indicates that floating plants located nearshore or in estuaries would have effects similar to those of land-based plants in the same areas, with the exception of the dredging required to bring a floating plant to its site, while offshore breakwater siting could reduce the environmental impacts.[40]

MONITORING

The NRC requires a plant operator to monitor specific discharges and the general environment for radioactivity in the region around a nuclear plant. The New Jersey Department of Environmental Protection conducts independent monitoring for radioactivity.

NRC and EPA inspectors visit nuclear powerplants an average of four times a year to appraise both safety systems and environmental conditions. Monitoring includes sampling fish, milk, and plant life in regions where a nuclear plant is operating to measure concentrations of radioactive particles.

Figure IV-57. Environmental costs of the proposed Atlantic Generating Station

Effect		Summary description
LAND USE		
Land required for station	Table 3.1, Sect. 4.4	47 acres of ocean surface and ocean bottom, 2.8 miles from shore, removed from natural use
Land required for underwater transmission lines	Sects, 3.12,4.4	127 acres of ocean bottom disturbed in a 582-acre right-of-way
Land required for underground transmission lines and switchyard	Table 3.1, Sect. 3.12	68 acres for cables: temporary disturbance and vegetation changes; 100 acres for switchyard: improves a former disturbed area
Land required for overhead transmission lines	Sect. 3.12	1870 acres altered, 95 acres cleared; primarily wooded
Land required for personnel	Table 3.1, Sect. 4.1	A few acres in urban area
WATER USE		
Once-through cooling and and auxiliary water requirements, two units	Table 3.1	4600 cfs (2,060,000 gpm)
Thermal discharge to ocean, two units	Sect. 3.4	15.5 X 10 Btu/hr at full power
Temperature rise	Sect. 3.4	16,1 F"
Thermal plume description from physical model	Sect. 5.2, Table 5.3	
1 F temperature rise		Does not impingeon shore
3 F° temperature rise		Distance from discharge1750 ft; area affected, 525 acres
5 F° temperature rise		Distance from discharge, 650 ft; area affected, 46 acres
Chemical discharge to ocean	Sect. 5.3	
Chlorine		0.1 ppm total residual for 2 hr/day per FNP unit. Acceptable environmental impact: meets EPA standard
Copper		Less than 7 ppb increment added to available 5.5 ppb average seawater concentration. No environmental effect expected due to rapid dilution
Nickel		Less than 1 ppb increment with no expected environmental effect
Use of surface	Sect. 4.2	Increased water surface traffic associated with AGS construction results in minor constraints on other users. This is localized, temporary, and dispersed
IMPACTS ON AQUATIC ECOSYSTEMS		
Construction		
Dredging	Sect. 4.4	Destruction of some blue mussels and surf clams, 339,000 lb valued at $6000: less than 1 % of annual surf clam harvest in New Jersey
Sedimental ion	Sect. 4.4	Little effect on benthic organisms
Turbidity	Sect, 4.4	Temporary; insignificant impact on finfish
Operation		
Impingement	Sect. 5.3	An occasional operational problem because of schooling fish but will not affect fishery
Entrainment	Sect. 5.3	Loss of less than 0.5% of plankton, fish e s, and fish larvae will not alter aquatic population dynamics o f New Jersey coastal zone
Thermal effects	Sect. 5.3	Little or no effect on finfish or benthic communities
Cold shock	Sect. 5.3	Expected occurrence of once per year. Impact on ecosystem is negligible
Chemical discharges	Sect. 5.3	Very little effect
Breakwater existence	Sect. 4.4	Increased finfish production and diversity because of reef environment; potential benefit of more than 14 tons per year of increased finfish production

Source Draft Environmental Impact Statement, Atlantic Generating Station,

Figure IV-57. Continued

Effect		Summary description
IMPACTS ON TERRESTRIAL ECOSYSTEMS		
Construction		
Shore support facility	Sect. 4.3	Negligible if in urban or industrial area
Underground transmission cables	Sect. 4.3	Destroys less than 0.1% of spartina marsh habitat within 10 miles. Temporary loss of bird nesting habitat. Alters upland habitat with little impact on animal life
Switchyard	Sect. 4.3	May improve abandoned sandpit by stabilization of pit slopes and planting of vegetation
Overhead transmission line	Sect. 4.3	Clearing corridor destroys some forest habitat but increases grass and shrub habitat. Potential loss of rare white cedar bog environment
Operation		
Underground transmission cable	Sect. 5.1	Little or no impact unless oil leak occurs; then, impact depends on leak rate and quantity and speed of repair
Switchyard		Negligible
Overhead transmission line	Sect. 5.1	No herbicides will be used. Maintenance activities will use existing roads, No ozone at ground level. Bird losses are not expected to be severe
COMMUNITY IMPACTS		
Housing		Very little
Schools		Very little
Hospitals		None
Municipal services		Very little
Highway use		intermittent local congestion near shore support facility; moderate congestion along Great Bay Boulevard during underground cable installation activities
Economy		Slight increase due to local purchases of materials and input of new worker incomes
RADIOLOGICAL IMPACT ON MAN		
Cumulative population	Sect. 5.5	C 14 man-rems compared with 125,000 man-rems due to natural environment
Radioiodine and particulate dose to thyroid from all pathways	Sect. 5.5	Adult at nearest residence, 0.05 millirem; child using milk from nearest dairy farm, 0.2 millirem
Occupational	Sect. 5.5	900 man-rems
RADIOLOGICAL EXPOSURE TO AQUATIC ORGANISMS		
Barnacle on FNP hull	Sect. 5.5	20 rads/year
Organisms in discharge plume	Sect. 5.5	<1 millirad/year
RADIOLOGICAL EXPOSURE TO TERRESTRIAL ANIMALS		
Birds feeding on food in discharge plume	Sect. 5.5	<1 millirad/year
Animals on shore	Sect. 5.5	Approximately the same as for man

RISKS AND SAFETY

Accident Risks

The most serious accident possible in an operating nuclear powerplant is overheating that causes the fuel core to melt. If the upper containment of a powerplant were to rupture as a result of a core-melt, the radioactive materials released into the atmosphere could have severe health and economic impacts. No core-melt accident has occurred in any commercial light water reactor and the 1975 *Reactor* Safety Study (WASH- 1400),[41] commonly known as the ‘Rasmussen Report, estimated the probability of such an accident in a land-based reactor as 1 in 20,000 years of reactor operation. WASH-1400 also concluded that only about one in six pressurized water reactor core-melt accidents would lead to the release of significant amounts of radioactive materials to the open air.

Under current NRC policy, the possible consequences of core-melt accidents are not considered in reviewing and approving either plant designs or proposed sites, although less severe accidents are considered. The rationale for this policy is the contention that the probability of severe accidents is judged to be so small that the total risk from such accidents (the probability of an accident multiplied by the expected consequences of the accident) is extremely low, so low that they can be safely ignored even though the consequences could be far worse than those of other malfunctions. The low level of risk from core-melts calculated in WASH-1400 has been cited by the Commission as a justification for concluding that no immediate changes in its safety and environmental regulations are required. [42]

The validity of the conclusions of WASH-1400 concerning the accident risks in nuclear powerplants is a matter of controversy, as is the subject of reactor safety generally.[43] Any resolution of the general debate would be far beyond the scope of this study of the onshore effects of offshore energy systems. Recognizing that there is disagreement over whether the risks associated with land-based plants are fully understood, OTA focused on the question of whether there are significant *differences* in the risks associated with floating nuclear powerplants and land-based plants, either on a generic basis or as far as deployment in the study area is concerned.

To determine whether there is adequate information available for such an analysis, OTA commissioned a preliminary study which compared the floating nuclear powerplant with the pressurized water plant (the Surry plant) examined in *WASH-1400*.[44] This comparison was designed to evaluate the applicability to the floating nuclear plant of WASH-1400’S conclusions about the probabilities and consequences of core-melt accidents. In addition, the preliminary study assessed the methodology being used in a Liquid Pathways Generic Study, a comparison of the radiological consequences of release of radioactive materials into water at land-based and floating plants being conducted by the NRC as a result of concern by the ACRS about the unique safety issues posed by floating nuclear plants. In examining both *WASH- 1400* and the Liquid Pathways Generic Study, OTA focused on their applicability either to a generic comparison of the relative risks from land-based and floating nuclear plants, or to an assessment of the specific risks from deploying floating plants in the study area. The results of the analysis are summarized below.

Probability of Core-Melt Accidents

Comparison of the floating nuclear powerplant with the land-based pressurized water plant studied in *WASH-1400* reveals three areas of difference which could affect the relative probabilities of core-melts in the two plants:

- *External hazards,* The floating plant will face several unique external hazards, such as the risk of ship collisions, which could increase the probability that an accident sequence would be initiated. At the same time, it will be less sensitive to hazards posed to land-based plants by floods and earthquakes.
- *Marine environment.* Floating plants located in offshore breakwaters will be subjected to continued low-level stresses from operation in the marine environment, such as platform motion and corrosion from salt spray and air. In addition, floating plants may be subjected to unusual stresses while they are being towed from the Florida manufacturing facility to their operating sites,
- *Design.* The reactor system used in the floating plant incorporates new features, such as the ice-condenser pressure-suppression system, some of which could decrease and others increase the probability of a core-melt.

A more detailed discussion follows of the areas of difference between floating and land-based plants which were addressed in the OTA analysis.

EXTERNAL HAZARDS

Because floating plants may be located at sea, they may be exposed to stresses that could not occur on land. The most obvious hazards are ship collisions, buffeting in storms, and disturbance by tidal waves. NRC has dealt with these hazards by establishing performance criteria for the plant and breakwater designed to reduce the possibility that any unusual stresses could trigger malfunctions in the reactor system. OTA's analysis indicates that if the design criteria are met, such hazards do not appear to have a significant potential for initiating core-melt accidents.[45] At the same time, because *WASH- 1400* indicated that earthquakes and floods are negligible contributors to core-melt probabilities, the fact that floating plants are less subject to these hazards than land-based plants would not lead to any significant reduction in core-melt probabilities for the floating plant.[46]

EFFECTS OF THE MARINE ENVIRONMENT

Floating nuclear powerplants will be subject to ocean-induced stresses both during towing to their sites and during the 40 years of operation. They will be exposed to salt water and spray which could degrade the reliability of exposed components such as external valves, the links with the underwater cables, and the mooring system. This exposure could also adversely affect the electronic equipment, even though there are provisions to limit the exposure. They also will experience more or less continuous motion because of wind and currents. While the breakwater must be designed to keep these motions within the design limits of floating plants, they will be subjected to open ocean conditions while being towed from the manufacturing facility to its site. The stresses of towing, combined with the cumulative effect of the small stresses of normal operation, may be sufficient to affect the reliability of crucial parts of the system. For this reason, the ACRS has recommended that instruments be installed in the plant to monitor and record stresses in order to verify structural behavior during towing operations.[47]

WASH-1400 concluded that the probability of a core-melt is relatively insensitive even to substantial variations in the reliability of individual components. However, exposure to the marine environment could reduce the reliability of enough components simultaneously to increase the probability of an accident. As with other features of floating plants, this question cannot be answered without an extensive risk analysis.

DIFFERENCES IN REACTOR DESIGN

The reactor design for floating powerplants is different in several significant details from the Surry plant on which WASH-2400'S conelusion about pressurized reactors was based.

Of the eight differences considered by OTA, seven are also incorporated in land-based ice-condenser plants using Westinghouse reactor systems. Hence, they are relevant only to determining the applicability of *WASH– 1400's* conclusions to the floating plant, rather than to analyzing general differences in accident probabilities between floating plants and land-based plants.

OTA evaluated the implications of each design difference by analyzing more than 60 accident sequences that could contribute to a core-melt and then factoring the floating plant's design differences into each sequence to the extent possible with the information at hand. This evaluation indicates that these design differences do not produce any significant difference in the probability of a core-melt in the floating nuclear plant as compared to the Surry plant.

After OTA had completed this analysis, an additional safety issue was raised at the beginning of the formal hearings on the manufacturing license for floating nuclear powerplants. Mr. Ernst Effenberger, a former employee of Offshore Power Systems, alleged that the turbine-generator on the floating nuclear powerplant was the most dangerous piece of equipment onboard and could disintegrate during destructive overspeed (180 percent of operating speed) thus producing missiles that would tear the plant apart. In response to these allegations, OTA conducted a survey of the issue. The turbine missile problem in general has been recognized by Offshore Power Systems, the Nuclear Regulatory Commission, and the Advisory Committee on Reactor Safeguards. In most ways, there is no difference between land-based and floating nuclear powerplants in terms of the relative dangers. For land-based plants, the production of turbine missiles is not considered to be a significant contributing factor to the probability of a core-melt. For the floating plant, missile barriers and special speed control mechanisms have been designed so that the probability of a safety system being damaged by the turbine-generator during destructive overspeed is within the low levels prescribed by NRC. Specific responses to Effenberger's allegations will be made during the* September 1976 hearings by Offshore Power Systems and the Nuclear Regulatory Commission. Based on the information to date, it does not appear that the production of turbine missiles is an important issue that would change the conclusion of OTA's analysis.

Taking all the differences that might alter the probability of a core-meltdown into account, OTA's preliminary analysis indicates that the probability of a core-meltdown accident in a floating nuclear powerplant is comparable to the value of 1 in 20,000 per year of reactor operation that was calculated for land-based plants in *WASH*– 1400, although substantial additional effort would be required to validate that conclusion. The effects of a towing and continued operation in a marine environment were not analyzed in detail because that would require an examination of. individual component failure rates that is beyond the scope of this study.

Consequences of a Core-Melt

The most serious consequence of a core-melt in a land-based nuclear plant is the release of radioactive materials to the atmosphere. According to the analysis in WASH-1400, even if a core-melt occurs in a land-based PWR plant, it will rupture the upper containment structure and permit radioactive materials to escape into the atmosphere only about one in seven times. How such a release would affect public health and safety would depend on weather conditions, population density around a plant, the effectiveness of evacuation plans, and other factors.

The human consequences range from deaths that would result within a matter of days from direct exposure to relatively intense radiation to deaths and illnesses over a period of years as a result of low-level residual radioactivity y. There also can be economic losses, such as the costs of evacuation, loss of contaminated crops, and loss of productive use of lands placed under quarantine for extended periods.

The OTA analysis indicates that the consequences of a core-melt on a floating nuclear plant may be significantly different from those for a land-based plant. One reason is that in the case of a core-melt on a floating plant the core eventually would melt through the bottom of the barge hull and release large quantities of radioactive material directly into the ocean, where it could contaminate beaches and be taken up into the food chain. While a core-melt in a land-based plant could also lead to waterborne contamination, e.g., if the core entered an aquifer after melting through the bottom of the containment, such effects were not considered in detail in *WASH- 1400*. Concern about this type of release prompted the Advisory Committee on Reactor Safeguards to request a special study of the effects of accidental releases of radioactive materials into water as part of its review of floating nuclear powerplants. The NRC subsequently decided to conduct a Liquid Pathways Generic Study to analyze the effects of such releases from both land-based and floating nuclear plants.

A second reason to expect different consequences for a floating plant is that it appears that in case of a core-melt a release of radioactive materials to the atmosphere is about seven times more likely with the reactor system used in the floating plant than with the WASH-1400 land-based PWR plant. On the other hand, this may be offset to some extent by design features of floating plants which could reduce the amount of radioactive material released in case of an accident.

The following discussion will summarize OTA's critique of the methodology of the Liquid Pathways Generic Study and the scope of its coverage, and an analysis of the atmospheric releases that could be expected from a core-melt in a floating nuclear plant.

Liquid Pathways

The Liquid Pathways Generic Study is being conducted jointly by Offshore Power Systems and the NRC staff in an attempt to compare the consequences of accidental releases of radioactive materials into water for various representative land-based and floating nuclear powerplant sites.

The study was initiated by the Advisory Committee on Reactor Safeguards to answer a series of questions and concerns that were raised during the Committee's review of the design concept and of plans submitted to support Offshore Power System's application for a manufacturing license for eight floating nuclear powerplants.

In the first phase of the study, the Advisory Committee asked Offshore Power Systems to analyze the dispersal patterns of radioactive material that might be released into the open ocean as a result of a number of postulated nuclear accidents on a floating powerplant. After analyzing the OPS study, NRC decided to conduct a generic study of the environmental effects of the release of radioactive materials into water from either land-based or floating plants.

The NRC staff is concentrating on land-based plants sited near rivers, the Great Lakes, estuaries, and desert areas. The OPS staff is continuing its study of hypothetical sites for floating plants, including sites off the Mid-Atlantic States and the Gulf of Mexico. Both the' NRC and OPS studies are examining possible methods of mitigating potential negative impacts.

The results of the Liquid Pathways Generic Study will be incorporated into the licensing processes for the manufacture of eight floating nuclear plants and for construction of the AGS in several ways. The analysis of the consequences of radioactive releases resulting from so-called "design-basis accidents, "[48] which must be considered in environmental and safety reviews and which exclude core-meltdowns, will be included in new environmental statements for each licensing action. In addition, the NRC will publish a separate report containing the analysis of severe accidents (core-meltdowns) as well as design-basis accidents.

Because the study has not been completed, OTA has reviewed only the methodology being used by NRC and Offshore Power Systems. The methodology appears to be valid and based on conservative assumptions which, if anything, will tend to overestimate the consequences of a release. Furthermore, the study is being subjected to extensive review by a wide range of experts prior to release. As a result, OTA expects the study to produce adequate analysis of the questions it has addressed.

Nevertheless, the Liquid Pathways Generic Study has serious limitations in the range of questions it addresses. Specifically, it does not consider the full range of consequences analyzed in *WASH-1400.* First, while it does calculate the radiological-dose-to-population resulting from releases into liquid pathways, it does not translate the dose into health effects such as illnesses and deaths. Second, it does not attempt to estimate the economic consequences of such releases, even though these may be very great. A core-melt at an offshore floating nuclear powerplant could prohibit commercial and recreational fishing for a wide area around a plant. It could lead to an extended quarantine of nearby waters and beaches for recreational uses, which could have extremely serious economic consequences for Atlantic and Ocean Counties in New Jersey. While NRC is sponsoring a survey intended to estimate both positive and negative effects of a nuclear powerplant on tourism at various locations in the United States including the Atlantic City area, it is studying only the effects of the fear of an accident as a negative effect and is not assessing the reduction in beach visitors that could result if an accident actually occurred.

These restrictions in the scope of the Liquid Pathways Generic Study mean that it will permit only a partial comparison of the consequences of accidental releases of radioactive materials into water pathways in land-based and water-based nuclear powerplants. The range of consequences considered would have to be expanded if the study is to be used in a comprehensive comparison of the overall risks associated with the two kinds of plants.

One additional feature of the Liquid Pathways Generic Study limits its usefulness, in its present form, in a comprehensive comparison of risks. Specifically, the study assumes that all of the radioactive material that *WASH-1400* indicates might be released into the atmosphere if the containment fails during a core-meltdown would, with a floating plant, be released directly into the water. While this assumption gives a conservative estimate of the consequences of liquid pathway releases, it does not readily fit into a realistic assessment of overall expected consequences of a core-melt, which would have to take into account the probabilities and consequences of atmospheric releases as well. The question of atmospheric releases will be considered in the next section.

ATMOSPHERIC RELEASE

The Liquid Pathways Generic Study assumes that the consequences of the release of radioactive materials into the atmosphere are comparable for land-based and water-based plants. This assumption may not be valid. Even if a given quantity of radioactive material would have roughly the same consequences whether it escaped to the air onshore or offshore, it is not reasonable to assume that the expected magnitude of atmospheric releases would be the same for onshore and offshore plants. Because there are significant design differences between the reactor system used in the floating nuclear plant and the plant analyzed in *WASH-1400,* OTA examined these differences to determine whether they would significantly limit the applicability of WASH-1400'S conclusions to floating plants. This examination suggests that the probability of atmospheric releases from a core-melt in a reactor system of the design used in the floating nuclear powerplant would be significantly greater than for the land-based PWR plant considered in WASH-2400. At the same time, the consequences of a release may be less severe because lower amounts of radioactivity may escape. For these reasons, the conclusions of WASH-2400 about the expected consequences of atmospheric releases cannot be directly applied to floating plants without modification.

The source of these differences is the ice-condenser, pressure-containment system used in the floating nuclear powerplant, as well as in one plant in operation and nine under construction onshore. This system, which uses 2.5 million pounds of berated ice as a heat sink to condense steam and thereby reduce containment pressure in case of an accident, allows the use of a smaller and lighter containment building, a distinct advantage for a floating plant. OTA's comparison of this design with the Surry plant indicates that the smaller pressure containment used in the floating plant ice-condenser system is about seven times more likely to rupture in the case of a core-melt than is the larger and heavier containment of the onshore plant analyzed in the Rasmussen Report. In fact, it appears that every core-melt sequence on a floating plant is likely to lead to a rupture of the containment above the water line, while only one in seven core-melt sequences in the Surry plant would produce an above-ground containment failure, The reason for this difference is that the smaller volume and lower design-pressure resistance of the floating plant containment structure would make it much more vulnerable to the pressure pulses that would occur at various points during any core-melt sequence as the molten core fell into various pools of water within the containment, and ultimately reached the water under the plant. This higher probability of an atmospheric release from a core-melt on a floating plant would tend to make the expected consequences of a core-melt proportionately greater for a floating plant than for an onshore plant similar to the Surry installation.

Despite the higher probability of a containment rupture, the ice-condenser system has certain features which would tend to reduce the amount of radioactive material released to the air from the failed containment. The ice-condenser itself would trap radioactive iodine, one of the more dangerous radioactive materials, while the higher ratio of surface area to volume in the containment structure might increase the amount of vaporized core material that is deposited on surfaces within the containment. These tentative conclusions also require validation.

It should be emphasized that these findings indicate that the analysis of atmospheric releases in *WASH- 1400* would require modification before it could be applied to any ice-condenser plant, whether located onshore or offshore. These findings do not imply that there is a generic difference between floating and land-based plants as far as atmospheric releases from containment failures are concerned, because Westinghouse ice-condenser plants are under construction, and in one case in operation, onshore. A comprehensive comparison of risks of floating and land-based plants would have to examine differences between the same type of plants located in the two environments.

While such a comprehensive analysis was beyond the scope of this study, several generic differences between floating and land-based plants can be identified. First, in the case of a core-melt in a floating plant the core would eventually melt through the bottom of the platform and contact the water on which the plant was floating, This probably would produce large quantities of steam because boiling conditions could be expected to exist at the surface of the core for a day or more after melt through,[49 50] This steam could in turn transport into the atmosphere significant quantities of radioactive material, including fine particles produced in the interaction of the molten core with water.[51] While the possible interaction of a molten core with groundwater is a potential mechanism for similar secondary atmospheric releases in some land-based plants, there are some factors that may lead to differences in the effects of such releases on the generic risks of floating plants as compared to land-based plants. For one thing, the potential for such releases exists for all plants located on water, and only for some land-based plants, depending on the site. In addition, the release would occur later in time after initiation of a core-melt sequence in a land-based plant because of the thicker containment base mat that the core would have to melt through before encountering groundwater; this could reduce the population at risk by allowing additional time for evacuation. However, since WASH-1400 did not consider this type of release, further analysis would be needed to determine whether the potential for such secondary releases leads to a difference in the generic risks of land-based and floating plants.

A second possible generic difference between land-based and floating plants is the fact that floating plants can be located away from shore, which guarantees a permanent zone of zero resident population for several miles around the plant. This could reduce the expected consequences of an atmospheric release compared to some onshore sites. However, this difference applies only to offshore sites, and would not affect nearshore sites as compared to land-based plants located near the coast.

In summary, OTA's preliminary analysis indicates that the conclusions of WASH-1400 about the expected consequences of atmospheric releases cannot be directly applied to the floating nuclear powerplant. Furthermore, substantial additional analysis would be required to enable a generic comparison of the types and effects of atmospheric releases resulting from core-melt accidents in land-based and floating nuclear plants.

Accident Risks in the Study Area

Because the objective of this study was to assess the three offshore technologies by examining the potential impacts of their deployment in a specific geographic area, New Jersey and Delaware, OTA's analysis of the safety of floating nuclear plants considered the risks from an accident at the AGS, as well as the generic risks of floating plants.

Several unique aspects of the AGS site could lead to more severe consequences in the unlikely event of a core-melt accident than would be the case with many land-based plants or floating plants at other sites. The first of these is the fact that the economy of the area around Atlantic City depends heavily on summer recreational use of the nearby beaches and ocean. An accident that released large quantities of radioactive materials into the ocean could have a severe regional economic impact.

The influx of summer tourists also greatly increases the number of people who could be exposed to radiation in case of an accident. For example, the year-round population of Atlantic City, which is estimated by city officials to be 43,000, increases to around 400,000 on some summer weekends.[52] The population of Long Beach Island, whose southern tip is 2.8

miles north of the AGS site, increases from 10,000 to a summer daytime peak of more than 100,000.[53] In the unlikely event that a severe accident occurred on a July weekend, some 500,000 people, few of whom could be expected to know emergency evacuation procedures, could be in the area.

Finally, the prevailing winds in the Atlantic City area are from the south from April through August, and could be expected to carry atmospheric radioactive releases from the AGS directly towards Long Beach Island.[54] Because the winds average about 10 miles per hour in those months,[55] an accidental release could be carried to populous beach areas on the island within an hour. Furthermore, the island is connected to the mainland by a single four-lane bridge, which can delay motorists leaving the island by as much as *2* hours in traffic jams under normal summer conditions. This suggests that evacuation procedures would be only of limited usefulness in reducing the consequences of an accident during the daytime in the summer.[56]

These peculiar aspects of the AGS site lead to the conclusion that both the Liquid Pathways Generic Study and WASH-1400 have only limited applicability in assessing the overall risks from deploying floating nuclear powerplants in the study area. As noted earlier, the Liquid Pathways Generic Study is not considering economic impacts, While WASH-1400 did analyze economic impacts, its calculations of the expected consequences of accidents are based on site characteristics developed by averaging the characteristics of 68 sites expected to be in use by 1981. The averaging technique makes it impossible to determine from WASH-1400 the effects of peculiarities of particular sites such as the AGS. For this reason, WASH-1400'S conclusions do not appear to be directly applicable to analysis of the risks from locating a floating nuclear powerplant at that site. A comprehensive risk assessment of the AGS would require some modification of existing analytical techniques, since neither WASH-1400 or NRC procedures for analyzing the consequences of design-basis accidents take into account correlations between wind direction and seasonal population peaks.

CONCLUSION

OTA's review of NCR studies related to the risks from accidents in floating nuclear powerplants indicates that these studies are not comprehensive enough to provide either a generic comparison of the relative risks from land-based and floating plants or an assessment of the specific risks from deploying floating plants in the study area.

While substantial additional effort would be required to perform these analyses, a review of relevant literature indicates that there exists a substantial amount of information applicable to assessing the consequences of a core-melt in a floating nuclear powerplant, and that research programs are underway to provide additional relevant information.[57]

Alternatives To Offshore Technologies

The Coastal Effects study has been concerned to this point with the consequences of deploying any or all of three offshore energy systems proposed for the waters off New Jersey and Delaware.

This phase of the study examines the consequences of not deploying the offshore systems, with particular attention to the question of alternative sources of energy for New Jersey, Delaware, and other Mid-Atlantic States.

Although the analysis includes a discussion of a range of alternatives, it concentrates on those that are judged to be realistic options during the period 1976-90.

Based on analysis of existing and potential energy sources and possibilities for reductions in energy consumption, this assessment finds that:

- Even if offshore Mid-Atlantic oil and natural -gas systems and nuclear powerplants are producing at presently projected levels in the 1980's and 1990's, the Mid-Atlantic States still will depend on other sources for at least 80 percent of their energy.
- It may be possible to develop conservation programs that would make up the energy lost if the offshore systems are not deployed, but such programs would need strong national leadership and would have to begin at once.
- Without strong national programs to conserve energy and develop alternative resources, the Mid-Atlantic States will be locked into existing energy patterns well into the next century.
- Utility managers will choose existing and tested technologies that are most apt to match the consumption levels in their forecasts and will assign reliability of power supply a higher priority than cost.
- The most promising alternatives for stretching out supplies of fossil fuels are programs to improve insulation of homes and offices, changes in automobile design to increase mileage, and the use of existing technologies to increase the amount of power generated per unit of fuel.
- Coal is a potential substitute for every basic fuel in the United States and supplies could last for more than a century, even if consumption were to quadruple without improvements in mining techniques. However, massive conversion to use of coal would entail such major changes as transportation networks, some changes in air quality standards, new mining techniques, and new miner training and safety programs.
- Utility companies and other energy suppliers in Mid-Atlantic States will not factor supplies of oil and natural gas from the Baltimore Canyon Trough into their future plans until exploration establishes likely production levels.
- No single new technology or change in the way existing technologies are used is likely to provide more than a small percentage of total energy requirements for New Jersey and Delaware before the end of the century. Solutions to energy problems will be found by putting together many relatively small conservation and supply programs.
- Given existing laws, regulations, fuel supplies, and technologies, New Jersey utilities would favor building floating nuclear powerplants as their first choice. If these are not permitted, the utilities would opt for shoreline floating plants,

land-based nuclear plants, and coal-fired plants, in that order.

. Solar programs will not contribute much to energy supplies before the end of the century unless Federal programs to cut solar installation costs and private plans to market solar products are given higher priorities than they now enjoy.

CONSTRAINTS ON ALTERNATIVES

Without strong national leadership in conservation and fuel supply programs, the most likely course for the Mid-Atlantic region over the next 20 years is to expand and extend the energy system that is already planned or in place, including floating nuclear plants.

One likely sequence that emerges from an examination of the study region is as follows:

In the case of electric power, only extensive conservation is likely to reduce the growth in consumption below predicted levels. Lacking assurance that growth in demand will be slowed down by new national policies, utility executives will schedule construction of new generating capacity according to their own forecasts, which factor in relatively modest changes in consumption growth rates. Because of the long leadtimes for planning and building large power-generating plants, this sequence tends to lock regions into existing technologies for many years into the future. For example, Public Service Electric & Gas Co., New Jersey's largest public utility, signed a contract in 1973 for two floating nuclear powerplants it did not intend to put into operation for 12 years. [1]

In scheduling construction of new generating plants, utility managers choose technology that is both available and time-tested. For at least the next 15 years, that inclination is likely to limit the choices to nuclear or coal-fired powerplants for baseload generators.

Several options to present plans for expanding central generating capacity are being studied in New Jersey and Delaware. With each alternative there are uncertainties as to performance, questions about cost, or legal or institutional barriers.

A June 1976 report concluded that enough electricity could be generated in New Jersey as a byproduct by producing steam or heat for industrial purposes to postpone for 10 to 15 years a need for new baseload powerplants. [2] The report noted that 29 percent of the electricity in West Germany is generated as a byproduct of industrial operations and that only 2 percent of the power supply in New Jersey involves joint production of steam and electricity. However, there has been no detailed study of the cost of expanding joint production in New Jersey. There is no inventory of plants that could be converted and, therefore, no estimate of the potential output for the State.

In theory, about 5 percent of baseload power in the Public Service Electric & Gas Co. service area could be generated by burning municipal refuse. But the only attempt to build a refuse-burning powerplant in New Jersey has been delayed for more than a year by problems of site selection, transportation, and guarantees of delivery of refuse in sufficient quantities to keep a plant operating. [3]

New Jersey and Delaware utilities could increase purchases of power from the Pennsylvania-New Jersey-Maryland (PJM) Interconnection as an alternative to building new central powerplants in either State. The Interconnection is a power pool that links 11 power companies and permits them to operate as a single, integrated system.4 Beyond some point, however, other Mid-Atlantic States might balk at increasing their generating capacity to supply New Jersey and Delaware on the grounds that both States would be taking the benefits of power without paying the potential costs of pollution.

ENERGY PATTERNS IN THE MID-ATLANTIC STATES

Present plans call for a steep increase in nuclear-generating capacity and a drop in the share of energy supplied by petroleum to bring basic changes in Mid-Atlantic energy patterns over the next 20 years.

According to a 1976 Bureau of Mines forecast, the share of energy supplied by petroleum in the Mid-Atlantic States—New York, New Jersey, and Pennsylvania—will drop by the year 2000 from a present 57 percent, which is well above the national average (46 percent), to just over 40 percents During that time, nuclear generating capacity is planned to increase by about 85 percent. By the turn of the century, nearly half of the region's total energy would be supplied by nuclear and coal-fired powerplants.

The forecasts make several assumptions about consumption and availability of fuels.

Because States in the Northeast and Mid-Atlantic are much more dependent on foreign oil than are States in other regions, forecasts probably are least reliable where they are based on assumptions about availability of petroleum. Sharp price increases, embargos, or decisions by producing nations to cut back output all could change the energy picture for the Mid-Atlantic States more drastically than for the Nation as a whole.

As with oil forecasts, several assumptions in the projections of growth in nuclear-generating capacity are open to question.

New Jersey utility companies plan to use nuclear power for virtually all of the increase in their baseload generating capacity between now and 1987.[6] By 1987, about 70 percent of the baseload capacity in New Jersey is expected to be nuclear powered, compared with some 40 percent in 1975.

However, escalating costs, scarcity of capital and questions about the availability of uranium have held back completion of nuclear plants to about two-thirds of the levels that were forecast as recently as 1974. Recent studies also raise questions about how close nuclear plants come to operating at their rated capacity. T Design changes in new plants now under construction may increase on-line generating time but there is no experience to support a judgment.

Despite these potential problems, New Jersey utilities have concluded that nuclear power is the least expensive technology at hand and have scheduled expansion accordingly.

OFFSHORE OIL AND GAS ALTERNATIVES

The only direct substitute for oil and natural gas from the Baltimore Canyon Trough during at least the next two decades is an increase in imports.

For the near term, conservation programs could reduce the rate of growth in foreign im - ports. Over a longer period of time, an accelerated switch from the usc of oil and gas to heat buildings to the use of solar power could achieve dramatic reductions in petroleum consumption,

Based on present estimates of offshore resources, substantial increases in oil imports will be necessary over the next 20 years in addition to offshore production if nothing is done to reduce projected increases in congumption.[8]

There are alternatives that could reduce demand for oil in Mid-Atlantic States without a need for new technologies. None of these can alleviate the problem by itself, but in com - bination they could ease the strain on energy supplies in New Jersey and Delaware, OTA is assessing the potent i a 1 for conservation programs in residences for a report to be delivered to Congress in early 1977. The assessment includes an examination of technology and institutional barriers to deploying the technology. The following are some examples of such programs:

Insulation

About 32 percent of the oil consumed in Mid-Atlantic States in 1974 was used for heating space and water.[9] That represented about 400,000 barrels of oil per day.

The promise of energy savings through widespread insulation programs so far exists largely on paper. No definitive studies of net energy savings have been done. No workable program to accelerate insulation on a national scale has been devised. But there is at least one program that seems to be working without national leadership and using accepted marketing techniques. That program, run by Washington Natural Gas Co. of Seattle, could serve as a model for other regions.

The results of that program indicate that consumption of energy for heating single - family homes can be cut by more than 50 percent with better roof and sidewall insulation.

Washington Natural Gas Co. found that attic insulation cut the fuel requirements for heating a single-family home by 22.7 percent and that wall insulation cut fuel requirements by another 28 percent.[10] The firm also found that appeals to conserve fuel were less effective than a marketing approach based on promises of lower home-heating bills. In April and May of 1974, while an insulating subsidiary of the company was stressing conservation, its crews insulated 17 homes. In the same 2 months of 1976, after the company began emphasing lower fuel costs in its advertising, it installed insulation in 1,404 homes.

It is not possible to compare the Washington experience with the potential for New Jersey and Delaware without a detailed study of insulation in those two States, but i f the pattern of uninsulated homes in *New* Jersey and Delaware is comparable to that in Washington State, a widespread insulation marketing program could cut consumption of oil and gas for heating purposes by 24 to 40 percent.

Solar

Solar heating systems probably could replace many of the oil and gas systems now used to heat Mid-Atlantic homes, apartment houses, office buildings., and stores. But the statistics that are emerging from research and demonstration projects indicate that the use of solar energy for heating will spread too slowly to make a significant contribution to total energy supplies before the turn of the century.[11]

Automobile Efficiency

Another alternative to offshore oil production and increased imports lies in increasing the energy-efficiency of automobiles. In 1974, more than 40 percent of petroleum products sold in the Mid-Atlantic were used for

79-188 O - 76 - 17

transportation.[12] Changes in design of automobiles could double the number of miles per gallon of fuel. Congress has moved in that direction by setting standards for automobile mileage in the Energy Policy and Conserve - tion Act of 1975.

FLOATING NUCLEAR PLANT ALTERNATIVES

Interconnection

The Pennsylvania-New Jersey-Maryland (PJM) power pool is a clear alternative to construction of floating nuclear powerplants or to shoreline or inland plants in New Jersey and Delaware.

New Jersey already imports about half of its electric power, either from PJM companies or from powerplants located outside the State but partially owned by New Jersey utilities. Public Service plans to buy 650 megawatts (MWe) of power from the pool in the early 1980's to meet forecast demands until it can bring new nuclear plants into operation.

The power pool includes 11 members and affiliates, operating in five States and the District of Columbia. The members and affiliates serve 21 million customers with a peak generating capacity of 43,000 MWe. The power pool's 117 generating plants are linked by 5,293 miles of transmission lines and are controlled from a central computer complex in such a way that power demands from anywhere in the system are met by activating the least-costly unit elsewhere in the system that is not already operating at capacity.

Utility executives do not flatly rule out the PJM power pool as an alternative to new generating plants offshore or in the State. However, their plans for new generating plants are based, in part, on a conclusion that lower operating costs of scheduled nuclear plants will make it possible to reduce power costs in the State, which now run about 60 percent higher than the national average.

Conservation

Neither insulation programs or solar-heating systems would reduce electrical demand in the Mid-Atlantic region significantly because only about 1 percent of all homes are heated electrically.

Estimates of savings in consumption that could be achieved by reduced levels of lighting, higher efficiency of electrical appliances, and improved building design are largely extrapolated from a relatively small base of actual experience.

Reduction in electrical consumption also will come slowly because of the long lead-times for replacing existing equipment and appliances with more energy-efficient equipment. The Energy Policy and Conservation Act of 1975 requires that most appliances sold in 1980 and thereafter be 20 percent more efficient than similar appliances sold in 1972. However, the replacement cycle for some appliances is 16 years or more.

The California Energy Resources Conservation and Development Commission voted on September 15, 1976, to require air-conditioners sold in the State* after 1979 to be 30 percent more energy-efficient than the average existing models.[13]

Technology is not a barrier to higher efficiency in air-conditioning. Several models now on the market will meet the new California standards. But air-conditioning manufacturers oppose higher standards because they mean higher price tags for air-conditioners and a possible decrease in sales volume.

After a recent study, one New Jersey utility company concluded that standards similar to those set in California would reduce the company's need for peak power-generating capacity in 1990 *by 7* percent.[14] Peak power is generated largely with the most expensive fuels-ail and natural gas—and its costs are five to six times as high as baseload electricity.

The New Jersey company tried to persuade the State legislature to write higher energy-efficiency standards into law. Air-conditioning manufacturers in the State opposed the law and the proposal was abandoned.[15]

Cogeneration

Cogeneration of electricity refers to generating both electricity and heat for manufacturing processes in a single plant. This dual use of energy is not a new concept in the United States. About 4 percent of the Nation's electricity is generated by steam which is then used in manufacturing.

A preliminary assessment of the potential for cogeneration in New Jersey concludes that somewhere between 10 and 90 percent of the State's electricity could be produced by plants that already generate steam for industrial use.[16] The actual number of plants that could generate electricity as a byproduct would depend on the number of plants that could convert to cogeneration and projections of future needs for steam or heat in manufacturing processes. The preliminary assessment prepared by the Princeton University Center for Environmental Studies recommends an in-depth survey of industry to determine the potential for cogeneration.

A prime argument for cogeneration, according to the report, is that fuel costs for electricity could be about half those for power generated in central stations because fuel efficiency would be 62 percent compared with an average 32 percent in existing powerplants. The higher efficiency results from the fact that one unit of fuel is used to perform two functions, power generation and production of steam or heat for industrial use.

The study did not anlayze the costs of installing dual-purpose steam generators on a large scale. Nor did it include a detailed study of water and transportation needs that would be involved in cogeneration on a large scale.

A common type of cogeneration already in use involves piping waste steam from powerplants to factories within a mile or so where the steam is used for industrial purposes. Advocates of cogeneration propose to reverse the process so that electricity would become a byproduct of industrial steam and heat generation.

Coal

Coal is a potential substitute for every basic fuel in the U.S. energy system-oil, natural gas, and uranium. There is enough coal in the United States to last well over a century, even if consumption were to quadruple and there were no improvements in mining technoiogy.

However, any such increase in coal production would require major investments in new mines, new transportation networks and equipment, adjustments in air quality stan - dards, new mining techniques, and improved safety systems.

Coal can be converted to fuels like oil and gas but existing technology for conversion is relatively primitive and expensive and has not been perfected for widespread commercial use. OTA is assessing the coal technologies that are or will be available between now and 1990 and evaluating methods of reducing environmental impacts of increased utilization of coal. A report on the assessment will be made to Congress in early 1977.

For at least a decade, coal could be used as a substitute for offshore energy resources by burning in conventional powerplants or for heating homes and commercial buildings. It is, in fact, the last of the fallback fuels on the lists of New Jersey utilities which are investing in offshore nuclear powerplants.

According to the most recent estimate of the Energy Research and Development Administration, new coal technologies that will burn fuel much more efficiently and with far less pollution will not be tested on a commercial scale before 1990. By that time, construction may already have begun on the last of four floating nuclear plants which PSE&G has agreed to buy.

The coal technology most likely to serve as an alternative to any of the proposed offshore systems during the next 10 to 15 years is a conventional powerplant. The capital cost of a conventional plant currently is between $700 million and $900 million, including advanced pollution control equipment. A 1,000 megawatt (MWe) plant would require about 1,000 acres of land and take some 4 years to build.

RESEARCH

The foregoing examination has concentrated on near-term alternatives, those likely to be available for widespread commercial deployment within the 20-year time frame of this assessment. They include alternatives that would involve changing the patterns of energy use and distribution and alternatives which would adapt existing technology to new uses.

Longer term alternatives could cover a much broader range of possibilities and many depend on research on new and promising technologies. The research is now being conducted on many levels in government and private industry.

Major federally sponsored research is being conducted on thermonuclear fusion as a generator of electricity and many expect the research will show fusion to be capable of providing long-term, environmentally safe energy in large quantities. Other research is directed toward more efficient conversion systems for coal such as the magnetohydrodynamic generator.

Still other research efforts are directed toward more effective use of solar energy, the most plentiful and long-lasting fuel known.

Technology already exists for using solar energy to heat water and space. Similar technology is under development to power cooling systems that now are operated largely by electricity y.

An OTA analysis has found that neither public nor private programs in solar energy are likely to lead to large-scale deployment of solar equipment in the next 20 years unless they are expanded and intensified.

The Energy Research and Development Administration estimates that at the present pace of development less than 6 percent of the heating and cooling systems in U.S. homes will be solar powered by the year 2000. The OTA analysis concludes that the potential for solar power is large enough to warrant more emphasis on development and marketing. The OTA study, which will be sent to Congress early in 1977, focuses on barriers to more widespread use of solar energy to generate electricity for individual residences and small cities and examines possible courses of action for removing the barriers, The stakes for solar power in New Jersey and Delaware are high in energy terms. As ha's been noted, about 32 percent of all oil and about 63 percent of all natural gas now consumed in those States is used for space heating and water heating. A major shift to solar power would make possible significant savings in both scarce fuels and in the need for future imports.

The OTA analysis of energy alter-natives is continuing beyond this and other studies.

One assessment now underway involves an investigation of renewable ocean energy technology, including methods of extracting useful energy from ocean tides, waves, winds, currents, and thermal differences in water-layers.

The study will assess the amount of research necessary to make such technology commercially feasible and the consequences of developing renewable ocean energy systems. A preliminary assessment is to be completed early in 1977.

CONCLUSION

No new alternative technology is likely to provide a significant share of energy supplies in the Mid-Atlantic States between now and the end of the century. The alternatives to the proposed offshore energy systems in that time- frame are, by and large, restricted to extending the existing pattern of oil and gas imports and land-based coal and nuclear powerplants.

Two courses of action that are open to the States, with or without Federal support, offer-some hope of reducing the rate of growth of oil imports and slowing the pace at which new powerplants are built.

- Conservation n programs, including widespread improvement of insulation of homes, could reduce the rate at which oil and natural gas imports grow over the next 20 years.
- Cogeneration of electricity as a by-product of industrial steam or heat could reduce the rate at which new central powerplants would be built.

Conservation and new uses of existing technology such as cogeneration are important because they could buy time for New Jersey and Delaware, in which new energy options may become available for both States.

A very important policy question involves alternative energy sources for easing the problems of transition from existing energy systems to more efficient and less polluting systems. That transition can be difficult because of the long lead times and the long operating lives that are involved in existing energy systems, particularly in electric power generators.

New Jersey public utilities have contracted for four floating nuclear powerplants to be installed off the Mid-Atlantic coast. * The last of these plants is scheduled for completion in 1992 and designed to operate for 40 years, until the year 2032. Four land-based nuclear plants already are under construction in New Jersey, all of which would be operating past the turn of the century.

The more central powerplants that are built using existing technology in the next 10 to 20 years, the more difficult it will be to replace

*Two floating plants are in the licensing process. No application for a site license has yet been filed for the second pair of plants them with new technology that may be more efficient and less polluting than may be commercially feasible after 1990. An analogy exists in the case of older coal-fired powerplants that now are used primarily for generating intermediate loads of power in the two States. Newer coal-fired systems already exist that are more fuel efficient and less polluting. But it is not economic to shut down the older plants and replace them with new plants because the older plants, most of them located near urban areas, still have many years of operating life.

Similar transition problems will exist in the future as new technologies come online while it is still economical to operate existing systems. Conservation, cogeneration, and other alternatives would ease the transition problem and make it possible to put new technologies in place with less delay and difficulty when they are ready.

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...ffshore Oil Study Defines ...ms, Solutions

... and New ... laws, ... serve the ... according ... report.

The OTA report concluded ... the odds of an oil spill ... the shore are only ... the accident happened at a drilling or production platform. A pipeline ... near the shore, ... of course, increase ... Under the first ...

The dismal chances are contained in a new congressional study that both ... problems in the drilling program ... definite solu...

weeks ... Senate ... that would ... money to assist the ... supplying services such as housing and police to the drilling communities.

Numerous congressional bills have been drafted to deal with the problem of oil spill liability and also will be concluded within the coming months. The OTA suggested in its report that a fund could be set up to which claims could be made directly. Those liable for the spill damages would have to repay the fund. That way, compensation would be speedily received.

...king ...pinion ...illing

NEWARK STAR-LEDGER/September 3, 1975

Cong... wants your ... on offs... ...ing

... before final

... power plants and deepw... constructed.

"It is," he contends, information is obtained interested and affected ci...

What the OTA speci... know is "What effects w... for yourself, your comm... if offshore energy syst... veloped off the coasts of Delaware?" "Do you thi... would be generally positi... "What comments do y... alternatives?"

To receive copies of th... and questionnaire, writ... gress, Office of Technolo...

By GORDON BISHOP

Every resident of New Jersey has an opportunity to participate in the decision-making process that will largely determine the direction and impact of America's energy policies.

Congress wants to know the implications of proposed new energy technologists off the shores of New Jersey and Delaware. And Congress is calling on the citizens who live, work and play in coastal states to share in the shaping of energy policies as they relate to offshore resources.

other complex ... fice of Technology ... (OTA) was ... search arm of the ... legislature.

Established ... 92-481, OTA ... in January ... it has been ... to undertake ... such vital ... oceans, health ... sources, food ... technology and ...

OTA's basic ... help Congress ... plan for the ... technological ...

ASBURY PARK EVENING PRESS, September 2, 1975

Oil Drilling Opinions Sought of N.J. Residents

... Texas, a Democrat, and ... chairman ... Clifford P. Case ... director of ... in the Nat... Senate committees ...

Chapter V

PUBLIC PARTICIPATION

Public Participation: A Pilot Project

The public participation element of this assessment was an effort to bring about an exchange of information between OTA and citizens in the study region. This two-way flow of information was intended to contribute to public understanding of the technologies being assessed, and to obtain information directly from the affected citizens about impacts of greatest public interest and concern.

The data obtained from the public participation program helped OTA ensure that factors which citizens consider relevant and important were adequately addressed in the study. The public participation program also helped OTA to make the assessment as complete as possible so as to assist the Congress in anticipating, understanding, and considering, to the fullest extent possible, the consequences of technological applications, as mandated by the Technology Assessment Act of 1972.

In addition to contributing to the content of this particular assessment, the public participation program was intended to help OTA learn how the public could participate in a meaningful way in the assessment of technology. The process of involving the public and integrating the results of such an effort into a technology assessment is an experimental one. There is virtually no practical experience upon which to draw, nor does the process lend itself to standardized formulas, models, or techniques. This pilot project was therefore designed to evolve throughout the coastal effects study so as to meet the needs of the assessment team and of the public participants.

Overall, OTA learned through responses to its public participation program that citizens were most interested in the economic benefits and losses, the social and environmental advantages and disadvantages, possible changes in their way of life, and the possible risk of major accidents associated with the three energy systems or their alternatives.

With regard to the current system for information gathering and decisionmaking, citizens were concerned that the States and the public lack an effective partnership role and that the various Federal agencies do not sufficiently coordinate their roles and activities.

Repeatedly, participants in the program saw an urgent need for a national energy policy in which each energy system could be considered, and serious research and funding could be given to determining conservation measures, identifying alternative sources of clean and renewable energy, and developing innovative energy systems.

The need for a national energy policy was stressed by many respondents, and their collective views are well expressed by a respondent from Hillside, N. J., who put it this way:

> Before these options are explored, the State and the Nation must develop a comprehen -

> **sive** energy conservation policy, including development of mass transit and recycling of all usable products. As a second step, all minimum polluting forms of energy-—such as solar, wind, and geothermal—-should be utilized wherever possible. If offshore facilities are eventually developed, legislation should spell out clearly that they must conform to all existing environmental legislation. This is especially important regarding onshore development which will definitely affect air quality maintenance planning.

More than 15,000 persons were reached by OTA during the project. Those who participated in the assessment by returning questionnaires, attending workshops, or communicanting with OTA in other ways, represented industry, trade associations, professional associations, consultant groups, academic groups, citizen organizations, and local, State, regional, and Federal officials, as well as the general public.

Since no attempt was made to obtain a representative sample, participants may or may not be representative of the entire population of the study area. Nor was any attempt made to conduct a public opinion poll on support for, or opposition to, the technologies. OTA was seeking substantive information and as many points of view as possible to ensure a thorough and reliable assessment of offshore energy systems.

Participation in the assessment was in response to OTA efforts to reach as many persons as possible in New Jersey and Delaware, but the study was not confined exclusively to that area.

The process of public participation was facilitated by the following factors:

(1) the limited size of the study area;

(2) the existence of actual proposals in the area for:

-offshore oil and gas exploration and development,
—a floating nuclear powerplant,
-deepwater ports; and

(3) the neutral position of OTA relative to each of the technologies being studied.

Response to the public participation project was mostly favorable. Participants indicated they were pleased to be consulted by the Government at a time when they felt their opinions would make a difference in the study. Dissemination of information to the public was indicated as a major step toward encouraging citizen involvement and OTA was encouraged to find more ways of distributing information and involving the public by the most efficient and least costly method.

Responsibility for planning, directing, and conducting the public participation project was assigned to one member of the OTA Oceans Program staff, but other members of the assessment team, including the Program Manager, also attended workshops, prepared materials, and evaluated information received. Thus, all members of the team were aware of the relevance of information being generated and public participation activities were integrated into the assessment process. Instead of being viewed as a separate part of the study, public participation was considered by the entire Oceans Program staff to be a necessary and integral part of the effort to provide Congress with relevant information, including public perceptions and views about the consequences of the technologies being assessed.

The following methods of communication were used for this information exchange:

- an initial OTA news release announcing the study;
- distribution of 100 copies of a staff-prepared briefing paper about the assessment;
- three public workshops which drew a total of about 90 participants;
- attendance by OTA staff at public hear-

ings and at meetings sponsored by other groups;

- distribution of 15,000 information brochures, "Proposed New Technologies Off the Shores of New Jersey and Delaware";
- more than 1,000 responses to questionnaire included in brochure;
- in-depth interviews conducted by the assessment team;
- correspondence and position papers supplied to OTA by participants;
- review of background papers by OTA advisory panel members and public participants;
- specially convened industry, government, and academic panel on alternatives sponsored by OTA;
- meetings with the OTA Coastal Effects Advisory Panel and the Technology Assessment Advisory Council;
- review of OTA draft report by panel, public participants, and government officials involved in the technologies;
- survey results and constituent correspondence supplied by congressional offices;
- monitoring of press reports on the assessment and the proposed offshore technologies in Delaware, New Jersey, New York, Philadelphia, and Washington, D. C.; and
- interaction with members of Congress and their staffs.

The process of identifying and reaching potential participants was, by design, an evolutionary one. Initial contacts were expected to provide additional names, and they did. Those sources in turn provided more names. Lists of potential participants were also obtained from interested persons and organizations, congressional offices, testimony at hearings, press reports, and requests for information received by OTA.

Supplementary sources of information, such as testimony at Government hearings, press reports on energy systems in genera], and similar sources not generated by OTA, were also used to determine whether there were any major d inferences between views expressed in those forums and views being expressed to OTA, and to detrmine whether relevant segments of the public were being reached by the OTA effort.

The public participation project was a continuous loop of information exchange from the assessment team to the public and back to the team. The information exchange made it possible for the OTA staff to confirm ongoing work or modify or expand the study in response to concerns and information needs identified by participants.

The following sections of this chapter detail major findings, the ways in which OTA made use of the information gathered through the public participation program, and how the program was conducted. Throughout the discussion, the actual words of respondents are often used to illustrate the level of public interest, understanding, and concern about the energy systems being studied.

Major Findings for All Technologies

BACKGROUND

From responses to a questionnaire (see figure V-1) distributed during the public participation program, OTA obtained two groups of information: lists of the positive and negative impacts expected from the three energy systems, and comments on all aspects of offshore energy development.

70-183 O - 76 - 18

Figure V-1. Public participation questionnaire

New Jersey-Delaware Offshore Energy and Coastal Zone Assessment

Public Participation Questionnaire

1. If you would like to be kept informed about the assessment, please print:

Name ____________________

Address ____________________

City ______________ State ______ Zip ______

2. If you belong to any organization(s) that would have an interest in the assessment, please indicate

Organization ____________________

Address ____________________

City ______________ State ______ Zip ______

President ____________________

Organization ____________________

Address ____________________

City ______________ State ______ Zip ______

President ____________________

3. If offshore energy systems were developed off the coasts of New Jersey and Delaware, what effects would you foresee for yourself, your community, and the nation? Do you think these effects would be generally positive or generally negative?

Possible effects? (Please list)	Positive Or Negative, (Please check)	
Offshore Drilling for Oil and Gas		
1. ______________	Pos ☐	Neg. ☐
2. ______________	Pos ☐	Neg. ☐
3. ______________	Pos ☐	Neg. ☐
Floating Nuclear Power Plants		
1. ______________	Pos. ☐	Neg. ☐
2. ______________	Pos. ☐	Neg. ☐
3. ______________	Pos. ☐	Neg. ☐
Deepwater Ports for Supertankers		
1. ______________	Pos. ☐	Neg. ☐
2. ______________	Pos. ☐	Neg. ☐
3. ______________	Pos. ☐	Neg. ☐

4. If you have other comments on any of the subjects related to offshore energy development in the New Jersey-Delaware area, or alternatives to such development, please note these below:

____

5. If you or your organization have developed any information relative to the subjects of this study that you would like to send along with this questionnaire, please note below the nature or title of the materials:

____

Please mail this questionnaire, along with any other information you wish to share with OTA to:

Please fold here

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Public Participation, Oceans Project
Office of Technology Assessment
Untied States Congress
Washington, DC. 20510

Source Off Ice of Technology Assessment

The lists supplied by respondents allowed OTA to determine which anticipated impacts were most important to participants. They also made it possible to compare responses from various areas of New Jersey and Delaware to determine if there were significant differences in views based on place of residence.

The comments, which were made in response to an open-ended question on the questionnaire, provided the quotes used in this chapter and advised OTA of alternatives and other actions which the respondents believed important, relative to energy supplies.

The following pages give the overall findings from the questionnaires and the findings for each of the three systems studied. For each system, the findings are grouped as they relate to anticipated effects, how the technologies will be implemented, and preferences or alternatives expressed by respondents.

OVERALL FINDINGS

The public participation program showed that:

- Questionnaire respondents attributed more positive than negative effects to offshore oil and gas systems and to floating nuclear powerplants, but more negative than positive effects to deepwater ports.
- More respondents perceived mixed effects—i e., some positive, some negative—from offshore drilling, than from floating nuclear powerplants or deepwater ports.
- For all technologies, the important positive effects related to increased energy supply, lowered energy costs, stimulus to the economy, fiscal advantages, increased employment, and environmental advantages.
- For all technologies, the primary negative impacts related to degradation of the onshore and marine environment, the dangers and consequences of major accidents such as oil spills or nuclear malfunctions, adverse economic impacts—especially potential losses to the tourist-recreation industry—and adverse energy use impacts such as depletion of nonrenewable sources, disincentives to conservation and to alternative energy source development.
- The major positive effect perceived for offshore drilling was increased energy availability y.
- The major positive effect perceived for floating nuclear powerplants was also increased energy availability.
- The major positive effect perceived for deepwater ports was lower energy costs,
- The major negative effect perceived for offshore drilling was undesirable onshore impacts.
- The major negative effect perceived for deepwater ports was the possibility of large oil spills.
- The major negative effect perceived for floating nuclear powerplants was potential nuclear hazards.

In addition, respondents expressed a preference for alternatives other than nuclear or oil-related offshore developments. These can be summed up by the following statements by participants:

> ConservatiOn of energy, wind, and solar power should be used, not stepped-up production of oil or dangerous nuclear power-the ocean belongs to the world and should be protected at all costs. (From Paramus, N.J.)

> More effort must be made to use solar energy. Nuclear, fossil fuels are at best stop-gap measures. (From Waldwich, N. J.)

> The only real solution to the energy problem is a commitment to development of sources

other than fossil fuels or nuclear fission. An all out effort to develop solar, wind, geothermal sources, etc., would meet with public acceptance. (From Chatham, N. J.)

It's time to develop new means of supplying energy in the United States. (From Montclair, N. J.)

FINDINGS BY REGION

The number of respondents -who listed predominantly positive or predominantly negative effects for each technology was tabulated and this information was sorted according to the counties in which the respondents live. This analysis allowed the study team to determine whether residents of coastal counties perceived effects which were significantly different from those perceived by residents of noncoastal areas. The major findings of this analysis are as follows:

NEW JERSEY

Delaware River Counties of New Jersey (Cumberland, Salem, Camden, Gloucester, and parts of Cape May Counties):

- more positive than negative on nuclear plants, offshore drilling for oil and gas, and deepwater ports; but
- largest positive margin on oil and gas.

Southeastern New Jersey (Cape May, Atlantic, Ocean Counties):

- positive on oil and gas, but by smaller margin than other parts of New Jersey;
- about evenly divided on nuclear, but negative percentage larger than in other parts of New Jersey;
- more positive than negative on deepwater ports, but by fairly small margin.

Northeastern New Jersey (Monmouth, Middlesex, Union and Essex Counties):

- largest number of respondents;
- more positive on oil and gas and nuclear;
- more negative on deepwater ports;
- more positive on floating plants than Southeastern New Jersey or Delaware River Counties;

Non-coastal New Jersey:

- larger margin positive for oil and gas than other New Jersey or Delaware regions;
- larger margin positive for floating nuclear plants than other New Jersey or Delaware regions;
- larger margin negative on deepwater ports than other New Jersey regions.

DELAWARE

New Castle County, Delaware:

- more positive for oil and gas;
- more positive for floating plants;
- more negative on deepwater ports.

Kent and Sussex County, Delaware:

- smallest number of respondents;
- more negative than positive on all three technologies;
- more negative on offshore development and floating plants than deepwater ports;
- margin of negative for all three technologies greater in Sussex than Kent.

OFFSHORE DRILLING FOR OIL AND GAS

Anticipated Effects.

The perceived positive effects of offshore drilling focused on very different factors from the perceived negative effects. The benefits of OCS oil and gas were seen mainly as economic and energy-related, with emphasis on energy self-sufficiency and employment opportunities; whereas the adverse effects were associated mainly with anticipated degradation of the coastal and marine environment, the quality of life, and the risks of major accidents causing losses to the economic base of the region—the recreational industry which depends on a clean environment. (See figure v-2.)

Concerning the positive effects, a Bloomfield, N, J., resident saw offshore drilling as "a positive step in the direction of providing this country with the energy it needs. " A Montclair, N. J., respondent saw offshore drilling as "absolutely necessary for our future economy. Another Bloomfield resident saw OCS development as "good for the State in that it provides much needed jobs and tax revenue, and a Pompton Lakes, N .J., person said that offshore drilling "should help the very bad economic and unemployment situation now existing in New Jersey. "

A Wilmington, Del., resident summed up these responses by saying "I favor offshore drilling as benefits seem to more than offset the risks. " Finally, a Basking Ridge, N. J., man said, "The United States should do all it can to develop energy supplies not related to other countries. "

In contrast, a respondent from Barnegat Light, N. J., summed up many of the negative perceptions by saying he felt that "such developments would ruin the N.J. shore. " A Wilmington, Del., resident was "against such development" because it "would supply very limited amounts of oil over a very short commercial life but would radically alter the ecology, both animal and human along the coast" and "may impose additional taxes on current residents. " And a South Orange, N.J., resident said "Tourism is N.J. 's number one business. Unattractive onshore development should not be allowed to damage this business. "

Process of Implementing the Technologies

The responses to an open-ended query on the questionnaire distributed by OTA confirmed the findings of workshops and interviews that the manner and timing of Federal decisions relating to offshore oil and gas development, as well as the State and public role in such decisions, are matters of concern. The way in which the offshore drilling technology is managed and regulated was also criticized by some, and the absence of adequate liability and compensation programs in the event of major oil spills was noted. Proponents of offshore drilling were less critical of the present system of implementation and management and many felt that changes in the process would cause undesirable delay in developing offshore oil and gas sources.

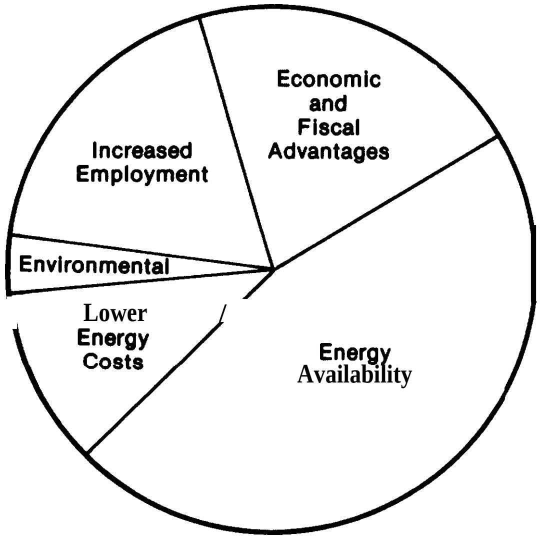
GOVERNMENT INVOLVEMENT

There were some widely divergent views on the nature and extent of appropriate government involvement in offshore oil and gas development. Views ranged from those of the Neshanic Station, N.J., resident who favored "minimal government interference in the develop merit," that of a Westfield, N. J., respondent who said "offshore exploration and production should be done by industry, not Federal or State agencies, " and the Mendham, N. J., man who wanted "a minimum of necessary government controls, " to those of a Leonia, N.J., resident who said "nationalize all energy industry, " and the Bayone, N. J., resident who felt that "if offshore development occurs it should be undertaken by the Federal or State government for maximum public benefit."

There were some who said, as did a South Orange, N. J., respondent that "the present OCS leasing system works very well" and that "pending OCS legislation looks like another attempt to destroy private enterprise, and substitute big government bureaucracies." A number of respondents cited the desirability

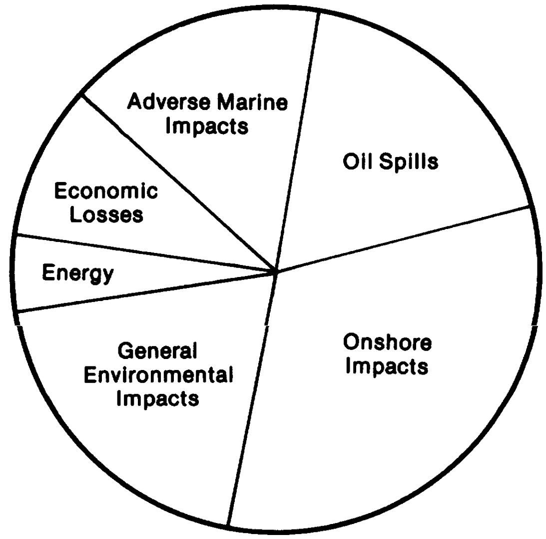
Figure V-2. Results of public participation questionnaire: offshore drilling for oil and gas

ANTICIPATED POSITIVE EFFECTS



(1207 Positive Effects = 58% of Oil and Gas Effects Listed)		
ENERGY AVAILABILITY		47%
Increased supply of energy to the nation or region in general	52%	
Enhanced energy independence and national security	4770	
Other	1%	
ECONOMIC/FISCAL ADVANTAGES		20%
Stimulate economy	57%	
Increase tax revenues	17%	
Industrial development	17%	
Balance of payments, other	9%	
INCREASED EMPLOYMENT (Increase employment - decrease unemployment)		19%
LOWER ENERGY COSTS (Cheaper oil and gas, cheaper transport costs)		12%
ENVIRONMENTAL ADVANTAGES (Less pollution from tankers, etc.)		2%
Total Positive Effects:		100%

ANTICIPATED NEGATIVE EFFECTS



880 Negative Effects = 42% of Oil and Gas Effects Listed)		
ONSHORE IMPACTS		32%
Damaged beaches, shore	29%	
Industrial development	21%	
Increased support/service facilities	17%	
Increased population	13%	
Aesthetics	7%	
Other quality of life impacts: Boom town, air pollution, traffic congestion, community dislocation	13%	
GENERAL ENVIRONMENTAL IMPACTS		21%
Harm to environment/ecology	65%	
Pollution	35%	
OIL SPILLS		20%
Oil spills	69%	
Accidents (including pipeline leaks, blowouts)	31940	
ADVERSE MARINE IMPACTS		15%
Harm to ocean ecology in general	61 %	
Harm to wildlife, marine life	30%	
Damage to wetlands	6%	
Damage to ocean floor	3%	
ECONOMIC LOSSES		8%
Losses to tourist-recreation industry	64%	
Damage to fishing industry	24%	
Other losses (property values, farmland)	12%	
ENERGY IMPACTS (Decrease conservation, further dependence on oil, use up non-renewable sources, delay energy alternatives)		1%
Total Negative Effects:		100%

of separating exploration from the development of offshore oil and gas or suggested several related ways to change the present leasing system. One respondent, from Chatham, N. J., said that "the United States should do its own exploration work to determine the oil and gas resources, then perhaps lease lands. These are public resources and if developed the public should receive a better return than has been true in the past. " A Brookside, N. J., respondent said, "I think exploration for oil and gas is important in terms of knowing our resources. However, development should not be undertaken until other resources are exhausted. "

And, finally, a Red Bank, N.J., respondent summed up the views of many public participants as follows: "The development of OCS oil resources must be done on a thoroughly planned basis. This requires a preliminary exploratory phase. After the total resources are known, then a rational national energy plan can be developed which will match the Nation's energy needs over the long term while minimizing environmental impact. "

STATE-LOCAL ROLES AND COMPENSATION

There were many general comments, relating to all technologies, that offshore developments should take place with adequate State and local participation in decisions. One summation of this view is that of the Newark, Del., resident who said, "The States of Delaware and New Jersey should have a strong voice in all proceedings. No 'Federal-experts-know-best' attitude, Some 'experts' simply are not greatest authorities on all matters, especially local ones." Cooperation among levels of governments was seen by a Dover, Del., respondent as especially needed with regard to offshore drilling: "Department of the Interior and the oil companies have a serious credibility problem. Top management is either insensitive or too arrogant. Offshore exploration can be speeded up with a 'true' cooperative program between local, State, and Federal govern merits."

Several aspects of the State and local role in OCS development were discussed by participants. A Glen Ridge, N. J., woman said "I believe New Jersey should have a say as to where the drilling will be done. . . ." Several respondents expressed views similar to that of a Fanwood, N. J., man who felt that "New Jersey should receive some compensation for use of the the land and natural resources" and the Selbyville, Del., resident who said, "If it is necessary, the States should be financially compensated to provide the facilities that will be needed for the increase in population. "

ORDERLY DEVELOPMENT

A recurring theme among questionnaire responses was that development should be preceded by proper planning and safeguards. As a Highland, N.J., man put it, "The OCS should be developed but with proper planning given to the many environmental impacts that will result. " A Fort Lee, N. J., respondent added, "1 cannot overemphasize the need for careful environmental planning, especially in regard to the effects on the local communities. It must be dealt with as a complete 'system' including access roads, pollution abatement, and recreation for the increased population. " A Wilmington, Del., woman wrote, "I would favor some offshore energy development (excluding nuclear) if it were undertaken with adequate safeguards for the environment and in a time frame allowing Delaware communities to plan for the resulting growth. " On the other hand, a State legislator from Centerville, Del., felt that "Coastal zone management and statewide land use plans must be developed with inputs from the total community. "

A Wilmington, Del., resident said, "I favor offshore drilling with control to minimize spills, " and a Washington, D. C., respondent saw the need for "strict adherence to environmental protection measures—provision for prompt remedies in case of spills, accidents, etc. ” A Phillipsburg, N. J., resident, who expressed support for drilling, wrote: “The technology exists to control spills and leaks from any oil-related activity. ”

Strict control over the technological systems was also emphasized by respondents like one from Wenonah, N. J., who saw a need for “constant reliability check on equipment and operators of vital equipment. Operators must be very well selected for ability to accept responsibility and to perform consistently. ”

A Westfield, N. J., man added that, “Enforceable stiff rules on spill prevention should be developed. ”

LIABILITY AND COMPENSATION FOR OIL SPILLS

Many respondents wanted, as did a Wilmington, Del., resident, to “make sure enough money is set aside to compensate for spills and damages. ” A Belleville, N. J., resi-’ dent wrote, “People should have quick inexpensive recourse for restitution for damages due to spillage. ” A Millville, N.J., resident stated that “any private company should be required to post bond of sufficient amount to cover cost of spill cleanup and restoration of wild life,” and the Belleville, N. J., respondent added that “Legislation should include oil companies to put up bond for cleanup and all damages from an oil spill. ”

Preferences and Alternatives

Some of the respondents made choices among the technologies.

For example, a Budd Lake, N. J., resident said, “Oil and gas is necessary for development of the United States and has many and varied uses. Nuclear power would make us less dependent on oil, but radioactive waste is a nearly prohibitive problem which should be dealt with before any further nuclear industry development. ” Similar views were expressed by a Lawrenceville, N. J., respondent who said, “Fossil fuels are a more sensible alternative to nuclear energy development”, primarily because of “nuclear debris generated during production of fuel elements. ” A resident of Wilmington, Del., stated: “I fully support these developments based on oil and gas energy. I’m concerned about nuclear-power development because of its potential hazards.” He cited disposal of radioactive wastes and the potential for sabotage at sea with offshore nuclear plants.

A resident of Ridgewood, N. J., added: “Offshore energy should be developed in oil and gas after full measures of the social and environmental impact have been made. The hazards of offshore nuclear facilities and deepwater ports do not warrant their development at this time. ”

While most of the comments on energy policy and energy alternatives were general to all three technologies, some participants did express specific views about oil resources in general and offshore drilling in particular. Some felt, as did a Mountain Lakes, N. J., resident, that “oil, at best, is a short-term solution to our national energy needs. A concentrated effort to develop suitable long-term solutions is required. Why run the risk of environmental disaster to achieve a short-range solution?” A Lewes, Del., woman felt that “less dependence on oil should be our first priority; with more Federal money being spent on the development of solar energy. ” A Pt. Pleasant, N. J., respondent, on the other hand, said “This offshore drilling for oil and gas is a short-term solution to energy-source problems. Energy sources other than burning of fossil fuels (with the exception of coal which is in good supply in this country) should be developed (i.e., tidal, solar, nuclear).” A somewhat similar view was expressed by a Wilmington, Del., man who said, “Petroleum development is only a stop-gap measure as supply will run out shortly. I suggest increased support of solar technology, wind power, and nuclear fusion supplies of energy. ”

In addition, the alternative of energy conservation was advocated by a large number of participants. As a Montclair, N.J., woman put it, “The proper alternative to offshore development is conservation .“ A West Orange, N. J., man elaborated on these themes as follows: “Devoting large amounts of capital to oil and gas exploration will ‘lock us in’—it will commit us to stick with these energy sources, since investors will not allow their investment to yield no return. The only way to escape from this development-consumption cycle is to break away and concentrate on a program of conservation and alternate sources.

Finally, the priority and nonpriority uses of offshore oil were discussed by a Fanwood, N. J., resident who asked, “Why offshore drilling? If this energy is going to be used for mass transportation and industry, OK, but let’s not do this to lower the price of automobile gas. The only thing this alternative would do is lower our undersea oil reserves. I say more mass transportation. ” A Franklin Lakes, N. J., respondent said, “Rather than floundering around for oil in the short term, we should tax the stuff out of use as a fuel except for aircraft-develop fusion, wind, and solar power and start the withdrawal from our oil jag before the whole world has to go ‘cold turkey ’.”

A respondent from Chatham, N. J., summed up the point of view of a number of participants by saying, “The total expected reserves off New Jersey and Delaware represent a small fraction of our energy needs. Developing it now will not bring us that much closer to energy independence, but it will be depleting a valuable resource for future generations who may, hopefully, use oil for more productive purposes than generation of power where coal could be used instead. Oil is extremely versatile and valuable as an organic building block for drugs, plastics, synthetic food, etc. It should be preserved where possible for these uses. ”

DEEPWATER PORTS

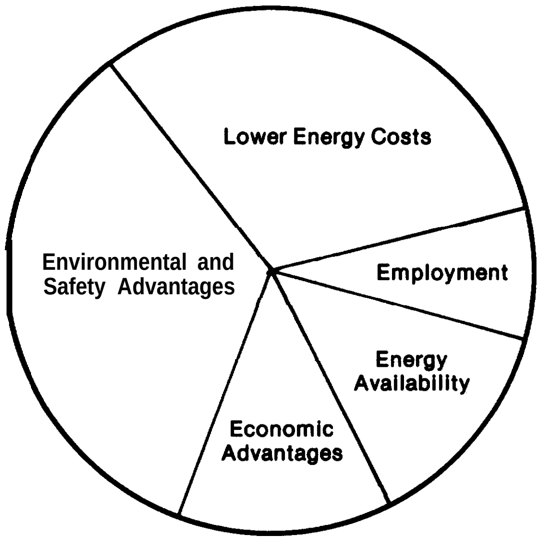
Anticipated Effects

While many of the perceived effects of deepwater ports focused on lower energy costs, other economic advantages, increased energy supply and more jobs, a significant proportion of respondents saw such systems as safer and less harmful to the environment than the smaller tanker traffic closer to shore. On the negative side, however, a large proportion of respondents were concerned about the potential for larger oil spills from supertankers. Greater danger of accidents and general offshore and onshore environmental degradation were also seen as negative effects. Many of these respondents saw such ports as encouraging continued dependence on foreign oil and therefore inconsistent with energy self-sufficiency. (See figure V–3.)

A Florham Park, N. J., respondent summed up many of the negative perceptions as follows: “The use of deepwater ports for supertankers would only marginally affect the economics of oil delivery. While it may be argued that the decrease in number of vessels involved reduces the chances of accidental spills, the increase in severity of one accident offsets this consideration. ” A Sea Girt, N.J., resident said, “See no need for deepwater ports, since these are intended principally for import of foreign oil which we ought to be

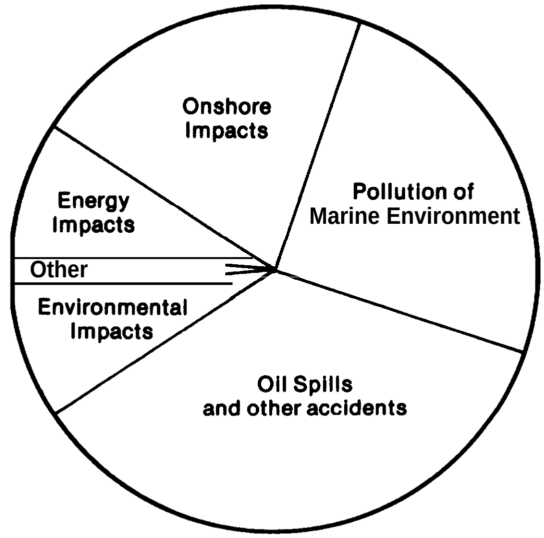
Figure V-3. Results of public participation questionnaire: deepwater ports

ANTICIPATED POSITIVE EFFECTS



(770 Positive Effects = 48% of Deepwater Ports Effects Listed)		
LOWER ENERGY COSTS		30%
Cheaper oil, energy	61 %	
Cheaper transportation costs	39%	
ENVIRONMENT AND SAFETY ADVANTAGES OVER PRESENT METHODS		28%
Fewer spills, less water pollution	4970	
Less tanker traffic in rivers and ports	29%	
Less general environmental impact	13%	
Fewer collisions, port fires, other accidents	9%	
ECONOMIC ADVANTAGES		16%
Stimulate economy	40%	
Industrial development	30%	
Help business activity, refinery operation, shipbuilding	24%	
Tax revenue	6%	
ENERGY AVAILABILITY		15%
(Increase needed energy supplies)		
EMPLOYMENT		11%
(Increase jobs)		
Total Positive Effects:		100%

ANTICIPATED NEGATIVE EFFECTS



(835 Negative Effects = 52%. of Deepwater Ports Effects Listed)		
OIL SPILLS AND OTHER ACCIDENTS		38%
Larger oil spills	70%	
Safety hazards, accidents including pipeline ruptures, collisions, bad weather effects, fires	30%	
POLLUTION OF MARINE ENVIRONMENT		24%
General pollution including water	76%.	
Harm to marine life, wildlife, wetlands, ocean ecosystem, ocean floor	24%	
ONSHORE IMPACTS		20%
Industrial development	29%	
Damaged beaches	27%	
Aesthetics	8%	
Other land use impacts onshore support facilities, increased population	36%	
ENERGY IMPACTS		10%
Encourage continued dependence on imported oil	71 %	
Postpone long-range alternatives, conservation	27%	
Other	2%	
ECONOMIC DISADVANTAGES		6%
Potential losses to tourist-recreation industry	49?40	
Expensive to build, higher energy costs	27%	
Other—lower property values, increased taxes, balance of payments	24%	
OTHER		2%
Use of supertankers, increase ship traffic, target for sabotage		
Total Negative Effects:		100%

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curtailing, " and a Ridgewood, N. J., resident said, "Supertankers . . . are notorious spillers of oil. "

A Wilmington, Del., respondent saw it differently. "The present method of lightening is more dangerous, potentially, than a deepwater port under controlled condition s." put another way, a Summit, N .J., resident stated, "Offshore tanker ports would add an important safety increment to our east coast ports. Much tanker traffic now operates in confined bodies of water at greater hazards. " Finally, a Lincroft, N. J., man said, "The Northeastern United States needs to be less dependent on the other areas of the country for supplies of gas and oil. " He asked, "Would a deepwater port give it an advantage over other areas?"

Process of Implementing the Technologies

Some respondents indicated that the risks associated with this system should be eliminated or minimized before the technology is deployed.

A Wilmington, Del., man put it this way: "The supertanker ports would be unacceptable to me unless new regulations were enforced in order to reduce the chance of major oil spills. At present, oil company policies are lax and attempts at self-regulation have seemed to fail. " A Whitestone, Va., resident pointed out that "we will lose small amounts of surf clams" from offshore development but proper precautions "will keep this to a minimum. Pipelines buried from deepwater terminals and from wells can circumnavigate most shellfish areas. "

The themes of State and local role, orderly development, the assignment of responsibility y for oil spills, and providing adequate compensation to persons and businesses damaged by oil spills, were concerns also expressed by respondents with regard to deepwater port development.

Preferences and Alternatives

Some respondents expressed preferences among the three technologies as follows: A Ridgewood, N. J., man said "We should proceed with offshore drilling and nuclear floating powerplants. Supertankers do not solve the problem of foreign oil dependence. " A Wilmington, Del., respondent made a different choice. "I favor offshore drilling ...1 oppose floating nuclear plants-risks of land-based plants seem less. I favor deepwater unloading ports. This may reduce pollution from spills. "

A Washington, D. C., woman wrote, "Since I question the efficiency of Project Independence I believe the importation of oil to be the most efficient policy, since the proposed projects would increase capital costs, raising prices to those of imported oil anyway. In the interim period, we should explore the large-scale development of large-scale solar energy more fruitfully."

Others saw alternative energy systems as preferable to deepwater ports. A resident of East Hanover, N. J., stated, "I am positively opposed to DWP's [deepwater ports] as an interim solution. Only a total effort to cut dependence on petroleum makes any sense. That means power rationing, efficient mass transit, and properly engineered atomic-energy plants." A Silver Spring, Md., man saw it this way: "Deepwater ports imply a continued reliance on imported oil—this is self-defeating. . . . Atomic power alone goes in the right direction, away from reliance on fossil fuels, until alternative sources (solar, thermal, etc.) can be developed." A Cinnaminson, N. J., respondent concluded, "Reliance on oil should be reduced. Increase use of coal and ration gasoline. Reduce imports. "

FLOATING NUCLEAR POWERPLANTS

Anticipated Effects

The major advantages of floating nuclear powerplants perceived by public participants were that such plants would increase the supply of needed energy, advance energy self-sufficiency, and provide electrical power at lower costs than would otherwise be the case. Increased employment and stimulus to the economy were also seen as benefits. Some respondents indicated that these plants would have less harmful environmental impact than oil-related energy systems, that they were clean and safe, that floating plants had environmental and safety advantages over those built on land, that such plants contribute to a good energy policy by helping to end dependence on oil and gas and by conserving fossil fuels.

The major concern of respondents who cited negative effects focused on the specific hazards and problems that they associated with such plants. Many of the participants pointed to the risk of nuclear accidents and of radioactive contamination with its attendant dangers to the natural environment and to human health, and to the unsolved problem of disposing of radioactive nuclear wastes. Some respondents said the plants were too experimental and there were too many unknown safety factors. Most of the other negative effects involved adverse impacts on the marine and onshore environment and, in particular, the potential thermal pollution from such plants. Others saw economic disadvantages, including the high expense of such plants and the potential losses to the tourist and fishing industries. Some said investment in these plants would take funding away from safer alternatives. A small portion cited risks of sabotage and theft. (See figure V–4.)

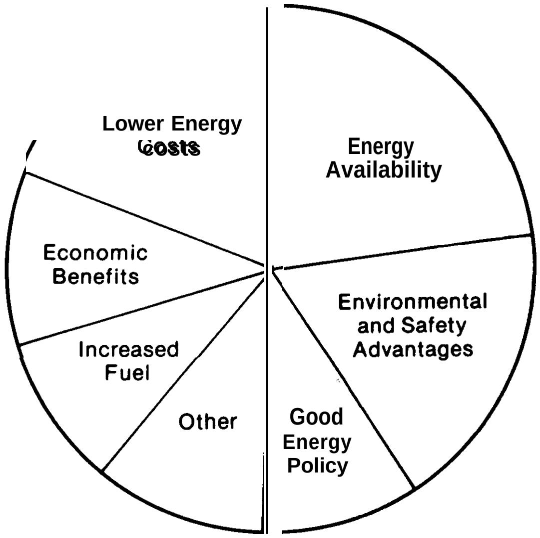
Some of the positive factors were mentioned by a Bloom field, N. J., resident who said, "Nuclear power is our most efficient and pollution-free source and should be utilized, " and a respondent from Cranford, N. J., who wrote, "Floating nuclear powerplants appear on the surface to be the safest short-term technology for development of New Jersey and Delaware. I feel there is better technology and fewer hazards with this development. ' A Woodbridge, N. J., man said, "The nuclear energy proposal would result in the 'cleanest' way of helping to develop our resources. " Support for nuclear, but not for the floating plants, came from a Cherry Hill, N.J., man who said, "Nuclear powerplants are needed, but building them at sea creates additional design problems and risk which I do not think are offset by the advantages. Additional nuclear plants should be built on land. "

On the negative side, a Wilmington, Del., respondent summed up many of the concerns about the risks of such plants by saying, "1 am opposed to the establishment of floating nuclear powerplants because of the greater safety hazards involved and the tremendous potential impact of a nuclear accident. In addition, I would not like to have the first such plant located near Delaware. "

A Linden, N. J., man cited "heat and radioactive waste problems. " An East Brunswick, N. J., man mentioned the "effect of water-temperature rise on marine life and migration behavior. " A Marlton, N. J., respondent said that nuclear power stations "will most likely negatively affect the ecological balance of marine life and lead to the inevitable destruction of same. " A Ridgewood, N, J., man said that, "Powerplants create an unnatural Gulf Stream water temperature to which marine life becomes accustomed. If shut

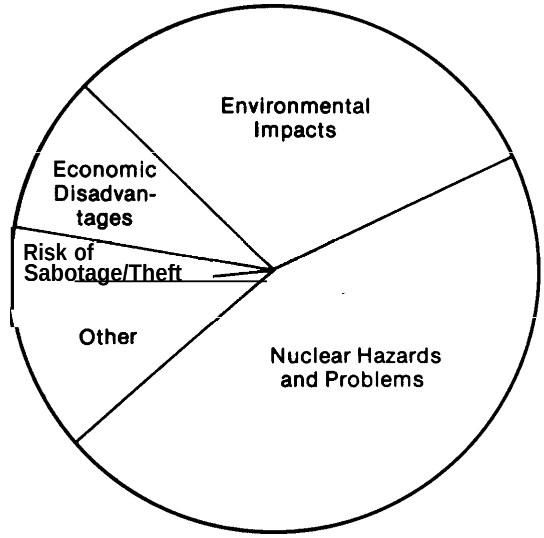
Figure V-4. Results of public participation questionnaire: floating nuclear powerplants

ANTICIPATED POSITIVE EFFECTS



(977 positive effects =53% of FNP Effects Listed)		
ENERGY AVAILABILITY		24%.
Increase energy supplies	81%	
Advance energy self-sufficiency	19%	
ENVIRONMENTAL AND SAFETY ADVANTAGES		20%
Advantages over land-based plants (isolation from people, reduced thermal pollution, less risky,better land utilization, unlimited supply of cooling water)	5070	
Clean and Safe (clean electricity, minimize air and water pollution, safe, good for fish)	28%	
Less environmental impact than oil	22%	
LOWER ENERGY COSTS		19%
ECONOMIC BENEFITS		11%
Stimulate economy	4170	
Industrial development	37%	
Other: higher standard of living, tax benefits. increased land values	22%	
GOOD ENERGY POLICY		9%
Stop dependence on oil and gas (save these for petro-chemical industry, other)	7570	
Conservation of fossil fuels	25%.	
INCREASED EMPLOYMENT		8%
OTHER		9%
Total Positive Effects:		100%

ANTICIPATED NEGATIVE EFFECTS



(872 negative effects = 47%. of FNP Effects Listed)		
NUCLEAR HAZARDS AND PROBLEMS		47%
Accidents	26%.	
Safety risks (unsafe, too experi-mental, unknown safety factors)	22%	
Radiation contaminant ion (includ-ing leakage, fallout, health hazards)	33%	
Nuclear waste disposal	190/0	
ENVIRONMENTAL IMPACTS		32%
Thermal pollution	29%.	
Harm environment, ecology	21 %	
Harm marine life, ecosystem	18%	
Pollution (including air and water)	17%	
Onshore impacts: industrial development, increased popula-tion, service facilities, congestion	1 20/0	
Aesthetics	3%	
ECONOMIC DISADVANTAGES		90/0
Expensive to build, drain on capital funds	46%.	
Losses to tourist/fishing industry	24%	
Cheaper to build on land	15%	
Take funding away from safer alternatives	100/0	
Lower property values; higher taxes	50/.	
RISK OF SABOTAGE/THEFT		3%
OTHER		9%
Total Negative Effects:		1000/~

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down, the water temperature drops back to normal and many thousands of species are killed. Environmentally, a powerplant causes more harm than good. " A Bethany Beach, Del., resident stressed the uncertainties by saying "Nuclear power has yet to prove itself. "

A Ridgewood, N. J., woman foresaw "total destruction if terrorists were to sabotage an energy system", and a Sewell, N. J., resident said the offshore plants "become extremely vulnerable to an enemy. "

And, finally, a local official in Brigantine, N. J., stated: "Consider the vast tourist development along the Jersey shore which will be hurt by even the threat of offshore oil or offshore nuclear development. Consider the problems of evacuating huge crowds in the event of a catastrophe. "

Process of Implementing and Managing the Technologies

If offshore nuclear plants were to be deployed, some respondents want certain safeguards included. These people, like a Hockessin, Del., resident, believe that "with careful design and operation, environmental and safety problems can be circumvented. " A Sparta, N. J., man said, "Floating nuclear powerplants pose slight risks from storm damage and problems with underwater transmission of electricity. Conservative design would minimize these problems. " And a Washington, D. C., resident said it is "essential to build into the systems measures to prevent introduction of . . . nuclear waste into the ocean, "

One respondent, a visitor from Arizona, had a specific technical suggestion, "Floating nuclear powerplants could be serviced by mobile shipboard fuel recycling factories. This would eliminate the risk of high jacked or lost nuclear fuel en route from a generator to a land recycling factory. In effect, the factory would go to the fuel. "

The siting of offshore plants requires rethinking, according to participants like a Ridgewood, N. J., resident who asked, "Why does it have to be Delaware and New Jersey? Why not some remote area where human life and marine life will not be affected?" and the Brick Township, N. J., person who suggested, "Select new site for offshore nuclear plant away from estuary. " A Pennsauken, N. J., man pointed out, "The development is situated directly in 'hurricane alley' (and) will be subject to hurricane damage. "

There were also respondents who saw the present risks and uncertainties about nuclear plants so great as to make deployment undesirable until those problems have been solved. A South Orange, N. J., man wrote, "Nuclear powerplants are entirely out of the question until feasible safety measures are developed," and a North Beach Haven, N. J., woman stated, "Until safe disposal of radioactive wastes is guaranteed, no more nuclear plants should be put in anywhere. " A Phillipsburg, N. J., resident echoed this view: "We still don't know what to do about nuclear wastes. I would . . . oppose any nuclear plant until radioactive-waste disposal has been perfected." A similar view was expressed by respondents such as the resident of Freehold, N. J., who said of all three technologies, "environmental effects should be minimized now to prevent opposition later. " Finally, an Elmer, N. J., resident said that "Dangers of nuclear power have been overrated and exaggerated, " but also expressed the view that we "need more research on utilization and disposal of nuclear-power wastes."

Preferences and Alternatives

Some respondents preferred nuclear plants offshore to oil-related developments. A Wilmington, Del., man stated, "Let's push nuclear so we don't have to import oil. " A Florham Park, N. J., respondent said, "First priority should be nuclear—step up oil and gasoline conservation. " An Essex Falls, N. J., resident said, "Nuclear energy should get priority over all." On the other hand, an East Brunswick, N. J., respondent said, "I prefer the nuclear option, but cautious oil exploration and development should be acceptable." A Woodbridge, N. J., resident saw advantages of the offshore plants in these terms: "The Jersey coast offers recreation to millions and the aesthetics of the shore line can best be preserved by the floating plant, not oil rigs and platforms. I have seen too many 'tar balls' on the sands of our coastline to allow encouragement of any offshore oil develop-merit."

A respondent from Princeton, N. J., said, "Offshore drilling and deepwater ports are well developed and should cause no problems. I doubt that our technology is a match for the sea in the construction of nuclear powerplants; thus, chances of nuclear accidents are greater than in land-based plant."

A Fords, N. J., resident saw it this way: "In the present overall economic and energy situation, offshore oil development should be recommended. Floating nuclear powerplants are undesirable due to various important reasons." Some such reasons were expressed in the form of questions by the Wilmington, Del., resident who said, "I fully support those developments based on oil and gas energy. I'm concerned about nuclear power development because of its potential hazards. What is the plan for disposal of radioactive wastes? Sabotage at sea more likely?" To answer these and other questions, a Linden, N. J., resident said that while "offshore drilling and loading ports are a must and much needed . . . nuclear powerplants still require more research into their safety and hazards of handling wastes."

Aside from the alternative of siting the plants on land, which was preferred by some respondents, there were many participants who wanted non-nuclear alternatives pursued.

A New Brunswick, N. J., man said, "Energy conservation methods should be more greatly stressed. Further pushing for nuclear power without adequate safeguards is simply continuing madness." A Princeton, N. J., resident wrote, "Should have a crash program in renewable energy sources, solar, wind. Firmly against nuclear power." A Wilmington, Del., man said, "Coal should be the number one source of energy for the immediate future," and an Ocean View, Del., resident said, "Accelerate methods to use coal in a non-polluting manner. Consider use of solar energy." A Florham Park, N. J., man said, "Energy conservation should be the keystone of fulfilling energy needs (and) would go hand-in-hand with environmental needs. I believe there should be priority over nuclear fuels in developing needed new energy sources."

A Millingtown, N.J., respondent said, "I believe that more attention (and funds) should be allocated to energy conservation such as solar heat, restrictions on cars, public transportation. Any studies on fossil or nuclear energy must include the full impact on ecology and public welfare. If this is done, the alternates become more attractive." And a Roselle Park, N.J., man said, "Energy should be conserved before offshore powerplants are built. Incentives should be formulated to conserve energy and reduce automobile traffic." A Roebling, N. J., respondent wrote, "More research money can be spent on fusion, solar power, wind power as alternates to nuclear power." A Wilmington, Del., resident asked: "Have you considered using the strong tides and currents in the Delaware River to generate energy?" A Townsend, Del., man also suggested "using tides to produce energy." A Newark, Del., man suggested, in addition to tidal sources to generate and store electrical energy, that "thermal gradient between surface water and ocean trough could be harnessed to generate power."

A Margate, N. J., resident who expressed opposition to nuclear powerplants said, "I prefer safe alternatives. Prof. [William] Heronemous has suggested a string of windmills either offshore or along the Garden State Parkway. Also, tidal power is a possibility worth developing. And solar power is the cleanest, safest method of power production. Government should finance it heavily. " A Watchung, N.J., resident added, as an alternative, "development to burn garbage for energy. "

A Westfield, N. J., resident saw this set of alternatives as desirable: "Limit nuclear-plant construction to demonstration plants for each promising reactor system. In view of the accidents that have already occurred, I want at least another decade of intense R&D and testing before widespread use. Fusion may then be more practical too." The same respondent had these recommendations: "Conserve petroleum for ultimate use in chemical synthesis. Build coal conversion plants for liquid and gases and fuels. Expand solar energy demonstration program—aim for solar and space heating in all new buildings. Use wind, geothermal, to the maximum extent feasible. "

How Public Participation Affected the OTA Assessment

OTA responded to many of the specific concerns identified during the public participation program by redirecting ongoing work, initiating additional studies, or broadening studies already underway.

The following are key examples of how this system worked:

1. Public Expressions—The potential adverse impacts of offshore oil development have social as well as economic dimensions. That is, increased industrialization of the coastal zone with consequent increases in population, transportation congestion, air pollution and noise would make the area less desirable for residents and tourists.

OTA Response to Expressions—OTA examined the types of facilities that would be required onshore for a range of estimates of recoverable oil and gas, but found that existing data did not permit a precise prediction of secondary land use and other impacts.

OTA Conslusion—Adequate information about offshore oil and gas development is not available and more involvement in the decisionmaking process by the State and local communities would enable them to better plan for impacts.[1]

2. Public Expressions—Onshore facilities and other aspects of offshore drilling may be a financial burden on State and local communities.

OTA Response to Expressions—OTA expanded its examination of fiscal impacts of offshore development.

OTA Conclusion—The capital-intensive nature of most facilities might produce substantial sales and property tax statewide after the first 2 or 3 years of development if OCS oil and gas were landed in the same State in which the main support bases were located. However, there are many factors that could make it possible that individual States or localities within a State would experience adverse budgetary impacts during some period of development.[2]

3. Public Expressions—Some thought the nuclear powerplant would make more energy available and that therefore costs of electricity would go down. Others thought the high capital costs of the floating nuclear powerplant could have the effect of raising energy prices.

OTA Response to Expressions—OTA investigated nuclear powerplant costs and explored the uncertainties involved in predicting the final cost of a floating nuclear plant.

OTA Conclusion—While the cost advantage of the Atlantic Generating Station over a land-based facility of comparable generating capacity is small, in the long run the floating nuclear power plant concept may provide a method of controlling the escalating costs of nuclear powerplants.[3]

4. Public Expressions—Pipelines and pipeline leaks may harm the wetlands.

OTA Response to Expressions—OTA intensified its examination of the effects of pipeline and pipeline leaks on estuaries and wet lands.

OTA Conclusion—The placement of pipelines i n coastal areas requires careful planning and the lines should be routed to avoid marshlands. The danger of an oil spill striking a beach would increase if it occurred as a result of a pipeline rupture near shore. Special consideration of pipeline design and installation is needed. q

5. Public Expressions—Air and water quality may be lowered as a result of OCS and deepwater port development.

OTA Response to Expression—OTA expanded its study of air and water quality status and standards in the two States and the relative impacts to be expected due to refinery construction.

OTA Conclusion—Air quality in many potential locations already violates standards and additional discharges would not be permitted under present guidelines.[5]

6. Public Expressions—Offshore energy development would provide needed jobs and secondary employment from increased energy would reduce unemployment, but many of the employment opportunities may not accrue to the New Jersey-Delaware region, and potential losses to fishermen and tourism could offset employment and income gains.

OTA .Response to Expressions—OTA followed up on this subject by talking to industry representatives about their practices and by refining estimates of peak employment, proportion of jobs likely to accrue to the region, and other aspects of the issue.

OTA Conclusion—Direct employment advantages would peak at about 4,500 jobs for a medium-sized oil discovery. On the other hand, it is not possible to predict accurately either what secondary employment might develop or what employment losses might take place.[6]

7. Public Expressions—There is a possibility the NRC is not seriously investigating the risks of a major nuclear- accident and its consequences.

OTA Response to Expressions—OTA reviewed the work of the NRC on the subject of accidents and initiated some special studies.

OTA Conclusion—The Nuclear Regulatory Commission is not evaluating the risks from accidents in floating nuclear plants comprehensively enough to permit either a generic comparison of the relative risks from land based and floating nuclear plants, or a-n assessment of the specific risks from deploying floating plants off New Jersey.[7]

8. Public Expressions—The problem of disposing of nuclear wastes has not been solved.

OTA Response to Expressions-OTA examined the waste disposal plan for the floating nuclear plant.

OTA Conclusion—Fuel and waste handling systems and the decommissioning procedures for the floating plant have not yet been adequately analyzed and decommissioning problems have not received the necessary attention.[8]

9. Public Expressions—The major advantages of offshore energy development may be increased energy availability for the region and lower energy costs.

79-183 O - 76 - 19

OTA Response to Expressions—OTA expanded its study of the regional energy supply and demand situation.

OTA Conclusion—Most supply networks and prices are determined on a nationwide basis and little change in regional supply or prices can be expected. Lower transportation costs might give New Jersey and Delaware a price advantage compared with some other region of the country, but future prices would depend, in part, on oil and gas price-control policies and on world prices. Transportation of imported crude oil by supertanker to deepwater ports would similarly not create important price cuts. For the floating nuclear plant, it was found that cost and price changes could not be predicted. g

10. General Concerns—In response to more general concerns surfaced through the public participation program, OTA also convened a panel of industry and government experts in New Jersey to discuss the need for conservation and alternative energy sources and to determine what actions industry and government are taking to foster conservation and to investigate possible alternatives to the existing energy systems. [10]

Sources and Uses of Public Participation Data

The major sources of public participation data were the OTA-sponsored workshops, questionnaire responses, interviews and informal meetings, and review comments on draft materials. Several of these activities were conducted simultaneously and each yielded somewhat different types of information.

The assessment began in the fall of 1974, with a major data-gathering effort. This effort produced descriptions of the technological systems, deployment scenarios, legal-institutional systems and procedures, and the ecological setting.

Workshops

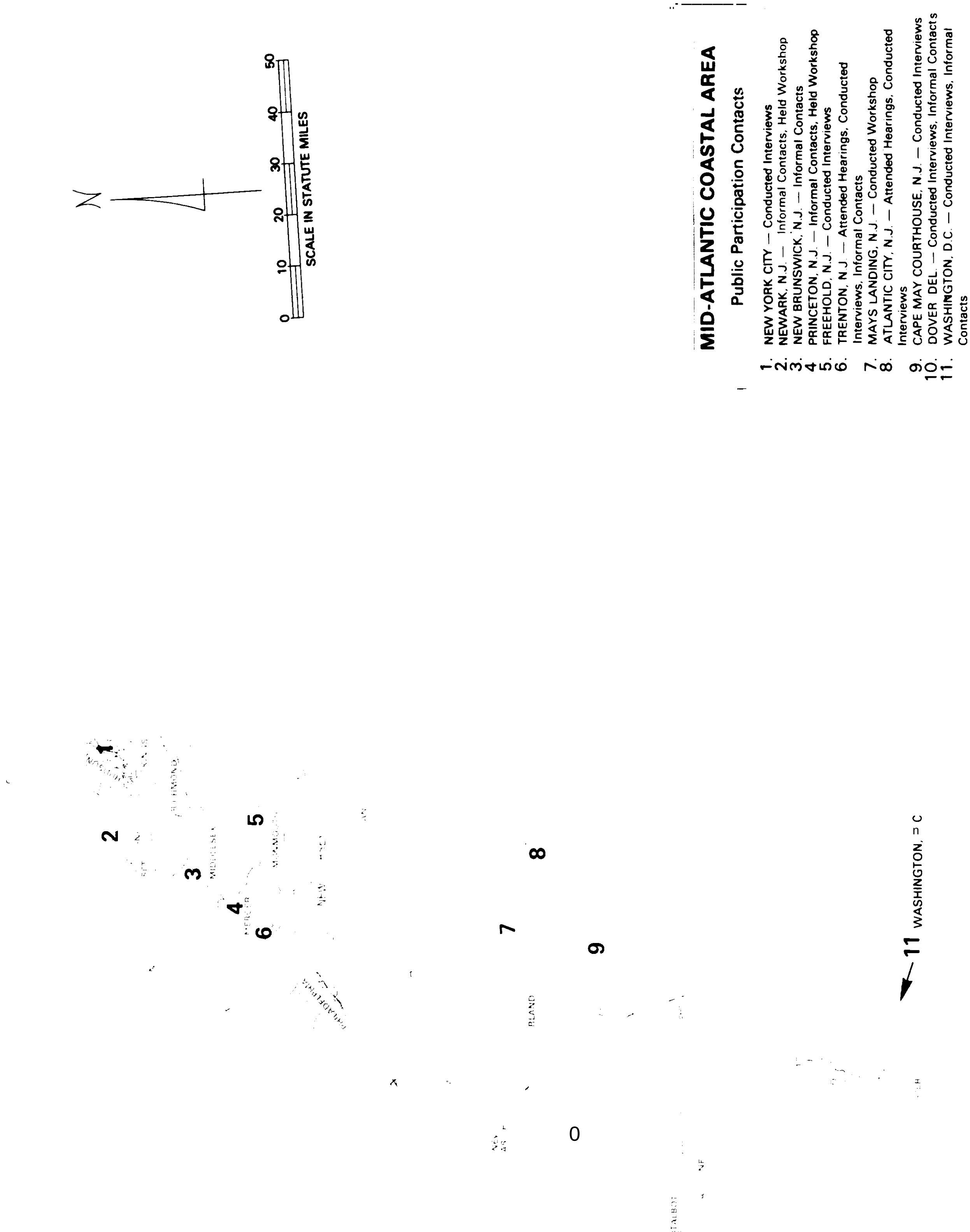
During this phase of the assessment, OTA held three public workshops (Washington, D. C., in May; Newark, N. J., in June; Atlantic County, N.J., in August, 1975). It also held numerous informal meetings in the study region to obtain preliminary information from representatives of affected and interested persons about potential positive and negative impacts of priority concern, policy issues related to the technologies, and alternatives to the technologies.

The Washington workshop was held for the specific purpose of obtaining data from national environmental, civic, and sport fishing associations, about potentially adverse and beneficial environmental effects of the proposed systems. The two New Jersey workshops were held to obtain data from a broad and balanced representation of affected and interested publics in the region (including industry, utilities, labor, State and local officials, academic, environmental, and consumer groups) on a wide range of impacts and issues of regional as well as national relevance.

These workshops, held early in the assessment, provided timely information on areas of inquiry and analysis considered most relevant by persons with knowledge, interest and active involvement in these subjects. (See figure v–5.)

In addition, workshop participants raised questions about the process by which the technologies are implemented and managed at the Federal, State and local level. These discussions helped OTA begin to identify factors which participants felt were not being ade-

Figure V-5. Sites of OTA contacts during public participation program



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quately addressed through the current process, and the difficulties encountered by citizens and local officials who wished to become involved in that process.

The workshops also provided information about participants' views of the scope, assumptions and methodology of this assessment. Some participants raised questions which they wanted the assessment to address; others suggested sources of additional information relevant to the assessment.

The workshop format, with its free-flowing and informal exchange among participants with diverse viewpoints and perceptions, provided OTA with a perspective not attainable through questionnaires or interviews. The give-and-take discussion enabled participants as well as study-team members to address and follow up on comments made by other participants. This helped OTA understand the extent to which viewpoints were shared, the level of differences in views, and the relative importance assigned to various factors by different participants representing different elements of the affected public.

Questionnaires

A questionnaire appended to an information brochure describing the assessment was distributed from August through December, 1975. (See figure V– 1.) During this time, the study team was starting the detailed analysis of potential impacts and the preliminary identification of policy issues. The questionnaire responses were examined periodically with a view toward providing the assessment team with more detailed data on impacts and issues of importance as seen by respondents. These data were useful in confirming, sharpening or supplementing information already obtained from workshops and from the study team's analysis.

One of the questions was:

> If offshore energy systems were developed off the coasts of New Jersey and Delaware, what effcts would you foresee for yourself, your community, and the Nation ? 'Do you think these effects would be generally positive or generally negative?

The responses to this question yielded the most systematic information on anticipated effects. The effects listed by respondents were tabulated in order to provide some indication of the frequency with which certain categories of effects were mentioned and to indicate which categories were viewed as positive or negative.

This analysis helped OTA staff to identify priorities among the anticipated positive and negative effects attributed by respondents to the three technologies.

The number of respondents who labeled the effects which they listed as all positive, all negative, or some of each, was also tabulated. This analysis provided OTA with a comparison among the technologies of the proportion of respondents who saw impacts as positive, negative, or mixed.

Finally, a tabulation was made of the number of respondents who anticipated predominantly positive or predominantly negative effects for each of the technologies. This information was used to identify the differences in perceptions by residents of various parts of the study region.

The quantification of responses in this report must be read with the knowledge that not all respondents answered all questions or listed the same number of impacts for each technology, and that some responses were not tabulated because they were illegible, could not be categorized, or did not indicate whether effects listed were positive or negative.

Another item on the questionnaire said:

> If you have other comments on any of the subjects related to offshore energy development in the New Jersey-Delaware area, or alternatives to such developedopment, please note these below,

While OTA did not ask for an indication of support or opposition to the technologies, many persons responded to this item of the questionnaire with an indication of support or opposition to the technologies. Many respondents expressed their opinion as to whether one, some, or none of these systems should be implemented. Some qualified their support or opposition by saying that certain things should be done before the energy systems are implemented. Some expressed a preference for alternative energy systems or policies. Others gave their views on the process by which decisions to implement the systems are made, and the manner in which the technologies are managed. The role of various levels of government and of the public was addressed by some respondents.

Some of these statements illustrated and elaborated upon the "anticipated effects" replies. Other explained the reasons for respondents preferences among the technologies or preferences for alternatives to the technologies. Many of the statements paralleled the types of information obtained from the workshops; some touched on different points.

The questionnaire did not ask respondents to indicate organizational affiliation. It did permit respondents to indicate whether they belonged to any organization that would have an interest in this assessment. Very few respondents answered this question. No attempt has been made, or could be made, to correlate replies with affiliations.

Brochures and questionnaires were mailed initially to nearly 2,000 persons and organizations on the preliminary mailing list compiled by OTA. Additional brochures were sent upon request for distribution by congressional offices, libraries, and various government or private organizations for a total distribution of more than 15,000. The office of Senator Clifford P. Case of New Jersey, distributed 6,100 copies, and another 100 copies were distributed by the office of Congresswoman Millicent Fenwick of New Jersey. Four hundred copies were distributed to New Jersey libraries through the New Jersey Library Association. In addition, the following organizations were among those who requested and presumably distributed more than 100 copies of the brochure and questionnaire:

	Copies
American Institute of Chemical Engineers	3,600
Delaware League of Women Voters	500
Chamber of Commerce, Wilmington, Del.	400
Exxon—Bayway Refinery, Linden, N.J.	300
Watch Our Waterways, Dover, Del.	400
Save Our Seashores, Chamber of Commerce, Dover, Del.	200
Control Data Corp., Md	50

Many people who learned about the questionnaire from press reports, from newsletters of various organizations, or from persons who had received one in the initial distribution, requested copies.

The brochure and questionnaire enabled the OTA team to reach and ot obtain information from a larger number of people than was possible with other methods.

Followup

The findings of the workshops and the questionnaires were supplemented with interviews and, in many cases, with further detailed analysis by OTA staff, or by additional studies on specific subjects and issues raised during the public participation activities.

Many of the issues relating to impacts or process were pursued in interviews and meetings with industry and utility representatives, citizen group leaders, and with Federal, State and local government officials. interviews were conducted throughout the assessment but most intensive use of this method took place just prior to identification and analysis by OTA staff of the issues and options to be emphasized in the assessment report (January through July, 1976). During this period, OTA staff also attended several public hearings and other official proceedings of Federal decision-making agencies and advisory bodies in order to obtain first-hand information on which to base an evaluation of the process.

Finally, in order to examine energy projections, energy alternatives and energy policies more fully, OTA convened a day-long session with government, industry, utility, and academic specialists.

Review of Draft Documents

When background documents on technology, institutional and ecological descriptions were completed, OTA made a copy available for study by the public in the OTA library, and also sent copies for review as to accuracy and completeness to persons knowledgeable in the subject areas who had participated in the assessment. This review took place during the period of February through April, 1976.

As OTA staff completed drafts of interim reports on each part of the assessment, these were sent out to the advisory panel for substantive review and, after release by the OTA Board, to key participants in the assessment. Summaries of the draft interim report were distributed for review to those who had attended workshops, replied to questionnaires, or requested copies. This review, for the oil and gas section, occurred in April, May, and June, 1976. The review comments helped OTA reevaluate, sharpen or expand upon the statements of findings, issues, and options. In some cases, additional options were suggested, or the potential consequences of options displayed in the draft reports were discussed by reviewers. These comments were considered in preparing the final report.

Summary

The public participation activities, which included workshops, questionnaires, interviews, and review comment, were important factors in this technology assessment. Information obtained from these activities was analyzed and evaluated throughout the assessment. These data provided valuable guidance as to appropriate modification, emphasis or elaboration of the analysis by the OTA study team. The public participation findings were one of the important elements used by the OTA team for determining which issues would be emphasized in the assessment.

The results of this public-participation effort confirmed that such a program can add a useful and essential dimension to the assessment of technology for the U.S. Congress. It also confirmed that reliable information on how citizens perceive they will be affected by new technologies can best be obtained by direct contact with those citizens.

Finally, the public participation effort provialed some experience on the basis of which public participation activities could be extended to other OTA assessments.

Footnotes: Chapter V

1. Chapter IV, Development of Offshore Oil and Gas in the Mid-Atlantic.
2. Working Paper #6.
3. Working Paper #10.
4. Working Papers #2 and #3.
5. Working Papers #4.
6. Op. Cit., Chapter IV.
7. Working Paper #8.
8. Working Papers #9.
9. Working Paper #5.
10. Chapter IV, Alternatives to the Three Technologies Studied.


LORRAINE C

Chapter VI

GLOSSARY

Accident risk—The possibility of loss or injury to people or property. The risk of a particular consequence during a period of time is measured by the estimated frequency of the event over that period of time and the magnitude of the consequences of that event.

ACRS—The Advisory Committee on Reactor Safeguards.

Availability y—The percent of time that a plant or an electric power system is actually capable of pet-forming its mission. Periods during which a plant is not available include both forced outages (due to equipment malfunction, etc.) and planned shutdowns (notably for refueling and planned maintenance).

Ballasting—The taking on by tankers of water to replace off-loaded oil and thereby improve stability.

Barrel—A unit of volume for petroleum products. One barrel is the equivalent of 42 U.S. gallons, or 35 imperial gallons, or 159 liters. One cubic meter equals 6.2897 barrels.

Blowout preventer—Equipment installed at the wellhead for the purpose of controlling pressures in the space between the casing and drill pipe or in an open hole during drilling and completion operations. The blowout preventer is the first line of defense against blowouts.

Capacity factor—The ratio of the average load on a plant for the period of time considered, to the load capacity for which the plant is rated by the manufacturer. For an electric generating unit, the capacity factor in a given 1 -year period may be calculated by dividing the total kilowatt-hours of electric output for the year by the number of hours in the year, and then dividing the average kilowatts thus calculated by the generating unit's electric-kilowatt-capacity rating.

Christmas tree—The collection of valves, pipes, and fittings, usually high pressure, used to control the flow of oil and gas from the well casing.

Class 9 accident —For analytical purposes, the Nuclear Regulatory Commission divides the spectrum of postulated nuclear powerplant accidents into nine categories. These categories are ordered according to the severity of consequence ranging from minor accidents (Class 1) to the potentially catastrophic but highly improbable core-melt accident (Class 9).

Containment—A gas-tight shell or other enclosure around a nuclear reactor to contain radioactive vapors that would otherwise be released to the atmosphere in the event of a major reactor accident.

Cooling system—A method of dissipating waste heat from nuclear (or other heat-engine-based) electric generating units.

Cooling tower—A structure through which water is circulated in order to reduce its temperature. In a dry cooling tower, the water is recycled after passing through tubes over which cooling air flows, in a manner similar to that of an automobile radiator. In a wet cooling tower, water cascades through the tower, in which air is passed either by mechanical or natural draft to cause partial evaporation of the water. A wet-dry *cooling tower* contains both dry-cooling and evaporative systems; these can be used alternatively or in combination.

Core-melt accident—Any accident in a nuclear reactor that leads to melting of the fuel elements in the core. This type of accident has the most serious potential consequences of any accident that can occur in a nuclear reactor.

Dead weight—The difference, expressed in tons, between a ship's displacement at load draft and at light draft. It is comprised of cargo, bunkers, stores, fresh water, etc.

Decommissioning—The activities of shutting down operations of a nuclear plant at the end of its operational life and either dismantling the plant or maintaining it in a safe condition.

Design-basis accident—NRC policy requires that nuclear power reactors be designed to include engineered safety features and protection systems to prevent or mitigate the effects of design-basis accidents, which include accidents in the first eight accident categories (see "Class 9 accident"). Class 9 accidents, involving melting of the coi-e, are not included among design-basis accidents on the grounds that their probability of occurrence is so low that they can be safely ignored.

Development and production—Basically, development of an oil and gas field begins after discovery of accumulations in commercial quantities. It includes definition of the extent of potential reserves, production rate estimates, and construction and installation of facilities for production of the field, including the means to deliver the product to a loading point. Production of the oil or gas begins only after a reasonable estimate has been made of the approximate amount and potential flow rates of the oil or gas found and completion of the installation of necessary facilities and the drilling of producing wells. (Oil and gas can occur together in a field or separately. There is usually some gas associated with all oil fields, but there can be significant occurrences of gas with little or no oil.)

Development well—A well drilled in a proven field for the purpose of completing the desired pattern of production. Sometimes called an exploitation well.

Downhole safety equipment—Valve or other devices installed below the Christmas tree in production wells to prevent blowouts. The blowout preventor is the first line of defense against blowouts. The downhole safety equipment is a second defense system.

Drill pipe—In rotary drilling, the heavy seamless tubing used to rotate the bit and circulate the drilling fluid. Individual pipe lengths are normally 30 feet and are coupled together with tool joints.

Drill string—A "string" or column of drill pipe.

Economic impact—The effects upon the production and consumption aspects of society which introduction of an installation or other innovation into the area is expected to produce. These would include effects on the labor force, industry, financial structure, infrastructure, tax rates, etc.

Environmental impact—The effects upon the physical and biological characteristics of an area which introduction of an installation or other innovation into the area is expected to produce. As used in this report, environmental impact does not include the effects upon human characteristics, except those which are an indirect result of the physical and biological effects.

Exploration—Simply defined, exploration involves two major steps: geophysical surveys and exploratory drilling. More broadly, exploration for oil and gas is the entire process of broad and specific surveys and collecyion of indicative data on an area followed by detailed Geophysical delineation of geologic features and by drilling of holes into potentially productive traps. Exploration is completed if oil or gas is found. Additional exploration work—the drilling of more holes—may be done after a disco\'ery to further delineate a field. Exploration in\'elves a high economic risk, since there is the high probability that no discoveries will be made, particularly in frontier areas. In the offshore oil industry, even after detailed surveys are conducted, only one drill hole in ten can be expected, on the average, to show a commercial discovery, and there are wide but unpredictable variations, in particular cases, from the average.

Exploratory drilling—Exploratory drilling is the second phase of an exploration progr m. In offshore areas it is accomplished by means of some type of mobile drilling rig, which can be moved from place to place to drill into traps located by geophysical methods. The primary purpose of exploratory drilling is to get a "yes" or "no" answer as to whether there is, in fact, oil or gas in a given trap. Coring and data logging techniques within the exploratory well may be necessary to make this determination and to provide certain additional geologic information. Data logging involves the lowering of a sensor (acoustic, gamma-ray, etc.) down a drill hole to obtain formation data.

Fission—The splitting of a heavy nucleas (such as uranium-235), accompanied by the release of energy and two or more neutrons. In a nuclear reactor, most of the energy released in fission manifests itself as heat, which is used to generate steam to drive turbines.

Frontier areas—Frontier areas of the Outer Continental Shelf are those which have not yet been explored and are generally considered suitable for leasing. A number of specific regions in the Atlantic, the Gulf of Mexico, the Pacific, and around Alaska are identified as frontier areas. The principal ones are:

- Georges Bank (North Atlantic)
- Baltimore Canyon Trough (Mid-Atlantic)
- South Atlantic
- Gulf of Mexico (beyond all present discoveries)
- Southern California Offshore
- Washington and Oregon Offshore
- Gulf of Alaska and Outer Cook Inlet
- Bering Sea, Bristol Bay, and Norton Sound (Alaska)
- Chukchi Sea (Alaska)
- Beaufort Sea (Alaska)

Fuel cycle—The sequence of steps through which the nuclear fuel used in nuclear reactors passes, including mining, milling, conversion, enrichment, processing, fabrication, utilization, reprocessing, radioactive waste management, and the storage of radioactive waste products.

Fuel element—A rod, tube, plate, or other mechanical shape or form into which the fissionable material used to produce energy in a reactor is fabricated. In prevalent power-reactor practice, a fuel element is a mechanical array or assembly of rods; the rods contain the fissionable material.

Fuel reprocessing-Chemical treatment of spent fuel to separate the uranium and plutonium from the fission products created as byproducts of the fission process.

Gathering lines—Flow lines which run from several offshore oil wells to a single storage system.

Geophysical surveys—Geophysical exploration is an indirect method of mapping subbottom geological forms and features to show submerged structures and interfaces. The principal method used is the seismic (or acoustic) survey, a technique of producing precise sounds (of discrete frequencies and intensities) which are variously reflected and refracted from underground layers and then measured at the surface. The measurement of natural gravity and magnetic fields also helps define the geology of an area. Having become a major component in oil exploration, the seismic survey is typically employed extensively in any offshore area prior to drilling. Seismic techniques have become much more sophisticated in recent years and are used both to identify good potential traps and to locate the most promising site for drilling an exploratory hole.

Ice condenser system—A pressure suppression system included in the floating nuclear powerplant, as well as some onshore plants, that uses millions of pounds of ice as a heat sink to condense steam and thereby reduce containment pressure in case of an accident in the reactor.

Isotopes—Variant forms of a given chemical element, differing from each other only in the number of neutrons in their nuclei.

Jack-up rig—A mobile drilling platform with extendible legs for support on the ocean floor.

Lay barge—A barge used to lay underwater pipelines.

Light-water reactor—(See *PWR)* The two basic types of LWR are the pressurized-water reactor (PWR) and boiling-water reactor (BWR). Most U.S. power reactors in existence or being built at this time are LWRS.

Lightening—A method of offloading tankers at sea or outside of ports, usually from large tankers to smaller ones which, in turn, continue into a discharge port. Lightering is a common practice at entrances to certain ports which cannot handle the deep drafts of large tankers.

LOCA—A Loss-of-Coolant Accident, involving a break in one of the lines carrying the water that transfers heat from the reactor core to the steam system. The LOCA is one of the two possible initiating events for a core-meltdown.

Megawatt (MW)—1000 kilowatts. The symbol "MWe" is sometimes used to denote electrical power or capacity, in order to distinguish it from the thermal power of the reactor (MWt), which is typically about three times as high.

Mud—A water or oil based slurry used to counteract pressure in oil or gas wells and remove cuttings during drilling operations. It is circulated by pumps.

MW, MWe—See *Megawatt.*

NRC—The Nuclear Regulatory Commission.

OCS (Outer Continental Shelf)—The submerged lands extending from the seaward limit of the territorial sea to some undefined outer limit. In the United States, this is the portion of the shelf under Federal jurisdiction.

Oil and gas reserves—Reserves of oil and gas in any field are those quantities which have been identified through drilling, sampling, and calculating specific quantities. "Proved" reserves are those quantities in a field which can be recovered with reasonable certainty under existing economic and operating conditions. Only a portion (usually from 20 percent to 40 percent) of the total reserves in place can be recovered.

PWR—Pressurized water reactor. A type of power reactor that employs ordinary water as coolant and moderator and is pressurized to keep the exit coolant stream from boiling.

Radionuclides—Radioactive nuclei of isotopes of various elements.

Rasmussen Report—See *WASH–* **1400.**

Reliability y—The probability that a power generating system will function without failure over a specified time period or amount of usage.

Segregated ballast—A term describing the provision of separate tanks for ballast water only, thus eliminating the need to carry ballast in cargo oil tanks. Tankers must carry about one-third or more of their total capacity in ballast when on an empty leg of a voyage to improve stability and control the draft of the ship. Usually sea water is used for ballast.

Seismic-line mile—Seismic surveys are normally conducted from a ship equipped with geophysical data-gathering instrumentation. The ship proceeds along predetermined lines following a grid on the surface above a given area. Many miles of closely spaced crossing lines are necessary to survey a major area. A seismic-line mile is a typical unit of measure of these survey lines.

Seismic survey—A geophysical exploration technique in which generated sound waves are reflected or refracted from underlying geologic strata and recorded for later analysis.

Subsea completion—A production well in which the Christmas tree assembly is located at or near the ocean bottom rather than on a platform. The produced liquids or gases are then transferred from the wellhead either to a nearby fixed platform or to a shore facility for processing. Some subsea competitions are presently in use in offshore U.S. water.

Subsea production system—A production system in which the wellhead assembly and all equipment for processing are located on the sea floor. There are presently no complete subsea production systems in use in U.S. offshore waters.

Supertanker —Tankers of great size and carrying capacity; generally considered to be any tanker of over 100,000 deadweight tons. Such tankers are typically more than 1,000 feet in length and 50 feet in draft. The largest supertanker afloat (480,000 dwt) is 1,250 feet long, 203 feet wide, and 90 feet in draft. Supertankers of 533,000 dwt are now under construction.

Surry Plant—The pressurized water reactor nuclear powerplant at Surry, Va., which was the basis for calculations made in the *WASH–* 1400 study. (See *WASH– 2400).*

Territorial sea—The sea area immediately adjacent to a coastal nation within which it claims comprehensive jurisdiction.

Tract—An at-sea area of up to 5,760 acres (3 miles square), defined in the OCS Lands Act of 1953 as the maximum unit offered in each lease sale issued pursuant to the Act.

Trap and field--oil and gas are found in commercial quantities because these hydrocarbons tend, by geologic processes, to concentrate in particular rock formations over long periods of time. Certain kinds of subterranean geologic features are known to have acted as “traps” for oil and/or gas, and such traps are commonly described by geologists as having the potential of containing hydrocarbons. The process of exploring for oil and gas is thus focused on finding traps where petroleum may have been collected. When a trap has been identified and subsequently, through exploratory drilling, found to contain commercially producible quantities of oil or gas, it is then designated a “field.” A field is thus a single trap or many traps in which commercial amounts of oil or gas have been discovered.

WASH 1400-The formal NRC designation of the *Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants,* published in final form in October, 1975. This study, which considered a range of possible accidents including core-melt accidents, was performed under the direction of Professor Norman Rasmussen of Massachusetts Institute of Technology, and is commonly known as the Rasmussen Report. Only land-based, light water reactor plants were considered.

Waste disposal—The placement of radioactive waste in a locale where it can remain indefinitely isolated, and from which retrievability may or may not be considered necessary.

Waste management—A program which involves all aspects of the transfer, and ultimate storage or disposal, of high-level radioactive nuclear materials which are no longer useful from the nuclear facilities in which they are produced,

Waste storage—The holding of radioactive waste in a locale from which it can be removed or retrieved at some future time.

Wellhead—The equipment used to maintain surface control of a well. It is formed of the casing head, tubing head, and Christmas tree. Also refer to various parameters as they exist at the wellhead: Wellhead pressure, wellhead price of oil, etc.

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