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**ONSHORE IMPACTS OF OFFSHORE HYDROCARBON DEVELOPMENT:  
ANNOTATED BIBLIOGRAPHY**

by

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**ABSTRACT**

Recognizing that a significant amount of the world's hydrocarbons are produced offshore, and that a majority of the impacts are felt in adjacent coastal areas, this bibliography is concerned with the opportunities and requirements for managing the coastal zone. The report attempts to compile a set of comments on literature (including other bibliographies) which relate to onshore impacts of offshore hydrocarbon development and which may be of use in Canada. The bibliography contains sections on facility types and requirements, socioeconomic impacts, environmental impacts, and the experiences in Britain, Norway and North America, highlighting the issues and recommendations discussed.

## RÉSUMÉ

Compte tenu du fait qu'une partie considérable des hydrocarbures est exploitée en mer et que la majorité des incidences se font sentir dans la frange côtière adjacente, les auteurs ont établi la présente bibliographie en fonction des possibilités et des besoins en matière de gestion de la zone côtière. Ils ont compilé une série d'observations sur des ouvrages (y compris d'autres bibliographies) qui ont trait aux incidences à terre de l'exploitation en mer des hydrocarbures et qui pourraient être utiles au Canada. La présente bibliographie comporte des chapitres sur les types d'installations et les besoins, les incidences socio-économiques, les incidences sur l'environnement et les expériences britannique, norvégienne et nord-américaine. Chaque notice présente les problèmes et les recommandations qui ressortent de l'ouvrage examiné.

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## I INTRODUCTION

In Canada, the major impacts of offshore hydrocarbon exploitation will not be felt for some time. This gives some leeway, though not very much, to allow pre-planning to take place such that impacts on the coastal zone can be minimized and development can proceed in controllable stages. It also allows the possibility of defining guidelines for coastal development which are adapted to local requirements but which would not impede the timely development of a critically important regional resource - offshore oil and gas. Unfortunately, one of the distinguishing features of offshore development is the high level of uncertainty which prevails; this makes any form of pre-planning extremely difficult to perform. Uncertainty is highest during the exploration phase because it is not even known when or where pay zones will be struck. The type of uncertainty changes once deposits have been found. The problem then becomes one of delineating the field in question, assessing potential flow rates and field size, and defining production methods and transportation modes. All of these phases obviously need support from shore bases, and all will have impacts in the shore zone. Until specific production decisions have been taken, little, if any, assessment can be made in a precise fashion as to the location and extent of impacts.

Hence, a very different and innovative kind of resource planning is required, one which assesses potential requirements and impacts, defines alternative strategies, and allows sufficient flexibility for adaptation to specific circumstances. This implies that those involved in managing coastal areas need to have a clear picture of the kinds of facilities they may have to accommodate, the site and infrastructure requirements of such facilities, the economic and social effects of local development, and the kinds of adaptations that can be made.

The development of North Sea resources, the lease-sale procedures in the U.S., and the consistency requirements in the U.S. Coastal Zone Management Act, have all acted in the recent past as an impetus for "studies" of the problem of onshore impacts and the preparation of "pre-planning" reports. In addition, there are many analyses of the overall experience in different countries. The institutional, administrative, social, economic, and political conditions in Canada are sufficiently unique that making comparisons with other jurisdictions is fraught with danger. Nevertheless, the first step in developing an innovative approach to resource planning can usefully be a review of the literature dealing with problems of interest.

This report is an attempt to bring together in one place a set of comments on articles/reports, etc., relating to the onshore impacts of offshore hydrocarbon development which may be of interest and use in the Canadian situation. Attention has been focused on those publications which raise substantive issues regarding onshore impacts and which make specific recommendations. Obviously, some analyses are not performed in an issue/recommendation format but are of interest because of their factual content or approach. Several sub-groups focusing on coastal zone management questions, facility types and impacts, and the experience of specific countries are presented in the following pages. Also referenced are other bibliographies dealing with onshore impacts. This report does not review all the literature available; however, the citations included can be considered representative of the majority of publications.



## II COASTAL ZONE MANAGEMENT

**THE AMERICAN INSTITUTE OF ARCHITECTS, Coastal Zone Management: Balancing Growth and Protection, AIA, Component Affairs and Practice and Design Departments, Washington, DC, (December, 1978).**

### ISSUES

1. For many years the U.S. government adopted a laissez-faire policy toward the management of the coast. This policy seemed appropriate during the time when there was less pressure for the development of the coast; however, now that the coast is used for diverse and competing purposes, coastal management cannot be left to chance.
2. The Coastal Zone Management Act (CZMA) of 1972, amended in 1976, combines two seemingly contradictory objectives: economic development and environmental protection.
3. In passing the Coastal Zone Management Act, Congress challenged the government, industry, and private citizens and organizations to help develop and implement policies and programs that would ensure a balanced and prudent use of the coast. Architects can play a significant role to help achieve the objectives.

### RECOMMENDATIONS

1. The Coastal Zone Management Act passed by Congress satisfies several objectives. The Act provides incentives in the form of federal loans and grants to state and local governments for coastal zone planning and management, sets up a framework of intergovernmental relations in which all levels of government and private citizens can decide together the future of the shore, and encourages and assists states to exercise effectively their responsibilities in the coastal zone.
2. To ensure effective management and planning of the coastal zone, the CZMA provides three important incentives: Management, Planning and Protection grants, Federal Consistency and Interagency coordination, and Coastal Energy Impact Program (CEIP). CEIP, for example, provides financial backing, in the form of direct loans or guarantees of loans and bonds, for local communities to provide services and facilities such as schools for the influx of new families associated with energy facilities before the anticipated increase in their tax base is able to support repayment of securities.
3. Because most important issues of coastal zone management involve development (or non-development) and because every construction project on the shore will involve an architect at some stage, architects can help reconcile the seemingly contradictory objectives of development and protection. Architects can also get involved in the coastal zone management process by serving on citizen advisory boards at state and local levels, by providing technical advice on such critical design matters as hazard protection and erosion control, by lobbying for better coastal zone management, and by presenting design proposals for coastal use.

**ARMSTRONG, J.M. and P.C. RYNER, Ocean Management: Seeking a New Perspective, U.S. Department of Commerce, Office of Ocean Resources and Scientific Policy Coordination, Washington, DC, 100 pp., (1980).**

### ISSUES

1. The evolution of Federal efforts in the United States to control ocean space and resources from the 1930s until present time is discussed. This analysis evolves by moving from an initial assertion of Federal authority over both territorial sea and some distance beyond, through legislative resolution of conflicts which resulted from this assertion, to the present consideration being given to new national and international jurisdiction regimes in the late 1970s.
2. Attention is directed to the Deep-Ports Act, the Marine Sanctuaries Provisions of the Marine Protection, Research, and Sanctuaries Act, the Coastal Zone Management Act, and the Fisheries Conservation and Management Act. Discussion thus focuses upon the type and degree of control being attempted, the role of the Federal and state governments, the relationship with other ocean programs, and various problems which these particular programs raise.
3. The efforts of the U.S. to exert control over the ocean have involved several basic national issues, namely the role of state and local government in Federal ocean management, national security aspects of ocean management, the national interest, and the role of private industry.

4. Federal ocean control efforts in terms of degree and type of control, problems of coordination, principles for management, the variety of possible actions and alternative management "regimes" are discussed in detail.

## RECOMMENDATIONS

1. In most instances there is no concise, central description of existing individual ocean-related programs which details the legislative and political process by which they are established. Based on this, there are measures which can be introduced to solve some of these problems. There could be (with respect to coastal zone management) thirty versions of how territorial sea decisions should be made, what criteria should be used in the siting of facilities, what activities should and should not be allowed access. Thus, there is a need to undertake a unified compilation of these programs so that there is a single source of information and a clear national understanding of what the nation's territorial sea management program is.
2. Authority over the water of the coastal zone is not clear. More precise distribution of both authority and responsibility is needed, not only for the 5 kilometre territorial sea but for the ocean beyond, especially in anticipation of possible extensions of the territorial sea from 5 to 19 kilometres.
3. The entire concept of a "coastal zone" should, at this point, be reexamined, particularly the idea of meeting the national interests that may exist within this zone through a voluntary program administered by individual states largely at their own discretion as to content and direction.

**ASHBAUGH, J. and J. SORESENSEN, "Identifying the Public for Participation in Coastal Zone Management", *Coastal Zone Management Journal*, 2 (4), pp. 383-409, (1976).**

## ISSUES

1. The Coastal Zone Management Act (CZMA) requires coastal states to apply for certification of their plans to design and implement a program of public participation. However, before any such program can begin, those groups and individuals which constitute the "Public" and with whom agencies will interact and collaborate in the program development must first be identified.
2. Several difficulties might be encountered in developing and maintaining an inventory of participating publics:
  - (a) Insufficient Program Development - In the formative stages of program development, an agency must define the coastal zone issues which will outline the objectives of management effort. This definition of coastal zone management issues will be incomplete without extensive public participation.
  - (b) Affinity for Support - A coastal agency could fail to identify objectives either through deference to or close contact with those publics which generally support its policies; or an agency could "stack" a review board by appointing individuals who favour its policies. Regulatory agencies could also be "captured" by a vocal and well financed public.
  - (c) Size and Diversity - The number of organizations and individuals interested in coastal management issues can be so large that time, budgetary constraints, and political process could prevent all of them from participating in the process.
  - (d) Dispersion - Jurisdictional boundaries of most coastal agencies seldom include all the publics which might be affected by a coastal management program. The dispersion or concentration of the public could limit their degree of involvement.
  - (e) Changeability - The evolution of membership, staff, and/or financial status of public interest groups could alter the scope or priorities of issues it deems to be important and thus change its interest in participating in a coastal zone management program. Public interest groups may also move, change names, merge with other organizations, split, or disappear altogether.
  - (f) Representation - An organization may not be a valid representative of those it claims to represent; the views given by one spokesperson may not be consistent with the adopted policy of the group he or she represents.

## RECOMMENDATIONS

1. Two basic approaches can be used to identify the groups and individuals which constitute the "Public" in coastal zone management: a systematic procedure approach and an integrated approach. A coastal agency using the systematic approach prepares and utilizes a directory of identified interests and uses

groups, while an agency using the integrated approach uses the aggregate response of a survey to determine the nature and interests of the participating publics and their organizational strengths.

2. Both approaches use some or all of the following methods:

- (a) Self-identification - Public interest groups or individuals recognize on their own proposed coastal zone management programs which are of interest to them and then get involved. Techniques for reaching self-identified publics include: mass marketing, newsletters, press releases, posting of hearing notices, and circulation of environmental impact reports.
- (b) Snowballing - This method builds on existing stocks of self-identified publics as well as other public agencies familiar with coastal zone related issues. In snowballing, the coastal zone agency asks representatives of self-identified interest groups, agencies or individuals for suggestions of names to add to the inventory of participating publics. Relying on this method alone runs the risk of excluding sensitive or controversial groups from the inventory.
- (c) Directory Research - This method involves reviewing specialized organizational directories prepared and published by national, state or regional environmental groups, research institutes, planning agencies, and trade associations.
- (d) Analysis - Under this method, coastal zone issues which are of concern to the agency form the basis for identifying the publics. Each issue suggests a certain type of public and thus a representative group which is then used in compiling a mailing or contact list.
- (e) Substitute Advocacy - This method recognizes the fact that a coastal agency may not always be able to create equal access to its decision-making process. Moreover, an interest group may frequently be financially weak, unstable, invisible, or inarticulate at meetings. Under such circumstances, an agency staff member may be designated to serve as an advocate for the interest of the missing or under-represented groups.

**BELKNAP, R.K., "Corporate Response to Coastal Zone Management: A Case Study of the Irvine Coastal Area", *Coastal Zone Management Journal*, 8 (2), pp. 123-164, (1980).**

#### ISSUES

1. Much of the literature on coastal zone management is on the nature of federal and state legislation, administrative organization and scientific information; very little has been written on corporate response to coastal zone management.
2. Coastal zone management processes do not adequately allow the private sector to participate. Consequently, private developers are portrayed as adversaries rather than as partners.
3. Inability to distinguish between a "plan" and a "process" can be a major stumbling block in successful completion of coastal zone management programs.
4. Delay in obtaining construction and operating permits may slow down the development of coastal energy facilities or even wear down the spirit of the plan.

#### RECOMMENDATIONS

1. While recognizing that blanket generalizations cannot be made about coastal facility projects, the author uses the plan of the Irvine Company of Newport Beach, California, (a plan to develop 4 047 ha of land which, after 7 years, still has not received final approval) as an example of a corporate response to coastal zone management and demonstrates the impact intergovernmental procedures have on integrated and site-specific land-use plans of corporations.
2. Corporations are composed of people who do respond with emotions and intellect to coastal zone management programs. Corporations therefore respond better when forums are provided where they can be candid and discuss the issues outside the charged atmosphere of public hearings.
3. The relationships between the private sector and the public sector are best served when dealings are clear and straightforward, without insinuations of private arrangements which cast doubt on the integrity and reputation of corporations.
4. A "plan" approach to coastal zone management is defined as "a geographic map as the end product of the planning effort", while a "process" approach involves "no picture or plan at all but a series of policies or rules which the administrator must follow in making his decisions".
5. Changes in the personnel within a corporation can significantly alter the direction of the project and the relationship between the corporation and government agencies. Besides, many voices speak within a

corporation, and a corporation's position is often the result of intensive debate. Thus, changes in personnel and delay in obtaining permits can lead to a change in the perception of the political process and to a reevaluation of issues, responses, and strategies.

**BIENEK, G.K. and G.L. HUFFORD, "Arctic Food Dependency Matrix: An OCS Management Tool", Marine Technology Society Journal, 14 (1), pp. 25-27, (1980).**

#### ISSUES

1. The extent of the Arctic region and the limited knowledge about the Arctic ecosystem processes make it difficult to determine, with any certainty, the environmental impact of an accidental oil spill.
2. Declining food production, reduced abundance, and the tainting of higher trophic species are possible consequences of petroleum pollution of the Arctic coastal zone. These consequences will have significant impacts on the food resources of the native people.

#### RECOMMENDATIONS

1. A food dependency matrix provides a better understanding about the inter-relationships of Arctic species and the potential effects of oil pollution through prey reduction and/or destruction.
2. A food dependency matrix developed by the authors identified 172 different species, classified into 41 groups of predators. The matrix showed the predominance of birds (98 species) in the Arctic coastal environment. The principal species of fish along the North Alaskan coast identified in the study include: arctic and least cisco, arctic char, arctic cod, and fourhorn sculpin; the major Arctic mammals identified included: polar bears, arctic foxes, spotted, bearded and ringed seals, and beluga whales.
3. The food dependency matrix serves as a management tool for decision-making. By showing the food web relationships, the matrix can provide an indication of the extent of the ecological impact should a specific species (e.g. Amphipods) be eliminated from the food chain. The extent of the ecological impact depends on whether or not the "eliminated" species is a primary food source.

**BOSCHKEN, H.L., "Interorganizational Considerations in Coastal Management: The 1976 California Legislative Experience", Coastal Zone Management Journal, 4 (1/2), pp. 47-63, (1978).**

#### ISSUES

1. Coastal management problems are not only complex but also transcend local boundaries. The designing of appropriate organizational structure and administrative decision rules in dealing with the complex issues of coastal resource allocations is one of the major problems facing state and local governments.
2. Local government in California had exclusive control over the coastal zone until 1973. During this period, the need for increased revenues by local governments compromised their ability to exercise effective control over developers. This resulted in a lack of statewide coastal planning, serious overuse, and lack of public access to the coastal zone. To correct this situation, the California Coastal Zone Conservation Act of 1972 was passed. The Act created an overlapping state authority to deal with coastal zone development - a state regional commission to review permits and a statewide commission to prepare coastal zone plans. Moreover, the traditional zoning and permit authority of the local government was not eliminated. The Act thus created serious problems of intergovernmental coordination.

#### RECOMMENDATIONS

1. The author suggests that there are two approaches to California's coastal zone management problems: a consolidated bureaucratic approach or a concurrent jurisdictional approach. A consolidated bureaucratic structure reduces interagency conflict, minimizes the cost of administrative negotiations, and mitigates indecision. Some of the major disadvantages are under-representation of the public and the greater possibility for administrative error.
2. The concurrent approach, being multinucleated, provides reciprocal scrutiny by different experts, encourages greater public participation by providing multiple access, and also enhances greater

awareness of alternative courses of action. The major disadvantages include redundancy and higher costs of public decision-making.

**CHAMBERLAIN, S.P., "A Petroleum Industry Perspective on Federal Coastal Zone Management", Coastal Zone Management Journal, 6 (4), pp. 281-294, (1979).**

#### ISSUES

1. Although full public participation is necessary and productive in addressing economic and environmental concerns, existing regulatory conditions encourage conflict and delay instead of timely solutions to critical coastal resource management problems. To overcome these problems, the facility siting process should be streamlined to eliminate duplication in the regulatory and public participation requirements.
2. Delays in the facility siting approval process frustrate attempts to increase the domestic petroleum supply; the capturing of new resources is thus more expensive to both industry and the public.
3. The federal government should be able to intervene in major facility siting conflicts where state and local attitudes unreasonably restrict or exclude projects of national interest, or where state and local roadblocks may lead to the abandonment of critical energy projects.

#### RECOMMENDATIONS

1. Complex and contradictory provisions of the Coastal Zone Management Act (CZMA), 1976, and the Outer Continental Shelf Lands Act (OCSLA), 1978, have contributed to the procedural delays in obtaining licenses and permits in U.S. coastal zones. The OCSLA has established new standards for effective coordination and cooperation between states and the federal government as well as safeguards to ensure that the interests of affected states are adequately considered throughout the OCS leasing process. For these reasons, the federal consistency procedures are counterproductive and a hindrance in expediting OCS development and should therefore be eliminated. This elimination would remove another layer of permit review (6-month OCS plan review at the state level) from the process. Secondly, it would also establish the Secretary of the Interior (i.e. the federal government) as the final arbiter on OCS development activities.
2. The National Oceanographic and Atmospheric Agency (NOAA) has often been criticized for approving state programs which include inadequate state and local resource management programs or which include laws which perpetuate the status quo in state resource and land use management. Such approvals fail to provide adequate considerations of the national interest in facilities. In order to rectify this situation, "national interest should be adequately considered in all planning and Siting decisions regarding facilities necessary to meet needs which are other than local in nature."
3. Lack of adequate mechanisms for resolving conflicts between state and local governments can also lead to longer permit procedures and inflated total project costs. Since local governments can impede the facility siting process through unreasonable or exclusionary local government action, states which do not provide mechanisms for resolving major facility siting conflicts between state and local governments should therefore not receive NOAA approval. Revenue sharing of sums generated by OCS lease sales and potential production royalties, between the federal government and affected coastal states, could provide the necessary incentive to motivate states to act more positively with regard to the national interest and to encourage them to assert effective control over local land-use policies.

**CHASIS, S., "Problems and Prospects of Coastal Zone Management: An Environmental Viewpoint", Coastal Zone Management Journal, 6 (4), pp. 273-280, (1979).**

#### ISSUES

1. The author argues that the national coastal zone management program is not fulfilling its promise because it is not ensuring the protection of the valuable coastal resources. The author attributes the failure of the Act to the fact that the federal government has interpreted the Act as a balancing statement and a neutral planning law emphasizing procedure rather than substance.
2. Some states have failed to exercise their full powers under the Act to effectively protect coastal resources and to direct coastal development to appropriate areas. State programs have become a paper planning process, undertaken to qualify for federal funds.

- (d) statements of coastal zone problems that led to the passage of legislation.
4. Coastal zone problems fall into two distinct categories. The first category, which reflects a dissatisfaction with the state of a natural resource, includes: intense-use conflicts among competing users; extensive environmental pollution; destructive dredging, filling and bulkheading; destruction of coastal habitat and degradation of fish and wildlife resources; limited public access and recreational opportunities; inadequate economic development; and damage to shoreline environments and developments from erosion and other natural phenomena.
- The second category includes organizational process problems and is comprised of procedures that inhibit an organization from attaining the goals and objectives. Included are such problems as lack of coordination among public agencies; complex, conflicting and confusing laws; insufficient data base and lack of information for decision-making; lack of understanding about coastal ecosystems; limited public participation in decision-making; and dominance of short-term management over long-range planning.
5. There are two basic types of program evaluation: outcome evaluation and process evaluation. Outcome evaluation compares program goals with program accomplishment in determining effectiveness or success. Process evaluation, on the other hand, examines the decision-making procedures of an organization by examining flow and quality of information, planning, and public involvement. Four problems are usually encountered in performing program evaluation:
- (a) difficulty in establishing causal relationships between resource outcomes and program actions;
  - (b) difficulty in obtaining baseline data to compare past and present conditions;
  - (c) absence of clearly identified program evaluation criteria; and
  - (d) difficulty in measuring evaluation criteria.

## RECOMMENDATIONS

1. Knowledge of the existence of a problem unit is the basis for remedial action; however, knowing the reasons why a problem exists enables one to determine why and what is happening and thus enables a careful selection of remedial actions. In program evaluation in coastal management, one should trace the causal chain from the outcome problem back to the problems in the process from which the outcomes emerge.
2. A six-step procedure can be used to trace the causes of outcome problems back via the causal chain until organizational process problems can be identified and remedied:
  - (a) analyse resource outcome problems;
  - (b) identify resource outcome causal problems;
  - (c) identify key public agencies that authorize resource outcome problems to occur;
  - (d) note important organizational process problems contributing to resource outcome problems for each public agency;
  - (e) analyze organizational problems;
  - (f) develop strategy for alleviating key organizational process problems.

**FREEMAN, R.R., "Ocean and Environmental Information: the Theory, Policy and Practice of Knowledge Management", Marine Policy, 1 (3), pp. 215-229, (1977).**

## ISSUES

1. Because of the huge cost involved in acquiring marine environmental information, private companies have made the exclusive use of information a necessary condition for their participation in exploration and development programs.
2. Qualitative differences significantly differentiate environmental information from other forms of scientific information.
3. The supply of and demand for environmental information is determined by a number of factors including users' perceptions of cost and benefits.
4. Environmental information is difficult to define partly because environmental and ocean information is multidisciplinary and partly because the applications are predictive.
5. Except for the International Referral Service of the United Nations Environment Programme (UNEP/IRS), there are very few international information systems.

awareness of alternative courses of action. The major disadvantages include redundancy and higher costs of public decision-making.

**CHAMBERLAIN, S.P., "A Petroleum Industry Perspective on Federal Coastal Zone Management", Coastal Zone Management Journal, 6 (4), pp. 281-294, (1979).**

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2. Delays in the facility siting approval process frustrate attempts to increase the domestic petroleum supply; the capturing of new resources is thus more expensive to both industry and the public.
3. The federal government should be able to intervene in major facility siting conflicts where state and local attitudes unreasonably restrict or exclude projects of national interest, or where state and local roadblocks may lead to the abandonment of critical energy projects.

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3. Lack of adequate mechanisms for resolving conflicts between state and local governments can also lead to longer permit procedures and inflated total project costs. Since local governments can impede the facility siting process through unreasonable or exclusionary local government action, states which do not provide mechanisms for resolving major facility siting conflicts between state and local governments should therefore not receive NOAA approval. Revenue sharing of sums generated by OCS lease sales and potential production royalties, between the federal government and affected coastal states, could provide the necessary incentive to motivate states to act more positively with regard to the national interest and to encourage them to assert effective control over local land-use policies.

**CHASIS, S., "Problems and Prospects of Coastal Zone Management: An Environmental Viewpoint", Coastal Zone Management Journal, 6 (4), pp. 273-280, (1979).**

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1. The author argues that the national coastal zone management program is not fulfilling its promise because it is not ensuring the protection of the valuable coastal resources. The author attributes the failure of the Act to the fact that the federal government has interpreted the Act as a balancing statement and a neutral planning law emphasizing procedure rather than substance.
2. Some states have failed to exercise their full powers under the Act to effectively protect coastal resources and to direct coastal development to appropriate areas. State programs have become a paper planning process, undertaken to qualify for federal funds.

3. Coastal zone management programs are seriously deficient, unambitious and a mere amalgam of existing authorities woven together by tenuous threads. Deficiencies include: absence of protection for key coastal resources, weak governing standards for wetlands development, lack of specificity in standards and policies governing resource use and protection, reliance on the existing network of laws and dubious enforcement mechanisms, and lack of mechanisms to assess and control the cumulative impacts of development on coastal resources.

#### RECOMMENDATIONS

1. A national policy to guide federal, state, local, and private action impacting on the coast should be established. Such a policy should be based on principles like:
  - (a) national interest to maintain and enhance the coastal zone;
  - (b) the highest and best uses of the coast should be permitted; for example, only water-dependent uses would be allowed to site along the coast and only in areas which do not interfere with the preservation of valuable natural features;
  - (c) development should be directed away from valuable coastal areas;
  - (d) increased public access should be provided; and
  - (e) development should be severely restricted in erosion-prone and coastal high-hazard areas.
2. To ensure the implementation of such a national policy, CZMA should be amended to include the design of substantive federal standards to protect key coastal resources; federal support for the implementation of programs should be directed to meeting the substantive federal standards; state and local agencies should be legally bound to implement coastal management programs.

**COMMONWEALTH OF MASSACHUSETTS, Office of State Planning, Offshore Oil Development: Implications for Massachusetts Communities, 68 pp., Boston, MA, (November, 1976).**

#### ISSUES

1. Two of the major concerns often expressed regarding offshore oil development are (a) that much of the initial development process is under exclusive federal control, and (b) that the revenues accrue to the federal treasury, while the immediate impacts and costs are borne by local communities.
2. Smaller towns with minimal services and limited labour and housing supplies will probably experience the greatest impacts if oil-related development occurs within their boundaries. In general, there are three particular problems facing smaller communities:
  - (a) a lack of adequate capital or borrowing power necessary to fund new public service facilities;
  - (b) a lack of resources and staff to adequately plan for or predict oil-related impacts; and
  - (c) inadequate local development regulations and inexperience in administering and enforcing them.

#### RECOMMENDATIONS

1. Due to the physical and cultural differences between Massachusetts and already producing petroleum areas, it is important to realize that experiences in other areas may be relevant only to a limited extent. Thus, there is the need for a rational and sensitive approach, an approach which will carefully weigh as many factors and cumulative impacts as are discernible before embarking on any particular strategy.

**COOK, E., "The Depletion of Geologic Resources", *Technology Review*, pp. 15-27, (June, 1975).**

#### ISSUES

1. The question whether shrinking resources will limit population and economic growth is difficult to answer. The author makes the point that no country whose economy is based on fishing, forestry, or agriculture is wealthy. Wealthy nations are those whose economies are based on the exploitation of fossil fuels, metals and minerals.
2. The author further wonders whether resource depletion is real. To consider this question, one must look at the nature of geologic resources or, more specifically, at the limits of geologic resources which encompass:



- (a) the limit of comparative utility;
  - (b) the living-level degradation limit;
  - (c) the limit of net work profit.
3. Geologic resources display modes of occurrence that affect the ability of human efforts to exploit them.

#### RECOMMENDATIONS

1. In view of the geological and geochemical constraints on the occurrence of economic deposits of minerals and energy resources, and the advanced nature of present exploration techniques, the author concludes that our resources are economically finite. "There is no endlessly retreating interface between ore and almost-ore which some optimists have described... Depletion of geologic resources is real; it is swift for those materials found mainly in sharply-bounded highly concentrated deposits - especially swift if they cannot be recycled after use."

**DRAKE, E. and C. REID, "The Importation of Liquefied Natural Gas", Scientific American, 236 (4), pp. 22-29, (April, 1977).**

#### ISSUES

1. With liquefied natural gas, the main problems are to find materials that will hold such a cold substance reliably and to determine what safety measures must be adopted against the possibility that the liquid might escape.
2. The question to be faced is whether the safety provisions that can be devised would be sufficient to allow the large-scale importation of liquefied natural gas to proceed with acceptable risks to the public.
3. Most of the questions concerning the safety of liquefied natural gas relate to tankers and storage tanks.

#### RECOMMENDATIONS

1. On the basis of the studies that have been made of the hazards of liquefied natural gas and the experience that has been gained in several countries in handling the fuel on a large scale, it seems reasonable to say that the hazards are similar to those involved in handling other fuels such as gasoline.
2. It can be expected that further experience in handling liquefied natural gas, and further research by the industry and by regulatory agencies will raise the level of safety in its use even higher.

**ENGLANDER, E., J. FELDMANN and M. HERSHMAN, "Coastal Zone Problems a Basis for Evaluation", Coastal Zone Management Journal, 3 (3), pp. 217-236, (1977).**

#### ISSUES

1. Information on the success of the past activities of an agency is very important if that agency is to achieve its planning and management goals. Program evaluation can provide this kind of information in a systematic way; once policies and programs have been implemented, they can be evaluated to determine if they have achieved their intended goals.
2. Very little program evaluation has been done in coastal management. This is partly due to the fact that many states and regions are now in the process of formulating coastal management programs or are in the early stages of implementing them. This, in a way, is an advantage because, by considering program evaluation now, states and regions that lack well-established coastal programs might be able to identify the kinds of information needed to evaluate their programs in the future.
3. Sources that could be used to determine the goals of coastal zone management programs include:
  - (a) policies and goals expressed in coastal legislation;
  - (b) program objectives delineated in administrative guidelines;
  - (c) attitudes and observations of those currently involved in coastal managements; and

- (d) statements of coastal zone problems that led to the passage of legislation.
4. Coastal zone problems fall into two distinct categories. The first category, which reflects a dissatisfaction with the state of a natural resource, includes: intense-use conflicts among competing users; extensive environmental pollution; destructive dredging, filling and bulkheading; destruction of coastal habitat and degradation of fish and wildlife resources; limited public access and recreational opportunities; inadequate economic development; and damage to shoreline environments and developments from erosion and other natural phenomena.
- The second category includes organizational process problems and is comprised of procedures that inhibit an organization from attaining the goals and objectives. Included are such problems as lack of coordination among public agencies; complex, conflicting and confusing laws; insufficient data base and lack of information for decision-making; lack of understanding about coastal ecosystems; limited public participation in decision-making; and dominance of short-term management over long-range planning.
5. There are two basic types of program evaluation: outcome evaluation and process evaluation. Outcome evaluation compares program goals with program accomplishment in determining effectiveness or success. Process evaluation, on the other hand, examines the decision-making procedures of an organization by examining flow and quality of information, planning, and public involvement. Four problems are usually encountered in performing program evaluation:
- (a) difficulty in establishing causal relationships between resource outcomes and program actions;
  - (b) difficulty in obtaining baseline data to compare past and present conditions;
  - (c) absence of clearly identified program evaluation criteria; and
  - (d) difficulty in measuring evaluation criteria.

## RECOMMENDATIONS

1. Knowledge of the existence of a problem unit is the basis for remedial action; however, knowing the reasons why a problem exists enables one to determine why and what is happening and thus enables a careful selection of remedial actions. In program evaluation in coastal management, one should trace the causal chain from the outcome problem back to the problems in the process from which the outcomes emerge.
2. A six-step procedure can be used to trace the causes of outcome problems back via the causal chain until organizational process problems can be identified and remedied:
  - (a) analyse resource outcome problems;
  - (b) identify resource outcome causal problems;
  - (c) identify key public agencies that authorize resource outcome problems to occur;
  - (d) note important organizational process problems contributing to resource outcome problems for each public agency;
  - (e) analyze organizational problems;
  - (f) develop strategy for alleviating key organizational process problems.

**FREEMAN, R.R., "Ocean and Environmental Information: the Theory, Policy and Practice of Knowledge Management", *Marine Policy*, 1 (3), pp. 215-229, (1977).**

## ISSUES

1. Because of the huge cost involved in acquiring marine environmental information, private companies have made the exclusive use of information a necessary condition for their participation in exploration and development programs.
2. Qualitative differences significantly differentiate environmental information from other forms of scientific information.
3. The supply of and demand for environmental information is determined by a number of factors including users' perceptions of cost and benefits.
4. Environmental information is difficult to define partly because environmental and ocean information is multidisciplinary and partly because the applications are predictive.
5. Except for the International Referral Service of the United Nations Environment Programme (UNEP/IRS), there are very few international information systems.

## RECOMMENDATIONS

1. Knowledge is power; for this reason, the marshalling, collating, organizing, analysing and testing of information is indispensable to public policy administration. If governments are to be able to protect public interests against the competing uses of the ocean and the environment, then they should have timely access to credible technical information. Governments should also establish guidelines for the utilisation, distribution and management of information relating to the environment and ocean resources.
2. Because environmental and ocean information systems serve several disciplines, they have been treated both as fugitive resources (unrestricted use or entry) and ubiquitous resources (infinite and unowned) at the same time. However, this duality of property rights accorded environmental and ocean information systems makes the establishment of institutional arrangements and the enforcement of property rights more difficult.
3. While very few international information systems exist, effort is being made to develop a worldwide network of centres. The Intergovernmental Oceanographic Commission (IOC) has started a Marine Environmental Data and Information Referral System (MEDIS). The FAO is also developing a more ambitious information system, the Aquatic Sciences and Fisheries Information System (ASFIS), with the collaboration of organizations in Canada, the Federal Republic of Germany, France, the USSR, the UK and the USA. These systems should eventually lead to the establishment of international cooperative production of environmental information services.
4. Despite the emerging trend toward international information systems, private profit-making and non-profit organizations will continue to provide environmental and ocean information. These organizations fall into the following groups:
  - (a) primary producers of publications;
  - (b) secondary publication and data base suppliers;
  - (c) sponsors of data bases;
  - (d) suppliers of reference retrieval and communication systems;
  - (e) document delivery suppliers including libraries and clearing houses;
  - (f) data delivery and data referral centres;
  - (g) information and data analysis and assessment centres;
  - (h) national, regional and local information search services, brokers, and extension and advisory services.
5. To achieve a complete search, users of environmental and ocean information have to consult several indexes and data bases. This lack of comprehensive coverage is due to the fragmentation and heterogeneity of environmental interests and to the existence of a relatively large number of secondary sources.
6. Compared to classical scientific disciplines, environmental information is characterised by a greater magnitude of intrinsic uncertainties, especially those associated with socioeconomic data. Furthermore, the multitude of variables and the environmental conditions under which research is conducted make definitive conclusions impossible.

**GENDLER, M., "Offshore Oil Power Plays: Maximizing State Input into Federal Resource Decision Making", *Natural Resources Lawyer*, 12 (2), pp. 347-387, (1979).**

## ISSUES

1. The Coastal Zone Management Act (CZMA) was passed in 1972 to encourage comprehensive state and local planning and management of coastal resources in cooperation with federal authorities. Thus far, the CZMA has not resolved federal-state disputes over ownership, control, and revenues from offshore petroleum resources.
2. Congress envisioned that the requirements of the CZMA would promote the cooperative planning which is necessary if the rational management of fragile coastal resources subject to competing use demands is to be achieved. Early experience under the CZMA indicates that federal-state communications processes have been weak and that federal agencies have resisted attempts by the states and the Office of Coastal Zone Management (OCZM) to increase state authority in traditional areas of federal control.
3. Although OCZM asserts that the CZMA is intended to enhance state authority and has resisted suggestions that it interprets the act narrowly in its regulations, there are strong pressures from other federal authorities and from industry to construct state power to limit development. The author argues that the policies and strategies of the Carter administration, Congress, and various federal agencies

concerned with coastal resources must be examined to determine how states can maximize their authority to ensure preservation of valuable resources and rational development in a timely manner in their coastal zone.

## RECOMMENDATIONS

1. According to the author, the opportunity now exists for state and local governments to seize the initiative in the management of important coastal resources. "Public consciousness of the need to plan and order priorities to ensure the best use and preservation of the fragile coastal environment has heightened, and federal authorities are more sensitive to state, local, and public demands for coastal policies responsive to their concerns."

**GILLMAN, K., Oil and Gas in Coastal Lands and Waters, Council on Environmental Quality, Washington, DC, vi, 153 pp., (April, 1977).**

This report describes the known impacts of oil on the coastal zone, tries to anticipate the effects of new development, and looks for ways to accomplish it with the least harm and the most benefits.

Offshore oil and gas from frontier areas are not the only recent arrivals on coastal energy scenes. The federal Deepwater Port Act of 1974 authorizes construction of offshore ports to berth the mammoth supertankers which carry crude oil in the world trade but are too deep in draft to enter most U.S. ports.

Natural gas imports are another likely development. Domestic production of natural gas in the U.S. began to drop in 1974 and declined more sharply in 1975; serious winter shortages have become a reality. Some of the deficit will be filled by liquefied natural gas shipped via cryogenic tanker from Alaska or perhaps from foreign sources.

In choosing among the important claimants to the limited physical, social, and ecological space in the coastal zone, some sacrifices are inevitable. However, it is misleading to think of the choices as between people and birds or fish. In fact, there will be choices among important human values that are at odds with each other. Planning is the key. States and communities striving to accommodate essential energy systems while preserving scenic beauty, living amenities, traditional economic structures, and the natural environment must delineate the choices and clarify the consequences early. With a clear understanding of the choices, communities can develop a plan and control development. In this report, an attempt is made to provide some of the facts (with respect to environmental issues and problems such as sources of oil pollution, probability of oil spills, biological effects of oil, and other sensitive environments), experience (which includes economic and social effects and impacts in places having faced development, i.e. Alaska-Cook Inlet, The Gulf Coast, Northampton County, Va., the Shetland experience, and Yakutat, Alaska), and analysis that must underlie planning.

**HENNESSEY, T.M., "Theory and Coastal Zone Management", Coastal Zone Management Journal, 5 (4), pp. 259-262, (1979).**

## ISSUES

1. The concept of "Management" in coastal zone management carries burdens and benefits. Being an umbrella term, it contains a variety of diverse concerns. The fact that it does not allow the introduction of theory is a disadvantage, as this would help students of coastal management on key policy questions; by ignoring it, one forgoes the means by which a given assignment can be accomplished.

## RECOMMENDATIONS

1. Three approaches can be used to introduce more theoretical content into the concept of "Management"; these include: implementation analysis, public choice theory, and evaluation research.
2. Because implementation is the process of putting policy into effect, the author suggests that theories shape what takes place during the implementation phase of a project. He also cites the Council relation between initial conditions and final consequences as further proof. Public choice theory, on the other hand, establishes a theoretical foundation for institutional analysis and design. In a discipline like coastal zone management where inter- and intragovernmental relations are very important, public choice theory is a valuable tool. Using evaluation research, coastal zone programs can then be evaluated as to their relative success or failure.

JOHNSTON, D.M., "The Economic Zone in North America: Scenarios and Options", Ocean Development and International Law Journal, 3 (1), pp. 53-68, (1975).

This paper reviews five alternative scenarios arising out of the Third UN Conference on the Law of the Sea and evaluates six economic zone options available to Canada and the United States.

#### ISSUES

1. Proposals have been brought forward for a multifunctional economic zone which is almost invariably envisaged as a zone that would have a maximum breadth of 322 km.
2. These proposals were designed chiefly to legitimize the acquisition by coastal countries of resources which are usually described as sovereign, or at least exclusive in character.
3. Counterproposals have been put forward with respect to coastal states' fishery rights in the zone. It is suggested that these rights should only be prior rights; that is, they should be exclusive only up to the maximum limits of the coastal state's harvesting capability.
4. Few economic zone supporters accept the revision mentioned above, except on the condition that it did not diminish the coastal state's exclusive authority over fishery management in the zone, whereby it has sole discretion in determining under what conditions the nationals of a foreign state should be permitted access to harvest any underexploited stock.
5. Based on these differences in how the economic zone concept should be settled, the author lists what he sees as the possible outcome of the Law of the Sea Conference:
  - (a) a comprehensive treaty based on majority consent;
  - (b) a limited treaty based on universal consent;
  - (c) a limited treaty based on majority consent;
  - (d) multiple treaties;
  - (e) nontreaty outcomes.

#### RECOMMENDATIONS

1. Neighbouring countries should consult each other before resorting unilaterally to legislation that is likely to have an appreciably adverse effect on the citizens of the other.
2. The more credible of the treaty outcome scenarios discussed in this article are all situations in which both states would gain more than they could lose by engaging in prior consultation. The aspects of economic zone legislation that seem least dependent on prior consultation are:
  - (a) the assertion of exclusive rights to non-living resources within the 322-km limit;
  - (b) the assertion of sole or primary authority over fishery management within the 322-km limit; and
  - (c) the assertion of exclusive or prior fishing rights within the 322-km limit.

JOHNSTON, D.M., "Coastal Zone Management in Canada: Purposes and Prospects", Canadian Public Administration, 20, pp. 140-151, (1977).

#### ISSUES

1. Without agreement among government officials (Departments) with respect to the treatment of coastal problems, the concept of coastal zone management in Canada will not catch on.
2. Creating a single integrated coastal management agency in Canada will be a difficult undertaking.
3. The formulation of a coastal land use policy in Canada will be hampered by bureaucratic fragmentations and uncertainties.

## RECOMMENDATIONS

1. The establishment of a 322-km fisheries (or economic) zone may help demarcate the seaward limit of the coastal zone and thereby help in the creation of an integrated agency.
2. As an initial step towards the integration of coastal management programs in Canada, three semi-independent coastal zone commissions should be established. These commissions would be composed of representatives from the federal and provincial governments, and of approved representatives from local governments, the private sector, and the universities.

**KEISER, G. and W. PICHON, "Management of Coastal Resources in Arctic Alaska", IN Coastal Zone '80, EDITED BY B.L. Edge, American Society of Civil Engineers, New York, NY, Vol. 11, pp. 1481-1495, (1980).**

## ISSUES

1. Compared to other coastal regions of the United States, where restoration and enhancement of coastal productivity is a problem, the Alaskan coastline of about 54 562 km is largely undisturbed and remains relatively productive.
2. The main problem facing coastal zone management in Alaska, especially along the Arctic coast, is reconciling competing demands on coastal lands and waters. Balancing conservation of suitable habitats for migratory animals and preservation of local hunting and fishing practices ("subsistence") against accelerated oil and gas production activities presents difficult challenges to Alaskan coastal resources managers.
3. The coastal environment of Arctic Alaska is covered by ice 8-9 months of the year. Consequently, marine fishes and mobile invertebrates migrate offshore to deeper waters or concentrate in shallow nearshore waters as the ice thickens. For this reason, anadromous and freshwater fish spend the winter in limited water pockets of river deltas, upstream springs, and deep lakes. The Arctic environment is also characterized by ice ridges which can be as high as 10 metres. The ice ridges are formed as a result of the juxtaposition of pack ice and annual nearshore ice; this in turn results in the creation of an active zone of colliding pressures.

## RECOMMENDATIONS

1. The enactment of the Alaskan Coastal Management Act in 1977 resulted in the creation of a 16-member Alaska Coastal Policy Council. This Council, composed of both public members and government officials, is a regulatory and review body responsible for the development of a federally approvable coastal zone management program. The Act also created the Office of Coastal Management (OCM), a lead state agency within the division of policy development and planning. The OCM was also to serve as a staff to the coastal policy council.
2. The Alaska Coastal Policy Council was charged under the Act with the responsibility of establishing, by regulation, state guidelines and standards, and program procedures and policies for the management of coastal land and water uses. Utilizing their planning and zoning authority, and the state guidelines and standards, local governments were to develop specific coastal resource district programs. Public and governmental participation in coastal management planning and development were to be facilitated through the public hearing process. Thus, the Act and the coastal management program provided mechanisms and frameworks for reconciling subsistence activities and accelerated oil and gas development.
3. One of the specific coastal resource district programs in Alaska that was subjected to extensive review and has provided much needed experience to coastal management planners at all levels of government in Alaska is the Mid-Beaufort Region Coastal Management Program of 1979, which covers 193 km of Arctic coastline. The Mid-Beaufort coastal program consisted of:
  - (a) framework plan - a conceptual document of objectives and policies, boundaries, zoning regulations and local permit system, priority of uses and administration;
  - (b) resource inventory map - delineating migratory fish, bird and mammal habitats;
  - (c) coastal zone district map - a zoning map designating six land/water use districts; and
  - (d) ordinance - specific legal mechanisms for regulating uses and activities.

KNECHT, R.W., "Coastal Zone Management, The First Five Years and Beyond", Coastal Zone Management Journal, 6 (4), pp. 259-294, (1979).

#### ISSUES

1. The CZMA was intended to facilitate the development of comprehensive programs to recognize and respond to a variety of resource management problems. To achieve this objective, CZMA provided for an integrated and multifaceted management approach sensitive to interactions among coastal resources and uses. However, the weakness of the program lies in its comprehensiveness. Critics have charged that the requirements for comprehensiveness and the relatively short time allowed for developing approvable programs have created "broad-brush" programs which do not treat issues with enough specificity.
2. National environmental groups have argued that the CZMA, as passed in its original form, was intended to be first and foremost an environmental protection statute; hence, emphasis should be placed on the protection and preservation of such prime coastal resources as wetlands, beaches, and dunes. There are others who also believe that the CZMA was designed to balance a number of divergent interests in order that it would achieve the appropriate degree and type of protection and management for causal resources. This, however, involves a consideration of environmental protection requirements, economic development needs, long- and short-term costs and benefits, and the differing interests and perspectives of various levels of government. Thus, the CZMA has not satisfied anybody.
3. It has been a debatable question whether the coordinated management provisions of the Act have resulted in reduced costs and more effective public expenditures, or whether state programs have added to rather than simplified the regulatory process. The suggestion has been made that the potential exists for coastal management activities to lead to long-term public savings at all levels of government by creating more efficient and coordinated government decision-making procedures, simplifying or reducing the number and type of permits required, consolidating growth in existing developed areas, and causing internalization of private costs of development. At the same time, coastal management programs can further complicate the already time-consuming regulatory process and thereby add more costs to both private and public interests.
4. Opinions also differ as to whether the national coastal zone management program has been effective in raising public awareness of coastal problems and support for the management activities necessary to resolve these problems. While the National Coastal Zone Management Advisory Committee pointed out that the lack of a strong, supportive, well-organized and active constituency is one of the major factors that has hindered the development and implementation of state management programs, people at the state level cite changes in public attitude as one of the important accomplishments of the national and state programs.

#### RECOMMENDATIONS

1. To address the fears of critics who feel the program lacks specificity and to ensure that policies and processes of coastal management programs are directed toward achieving clearly defined and national goals, the Act should be amended to ensure that states focus on four major areas:
  - (a) protection of significant national systems;
  - (b) management of coastal development;
  - (c) provision of public access; and
  - (d) coordination and simplification of public decision-making.
2. The workability of the federal consistency provisions has been questioned by various people. The author therefore proposes that the consistency requirements be integrated with provisions utilized under the National Environmental Policy Act (NEPA). While this integration achieves governmental coordination and efficiency objectives, it has the additional advantage of providing both an information and assessment mechanism for federal actions and a reporting procedure to states which fit with the objectives of the consistency provisions.
3. A program evaluation system which provides an accounting of the accomplishments and shortcomings during operation is needed. An annual state performance review, which includes assessment of state progress in addressing significant national issues, is therefore proposed. Under this proposal, the state would be reviewed to determine compliance with the provisions of approved programs and to ascertain the extent of improvements in protection of significant national systems, management of coastal development, provision of public access, and coordination and simplification of governmental decision-making.

4. Federal programs related to OCS oil and gas development, fisheries conservation and management, revitalization in urban waterfronts and ports, and development in hazardous areas could be hampered and delayed by ineffective state and local coastal management programs. Withdrawal of federal support for state coastal management programs could therefore be counterproductive. However, to make coastal programs contribute to national goals, it is proposed that a percentage of the federal grants to states be targeted for selected issues of national concern: fisheries assistance, hazard management, urban waterfront development, or permit simplification. It is further proposed that the improvements in the selected issues should be measurable.

LEWIS, J. and C.P. BENEDICT, "Icebergs on the Grand Banks: Oil and Gas Considerations", World Oil, 192 (1), pp. 109-114, (1981).

#### ISSUES

1. With the commercial production of petroleum hydrocarbon on the Grand Banks becoming a reality in the next few years, there is now the need for the development of better ice technology and iceberg prediction and management capabilities.
2. Except for the problems posed by icebergs, hydrocarbon production on the Grand Banks is not significantly different from that in the North Sea. The water depth is less than 91 metres, and water temperatures are not much colder than those of northern parts of the North Sea.
3. Icebergs present several problems to hydrocarbon production on the Grand Banks, one of which is the destabilizing influence of the ablation process. The tendency to roll makes the towing of icebergs very difficult. This tendency also increases the draft of the iceberg, thus making it possible to plow several metres into the seabed sediments, posing a threat to pipelines and gathering systems. Iceberg management could also be hindered by pack ice.
4. Icebergs reaching the Grand Banks originate from glaciers on the east and west coasts of Greenland, Ellesmere Island and Devon Island. Weather, current and rate of glacier recession are some of the factors that determine the number of icebergs reaching the Grand Banks. Iceberg flux varies from year to year: the largest number, 1 600, was recorded in 1972; the lowest, 20, in 1980. The mean yearly iceberg flux for the Grand Banks is 380. However, the iceberg threat is less on the southern and southwestern Banks than on the northern Banks.

#### RECOMMENDATIONS

1. Iceberg management techniques developed for drill rig disconnections can be extended to reduce offsite downtime for floating rigs or to decrease the number of iceberg impacts with fixed platforms.
2. Iceberg management consists of four phases:
  - (a) detection - visual observation aided by marine radar. Visual observation, in clear weather, can detect large icebergs 18 nautical miles away, while radar can pick icebergs 4 to 15 nautical miles away. Iceberg detection could be improved with the use of computerized decluttering and image-enhancement techniques;
  - (b) track prediction - due to the irregular shape, current variations and wind speed, icebergs follow random looping and meandering paths. However, using a probabilistic method based on initial position and velocity, it can be determined if a rig lies within a high-probability area. If the rig is in such an area, then the iceberg becomes a candidate for towing;
  - (c) pre-tow survey - this involves visual examination of the iceberg for stability and other relevant information;
  - (d) iceberg towing/diversion - anchor-handling tugs are used for operational towing.
3. Iceberg management can also be carried out by demolition with explosives. However, this procedure is less satisfactory, and more research is necessary to improve the blasting and deployment of the explosives.



**LOWRY, G.K., "Policy-relevant Assessment of Coastal Zone Management Programs", Coastal Zone Management Journal, 8 (3), pp. 227-255, (1980).**

#### ISSUES

1. The main purpose of policy-relevant approaches to the evaluation of Coastal Zone Management is to provide information directly relevant to making decisions about the development, alteration or termination of OCS programs.
2. Resource-allocation decisions, decisions to intervene in regulatory activities to ensure compliance with coastal zone management goals and objectives, decisions to modify management programs, and decisions to terminate a program or aspects of a program, are the basic types of decisions often made with respect to implementation of coastal zone management programs.
3. Evaluative studies of coastal zone management programs are usually broad and unfocused and thus do not respond to potential future information demands. Alternatively, they are too narrowly focused on those aspects of coastal zone management programs that are easily quantifiable.

#### RECOMMENDATIONS

1. Coastal zone management policy decisions require "implementation process" information which relates to program management objectives, and "program outcome" information which refers to measurable changes of program goals. "Sophisticated" evaluations are those that link program process to outcomes.
2. There are five approaches that can be used to evaluate coastal zone management programs. The choice of a particular approach depends mainly on the issues faced by policy makers:
  - (a) program logic evaluation - involves qualitative, before-the-fact assessment of potential program effectiveness. The basic objective of this approach is to ensure that programs comply with the letter and spirit of the Coastal Zone Management Act;
  - (b) compliance evaluation - the objective of this approach is to determine the extent to which plans or permit-letting activities are consistent with state and federal objectives and programs;
  - (c) organizational process evaluation - attempts to identify how or why coastal zone management programs succeed or fail. The focus of this approach is on identification of agencies or groups whose activities may affect the outcome of a program, specification of desired program effect, specification of program attributes, and specification of management contexts which may affect the success or failure of a program;
  - (d) goal achievement - involves analysis of the extent to which an organization's goals have been achieved, the objective being to measure the effects of a program against the goals it sets out to accomplish;
  - (e) broad impact evaluation - identifies social, environmental, political or economic impacts that have been caused by or are associated with implementation of coastal zone management programs.

**LUKE, R.T., "Managing Community Acceptance of Major Industrial Projects", Coastal Zone Management Journal, 7 (2-3-4), pp. 271-296, (1980).**

#### ISSUES

1. Industry faces a number of risks in selecting a site for a major facility. These risks include obtaining construction and operation permits, changes in state and local political conditions, and community opposition to energy facilities.
2. Industry sometimes considers the ability to obtain permits more important in a site selection process than the physical characteristics of the candidate site.
3. Community acceptance has posed a major problem to OCS drilling, siting of refineries, port development, and siting of petrochemical plants partly because industrial corporations are not organized to effectively manage this type of risk in facility siting. Until recently, the primary concern of industry had been the impacts of facilities on the natural environment.
4. During preliminary evaluation, industry representatives tend to talk to proponents of projects (Chamber of Commerce, City Industrial Development Committee, etc.) and ignore potential opponents. By having citizens' views filtered through community boosters, industry overlooks important information necessary to an accurate assessment of potential community acceptance problems.

## RECOMMENDATIONS

1. Corporations have not been successful in dealing with community acceptance problems because the traditional functional organization of a corporation encourages members of project teams to perform in terms of their tasks. They are therefore unable to adapt their efforts to specific community acceptance problems. Besides, project managers, often being engineers, do not see themselves as politicians and therefore do not take advantage of establishing informal relationships with community leaders.
2. To reduce the risk of community rejection, corporations should adopt a positive approach to facility siting. This approach involves:
  - (a) careful site selection, not necessarily the least cost site;
  - (b) developing an atmosphere of trust with individuals and groups;
  - (c) assigning staff with specific responsibilities to deal with the community;
  - (d) creating a budget for mitigating the impacts of the project on the community;
  - (e) acquisition of sufficient land to serve as buffer zones to contain impacts of the facility which cannot be controlled through engineering;
  - (f) establishing a corporate policy on public release of information; and
  - (g) participation in the government policy development process at federal, state, and local levels.

**MACFARLAND, J.W. and R.S. WEINSTEIN, "The National Estuarine Sanctuary Program", Coastal Zone Management Journal, 6 (1), pp. 89-97, (1979).**

## ISSUES

1. Estuaries are among the most biologically productive regions of the nation (USA) and have been estimated to account for about two-thirds of the commercial and sport fish landed in the USA. However, competing uses, physical alteration, and pollution have led to deterioration and reduction in size of estuaries in the USA. The threat to estuaries led to two major studies: Our Nation and the Sea (1969) and National Estuaries Study (1970).

## RECOMMENDATIONS

1. These two major studies resulted in the passage of the Coastal Zone Management Act of 1972, amended in 1976. Under this act, the estuaries sanctuary program was established which provided 50% matching grants to coastal states to acquire, develop, or operate estuarine areas set aside to serve as natural field laboratories for the studying and gathering of data on the natural and human processes occurring with estuaries of the coastal zone. The sanctuaries are owned and managed by the individual states within the guidelines established in the Estuaries Sanctuary Rules and Regulations.
2. Administratively, the estuaries sanctuary process is broken down into three phases: preacquisition, acquisition, and operation. A preacquisition grant may be used for land appraisals, refinement of boundaries, and for the development of management plans and/or programs for research and education. Acquisition grants are used to cover the actual and released costs of land acquisition, while operation grants are for the costs necessary for monitoring the sanctuary and protecting its ecosystem and for the establishment and maintenance of an educational program.
3. The purposes of a sanctuary program are:
  - (a) to gain an understanding of the ecological relationship within the estuarine environment;
  - (b) to make baseline ecological measurements;
  - (c) to monitor significant changes in the estuarine environment;
  - (d) to assess the effects of man's activities on the ecosystem; and
  - (e) to provide a vehicle for increasing public knowledge and awareness of the estuarine system.

**MANNERS, I.R., W. DIETRICH and T. KEEN, "Energy, Development and Coastal Zone Management in Texas", Texas Business Review, 54 (1), pp. 45-52, (1980).**

## ISSUES

1. "Advocates of an accelerated program of offshore leasing and development confront conservation groups who are concerned with the protection and preservation of coastal biotic and recreational resources."

The costs and benefits of offshore oil development are viewed very differently by the two groups. Keeping this dissension in mind, "an effective coastal zone management must not only seek to balance competing interests (national and local as well as development and conservation) but must recognize that the impacts will vary markedly from one region to another."

2. The establishment of the OCS-related onshore support facilities causes the greatest social, economic and environmental disruption. These changes are of both immediate and long-term character, and these impacts are being felt at a different intensity according to the size of the community.
3. A discussion of the coastal energy impact program is given as it describes the variety of funding programs available for the communities. "CEIP is intended to mitigate the more adverse impacts of rapid energy development in the coastal zone."

**MAXWELL, J., Energy from the Arctic: Facts and Issues, C.D. Howe Research Institute, Montreal, P.Q., x + 125 pp., (1973).**

#### ISSUES

1. The underlying theme of this book is that Canada would like to abandon the old continentalist approach to resource development especially with respect to the development of the Arctic.
2. To the American consumer who needs new sources of energy supply, Canada's measured approach may seem selfish.
3. The second theme of the book is that the Arctic provides an opportunity for good management of the environment, of resources, and of the Canadian economy. Good management, mixed with good luck in finding a lot more oil and gas, would bring substantial benefits to both Americans and Canadians.

#### RECOMMENDATIONS

Two questions concerning the impact of the U.S. energy shortages on Canadian-American relations are raised:

- (a) just how much help can Canada give the United States?
- (b) what would Arctic energy exports mean for Canada's own economic development?

This book concludes by answering these two questions:

- (a) Canada can give only a modest amount of help to the United States by developing its Arctic potential. It will take many years to develop the resources in the North; Arctic energy therefore cannot help the Americans through the next few years when shortages could be acute;
- (b) The question concerning Canada's own economic development remains unresolved. Operation of Arctic energy systems will bring enormous new challenges in economic management; the benefits could be substantial. However, only time will tell whether the two countries can find the right answers for economic and energy policies.

**MENARD, W.H., "Toward a Rational Strategy for Oil Exploration", Scientific American, 244 (1), (1981).**

#### ISSUES

1. Knowledge of the total amount of recoverable oil and gas and the size distribution of the fields are important factors that must be considered in determining a national petroleum policy.
2. Perceptions of shortage and glut have had a major influence on national oil policies; these policies have usually turned out to be counterproductive.
3. The accurate estimation of reserves is not simple and is always subject to revision. Much of the ignorance about reserves in past decades may have owed less to geological factors than to institutional and economic ones. Such factors are susceptible to change if it is deemed in the national interest to base oil policy on a broader foundation of information than was available in the past.

## RECOMMENDATIONS

1. Most of the oil that can be extracted quickly is found in giant fields. The only way for the U.S. to meet most or all of its requirements for oil over the next two decades is to discover a substantial number of giant fields.
2. Possible ways to speed the inventory of giant new fields include:
  - (a) the government could do more of the exploration itself;
  - (b) the oil industry could be required or induced to drill structures prior to leasing;
  - (c) the government could allow single companies to lease scattered tracts instead of encouraging many companies to bid on tracts within compact areas;
  - (d) tract sizes could be increased from the standard 23 square kilometres to areas 100 to 1 000 times larger;
  - (e) the time between leasing and the beginning of exploration could be shortened.

MITCHELL, J.K., "Impact of Offshore Oil and Gas Development on the Coastal Zone: Reforming the Impact Assessment Process", Coastal Zone Management Journal, 4 (3), pp. 299-327, (1978).

## ISSUES

1. The Environmental Impact Statement (EIS) provisions of the National Environmental Policy Act (NEPA), 1969, contain serious substantive and procedural deficiencies in the preparation of impact statements for Offshore Continental Shelf (OCS) projects, and limited mechanisms for ensuring adequate consideration of "downstream" and cumulative effects of complex energy-management proposals.
2. The complexities of OCS development and regulatory systems create formidable problems for onshore residents who wish to participate in the OCS decision-making process. These problems are compounded by several factors: piecemeal regulations, lack of knowledge about or awareness of the timing, nature and boundaries of the key parties in the institutional process. There is also opportunity for public involvement in the early stages of OCS activities when the framework for future growth strategies begins to emerge.

## RECOMMENDATIONS

1. To facilitate rapid compilation of data and review by decision makers, most federal agencies charged with the preparation of impact statements use a common format. The desire to guard against possible legal challenges on the basis of important information has also contributed to the popularity of the common format approach. The net result is that documents produced are rigid, repetitious, and lack internal continuity. The limitations of impact statements can be overcome by placing greater emphasis on data quality and analysis proficiency as primary considerations in assessing statement adequacy.
2. While more direct environmental damage has been caused by the construction of pipelines through coastal wetlands, public fears have often centred around pollution from blowouts and massive oil spills. Consequently, OCS impact statements have failed to emphasize onshore socioeconomic factors. This lack of emphasis can be addressed by bringing together the principal federal agencies responsible for offshore development and onshore environmental management in coastal areas.
3. Thorough analysis of location-investment decision processes is often absent in OCS impact statements. This leads to a situation whereby the spatial distribution of costs and benefits associated with onshore impacts are not adequately assessed. Making impact statements sensitive to spatial and locational factors can help avoid this.
4. Most impact statements lack sufficient information about future environmental conditions; the degree to which this constraint is overcome is often a measure of the success of the impact statement. For example, most statements admit that the extent of economic harm from an oil spill cannot be calculated with any degree of specificity. However, the onshore economic impact of an oil spill can be made more understandable to onshore residents if impact statements will compute the economic costs by using such items as: cost of cleaning and replacing sand, the opportunity costs of using alternative recreation sites, and ecological and aesthetic damages. This approach has the advantage of making use of a more complete data base and it also draws attention to the value of the environment.
5. Very often, OCS impact statements contain only implied assumptions. On occasions when they are stated, it is only in absolute terms with no attempt to assess the consequences of using different sets of

assumptions. This problem can be alleviated by careful preparation of impact statements and by inviting external interest groups to comment on the statements.

6. Detailed consideration of the downstream and cumulative impacts associated with OCS development and production are often postponed partly because they appear to be easily resolved. This contributes to the piecemeal nature of the process. One of the suggested mechanisms to deal with the downstream and cumulative effects is a separation of OCS exploration rights from development rights and requiring an impact statement for each phase.

**NASSAU-SUFFOLK REGIONAL PLANNING BOARD, *Integration of Regional Land Use Planning and Coastal Zone Science - A Guide Book for Planners*, Houppange, NY, 314 pp., (1976).**

This report describes methods developed by the Nassau-Suffolk Regional Planning Board for use by planners; it integrates traditional land use planning techniques with scientific knowledge into a framework for assessing the environmental impacts of land use decisions in the coastal zone. A number of conclusions are drawn from this experience and include the following.

1. Quantitative outputs generated by the component methods are open to more criticism and debate as to their accuracy than are methods based on qualitative reasoning. However, the quantitative results are of value in the development and revision of land use plans and technical strategies.
2. Coastal zone planning suffers from a lack of data and information, especially site-specific data for key unknowns such as transport coefficients.
3. COSMOS (Coastal Zone Modeling System) served as an input to the planning process by helping the planners in the evaluation of land uses and technical strategies that mitigate the marine water quality impacts of future development. The various methods permitted the analysis of environmental problems of the coastal zone and were used by planners to test land use alternatives which meet regional development objectives. The nature and scope of each method are described in terms of their possibilities and constraints.

**OCS PROJECT TASK FORCE, *Offshore Oil and Gas Development: Southern California*, Office of Planning and Research for the California Coastal Commission, Sacramento, CA, 2 volumes, 879 pp., (October, 1977).**

The study area encompasses the outer continental shelf, extending offshore from Point Conception in Santa Barbara County south to the international boundary with Mexico, as well as inland areas to the extent that they are directly affected by OCS development. Topics covered by the report include institutional arrangements for managing the OCS, socioeconomic and environmental effects of OCS development, facility siting, and future leasing. The report suggests changes in the present system of OCS management and also identifies opportunities for new OCS development. Recommendations to carry out needed actions are addressed to federal, state, and local governments and to industry.

#### ISSUES

1. California has little control over OCS development on federal offshore lands but must live with the onshore economic, social, and environmental consequences of that development. Federal OCS lands are leased on the basis of speculative estimates of oil and gas potential, without any direct information from exploratory drilling.
2. There are three kinds of information that are most needed by state and local governments: oil and gas resource estimates, development plans, and environmental baseline studies. At the federal level, leasing decisions are proceeding without the benefit of environmental baseline information that would allow the formulation of appropriate trade-offs between development and environmental protection.
3. Preventing further degradation of air quality is one of the most critical environmental issues facing southern California. OCS oil operations contribute substantial amounts of reactive hydrocarbons, aggravating an already critical problem of smog in the South Coast Air Basin.
4. Key natural resources that could be affected by OCS development include pinniped and seabird rookeries, wetlands, rocky intertidal areas, and offshore banks. In addition, the Channel Islands are richly endowed natural areas which should receive special protection from oil spills.
5. Economic effects - Lease Sale No. 35 will not have a significant effect on the economy of southern California. The ratio of OCS-related activity to other economic endeavours is so small that new direct

and indirect employment will be insignificant and increases in public service demands so small that they can be satisfied with existing excess capacity.

6. Facilities planning - Unitization and consolidation offer key opportunities for reducing the environmental effects of offshore oil and gas development and for recovering the greatest amount of oil and gas efficiently.

#### RECOMMENDATIONS

1. State recommendations - Congress should pass legislation requiring the Secretary of the Interior to accept the recommendations of an affected state's governor on the 5-year leasing schedule, a proposed lease, exploration plan or development plan.
2. Pre-lease drilling - the Interior Department should acquire direct information from exploratory drilling to make tract-by-tract oil and gas resource estimates before lease tracts are offered for sale.
3. Authority to cancel leases - Congress should amend the OCS Land Act to give the Secretary of the Interior authority to cancel any lease or permit at any time when continued activity under that lease or permit would cause serious harm or damage to human life, to property, to any mineral deposits, or to the marine, coastal, or human environment.
4. Re-examine incentives for timely exploration - Congress and the Interior Department should consider alternatives to the present system of collecting rents from OCS lease tracts without commercial discoveries of oil and gas, including progressive rental schedules, mandatory work programs, and a requirement that a portion of the leased acreage be given up after a specific time.
5. Improving the state and local roles in the process - the Interior Department should act under existing authority to make the following changes in the leasing and development process:
  - (a) Resource reports - issue resource reports to the state at the same time they are issued to federal agencies;
  - (b) Call for nominations and tract selection - hold an environmental briefing for state and local representatives on the lease area before nominations are due;
  - (c) Environmental Impact Statements (EIS) - create an EIS task force with representatives from state and local governments, the public, and private industry to assist in the development of work programs, the selection of contractors, and review of drafts;
  - (d) Development plans - invite state and local representatives to participate in informal discussions with offshore operators and USGS personnel before formal submission of development plans.
6. Environmental Impact Report (EIR) preparation and content - environmental impact reports prepared in conjunction with applications to site OCS-related facilities should carefully examine alternatives to the proposal and possible strategies for mitigating impacts, including consolidation potentials.

**PIMLOTT, D.H., "The Hazardous Search for Oil and Gas in Arctic Waters", Nature Canada, 3 (4), pp. 20-27, (1974).**

#### ISSUES

1. Arctic offshore waters are the most hazardous to industrial operations. An "awesome" range of environmental forces must be faced: the presence of ice in many different forms; the shortness of the ice-free season; the intensity and duration of the cold during the winter; the occurrence of intense storms which are difficult to predict; and the occurrence, in some areas, of very high pressures in geological formations.
2. Technology and equipment do not exist which would be available or could even remotely be considered adequate to clean up a massive oil spill in Arctic waters.
3. According to the author, "the history of offshore development has been the history of DINA ascendancy over the interests of the Department of the Environment. At every step, Environment Canada's sphere of action has been narrowed and usurped by DINA."

## RECOMMENDATIONS

1. In retrospect, the autor states that the momemtum of development has far outpaced the efforts of researchers and legislators to shape and influence events in the Arctic. "The history of the preparations" for offshore drilling adds yet another piece to the mounting evidence in support of the charge that the protection of the environment is being subverted to economic development in the North.

**ROBINSON, A.H., "Planning, Considerations for Preservation and Use of the National Seashores", Coastal Zone Management Journal, 5 (1/2), pp. 5-34, (1979).**

## ISSUES

1. The potential conflict between public and private interests in seashores has been further accelerated by the equal rate of growth of recreational use by the public and private development of the beachfront properties as well as the failure of the U.S. government to establish national seashore parks sooner.
2. The primary objective of any national seashore park must be to preserve the natural and scenic values. Active or mass recreation is therefore secondary.
3. The national seashore planning process must address such issues as: land classification/suitability (zoning), carrying capacity, access transportation modes, land ownership and legal jurisdiction, and traditional resource use.

## RECOMMENDATIONS

1. Most national seashore parks were created by individual Congressional Acts. Although separate enabling acts are time-consuming, they have the advantage of ensuring that each is carefully considered and the trade-offs between preservation and use carefully evaluated. The separate Congressional Act also ensures that each management plan for a national seashore park is a blend of legislative mandate, service-wide policy and public involvement.
2. A national seashore park planning process must consist of six important steps:
  - (a) statement for management (of goals and objectives);
  - (b) outline of planning requirements - defining the scope and sequence of planning;
  - (c) information base;
  - (d) development and analysis of alternative strategies;
  - (e) environmental assessment;
  - (f) environmental review.
3. Use-suitability analysis is an important first step in the formulation of any management policies regarding intensity of use and development. The natural zone (where development is to be minimal or absent), the historic zone (areas of historic sites where compatible development is possible), the development zone, and the special use zone must all be identified. The visitor-carrying capacity of these zones must also be evaluated, using either a systematic objective analysis approach or a subjective approach.

**ROSENER, J.B., "Intergovernmental Tension in Coastal Zone Management: Some Observations", Coastal Zone Management Journal, 7 (1), pp. 95-109, (1980).**

## ISSUES

1. While preservation, protection, development, and restoration of coastal resource can be legislated as the main objective of coastal zone management, achieving these objectives requires administrative skills and political will.
2. The "Pull of Local Control" means that there will be inherent conflicts between levels of government in coastal management programs, especially when local officials view resource protection differently than do state or federal officials.

3. Because local officials often resent usurpation of their land-use regulatory power and view resource decisions in a local context, the issue of permit veto power and the allocation of permit authority are important factors in understanding intergovernmental tension.

**SHABMAN, L.A., "Toward Effective Public Participation in Coastal Zone Management", Coastal Zone Management Journal, 1 (2), pp. 197-207, (1979).**

#### ISSUES

1. Public participation is essential in the development and administration of coastal zone management programs. Through citizen involvement, public needs and aspirations can be reflected in use decisions for the coastal zone.
2. The goal of a responsive public agency is to reconcile conflicting public preferences as expressed and supported by different political sectors. At the same time, a public agency must make choices that will ensure the organization's viability.
3. There is a general public apathy with respect to coastal zone management.
4. Since public participation seeks to increase communication of information, it is important that factors affecting information flows be given due consideration in any effective development of a public participation program. After all, communication of information is the link between an agency and the public it serves.

#### RECOMMENDATIONS

1. The main factor influencing information flow is leverage. Leverage has two components: sources of information and contents of information. However, the greater the leverage behind a piece of information, the more likely it is that the information will be used in decision-making and therefore determine an agency's achievement of the goals of responsiveness and viability.
2. In evaluating the information received, decision-makers make a judgment about the importance of the information in achieving agency goals. This judgment is based upon the regulation governing agency decision-making, the training bias of the decision-maker, and the issue context.
3. Those who control political resources and are willing to use these resources to communicate their preferences and beliefs are likely to be heard in a pluralistic society. Political resources are determined by authority, legitimacy, unity and cohesion, data base, technical expertise, staff and budget considerations.

**SHANKS, L.R., Coastal Systems and Management Options Related to Outer Continental Shelf (OCS) Development, U.S. Fish and Wildlife Service, Biological Services Program, Washington, DC, FWS/OBS-78/74, 13 pp., (September, 1978).**

#### ISSUES

1. The coastal region is a complex blend of earth, air, water, and hundreds of species of plants and animals, all functionally interrelated. Protection of coastal resources requires the maintenance of a functioning system extending, at a minimum, from the critical line of near high water to the continental shelf. Protection of coastal resources depends not on the protection of isolated points (key habitats), but on the protection of a process (ecosystem).
2. Dredging activities possibly pose the greatest single threat to many coastal ecosystems and create complex environmental management problems.
3. The risk of spills and disruption to aquatic communities is associated with the construction and operation of pipelines.
4. Site preparation requires adequate consideration of buffer areas: key habitats, runoff and erosion control, and surface water-system protection.



5. Studies have shown that alteration of wetlands significantly disrupts the coastal system. However, due to their location on the edges of most coastal bays and estuaries, wetlands become involved in nearly all developments in the coastal zone.
6. Shoreline alteration can extensively damage natural resources in the coastal zone. Even though alteration may look small in relation to the size of the coastal system, the cumulative effect of the process must be considered.

#### RECOMMENDATIONS

1. When coastal planning involves a dredging project, many of the environmental problems or issues may be detected by evaluating the following items: type of dredging equipment, volume of material to be removed, whether the project is original construction or maintenance dredging, location of spoil disposal areas, tidal circulation patterns in relation to dredging, and key habitats. Several techniques to minimize impacts associated with dredging are mentioned and are classified into three groups: techniques to reduce the frequency of maintenance dredging, to control turbidity and sedimentation, and to dispose of spoil in the least damaging manner.
2. Pipeline routing and construction should be evaluated to identify possible problem areas. Considerations include the following: pipeline size and safety features, pipeline routing offshore, landfall siting and rehabilitation methods, laying pipeline in wetland and estuarine areas, and key habitats.
3. Site preparation involves a commitment to land clearing and construction of a permanent facility. Since there are no alternatives after this commitment is made, the site should be selected to avoid, as much as possible, key habitats, prime flood areas, aquifer recharge areas, and similarly sensitive sites. Local soil and groundwater conditions must also be considered.
4. Coastal wetlands are identified as key habitats and should not be developed because of their extreme value to coastal ecosystems. If development should occur, management techniques must encourage activities that do not alter wetlands.
5. When evaluating shoreline alterations relating to a proposed project, the coastal planner must consider the site itself, the effect it may have on adjacent properties, and the cumulative impacts of continued development. When evaluating a specific site, the following items should be considered: type of facility, location of structure in the tidal zone, type of structure, and key habitats.

**SORENSEN, J., "State-Local Relations in Coastal Zone Management: Implications for Change", Coastal Zone Management Journal, 6 (4), pp. 295-302, (1979).**

#### ISSUES

1. There is a growing shift away from the historical practice of state governments delegating their constitutional land use management power to local governments. By 1973, 48 of the 50 states had enacted or proposed state land-use powers. The passage of the national Coastal Zone Management Act (CZMA) also provided a further incentive for states to reassert their control over land and water uses.
2. The only significant opposition to the federal coastal zone management effort before the passage of CZMA came from the local government lobby who foresaw the erosion of their power to control land use. Local government opposition to relinquishing or sharing authority is one of the major reasons for the delays by all coastal states in their coastal zone program development.

#### RECOMMENDATIONS

1. While the CZMA clearly intended the states to be the focal point of coastal zone management, local governments were to be involved in the program development. To ensure more effective local government involvement, some states enacted legislation that created a state-local Collaborative Planning Process (CPP). The CPP approach meant that the state and local governments were to work jointly to prepare and implement local, regional or state land-use plans.
2. The author feels that CPP is not the most appropriate arrangement for all states; because there were considerable state differences in the methods used to implement programs, most local coastal programs contained vague and non-specific policies and some state-local collaborative programs were structurally deficient. The author therefore recommends that the Act be redrafted to enable states to impose sanctions on local governments where necessary, to reverse local government permit decisions or appeals

that are inconsistent with the certified local programs, and to reverse amendments to certified programs that do not further the objectives of the Act.

**STATE OF ALASKA, Office of Coastal Management, Alaska Coastal Bibliography and Index, Region A, Northwest Alaska, Information Services, Arctic Environmental Information and Data Center, University of Alaska, Anchorage, AK, 103 pp., (January, 1980).**

This bibliography, put together by the State of Alaska, Office of Coastal Management, deals with all aspects of research concerned with the coastal zone. The data base deals specifically with the northwest region of Alaska.

This bibliography with indexes (author, subject, region and geographic) was generated from publications, data files, and current research concerning the coastal zone on a continuously monitored basis. Thus, the research compiled in this document would be useful to coastal communities in the formulation of their coastal management plans and to other jurisdictional bodies - provincial or federal-agencies - in carrying out their mandated responsibilities over coastal resources.

**STONE, J.H., L.M. BAHR, J.W. DAY, R.E. TURNER and P.H. TEMPLET, "Developing Management Guidelines for Oil and Gas Activities: The Louisiana Experience", Coastal Zone Management Journal, 6 (1), pp. 9-35, (1979).**

#### ISSUES

1. In addition to more than 70 years of both offshore and onshore petroleum production activities, Louisiana has the highest level of activity associated with petroleum production in the U.S., with over 70 000 workers employed in petroleum and natural gas activities in the coastal parishes. The coastal zone of Louisiana, which constitutes 25% of the wetlands of the contiguous 48 states and produces 28% of the fisheries tonnage of U.S., is a broad flat wetland interspersed with ridges of higher land.
2. The petroleum production activities, especially the ancillary development activities (dredging of navigation canals, increased erosion of land due to boat traffic, oil pollution from spills and leaks, and industrial and residential developments), have had serious impacts on the environment and health of the residents in Louisiana's coastal zone. Those impacts have generated the need for management guidelines to control oil and gas activities.
3. Management guidelines should be based on ecological principles, quantifiable, and systematic, and should be able to provide alternatives. However, the greatest problem is to convince the oil and gas industry that the guidelines are designed in their own interest and should therefore be used.

#### RECOMMENDATIONS

1. Before developing management guidelines for the oil and gas industry, the following "problems" have to be solved:
  - (a) to agree that there are environmental impacts;
  - (b) to estimate the extent of the impacts;
  - (c) to establish procedures (namely guidelines to deal with impacts);
  - (d) to solve technical problems associated with guidelines;
  - (e) to transfer and implement procedures or guidelines; and
  - (f) to enforce the procedures or guidelines.
2. A conceptual model should be constructed first in any development of environmental management guidelines, because the model provides a framework for systematic testing of potential interactions among all the major components of the ecosystem.
3. Transferring oil and gas from coastal wetlands to refineries and other users involves dredging by floating barges. Dredging in coastal wetlands can reduce the flow of water over marsh by 2-35%. Thus, the cumulative impact of oil and gas transport from coastal wetlands can be considerable.
4. The authors believe that the development of their guidelines suggests that several petroleum development activities can occur in coastal wetlands provided proper procedures are designed to mitigate the potential impacts. Another advantage with the development of guidelines is that it makes the decision regarding the use of air, land, and water predictable.

STRADLEY, J.R., "Unresolved Issues of Coastal Zone Management", Coastal Zone Management Journal, 6 (4), pp. 303-310, (1979).

#### ISSUES

1. Electric energy facilities, unlike other energy facilities, are of national and state interest and of regional and local benefit.
2. CZMA requires that federal agency activities and development projects and federally authorized private activities in the coastal zone or outer continental shelf be certified as consistent with an approved state program.
3. The Act requires that the program provide adequate consideration of the national interest in the planning and siting of energy facilities. However, NOAA fuses this facility-specific national interest with the broader national interest in coastal zone management.
4. The Act requires that state programs provide a method of assuring that local land and water use regulations within the coastal zone do not restrict or exclude land and water uses that are of regional benefit.

#### RECOMMENDATIONS

1. Recognizing the urgent need to protect and give high priority to natural systems in the coastal zone and the importance of attaining a greater degree of energy self-sufficiency, Congress provided for federally funded state management of coastal resources.
2. Since coastal interests have differing concerns regarding consistency, the fear has been expressed that federal agencies may act unreasonably in determining that their activities are consistent, or that states may unreasonably withhold concurrence, prescribe, or delay national interest facilities. It is also feared that antagonists may use consistency procedures to delay licensing hearings for needed energy facilities. In order to overcome these fears, it has been proposed that the federal consistency provision of the Act be restricted. In addition, the Act should be amended to direct states to plan for energy facilities to be located in the coastal zone.
3. Coastal agencies should not be given authority to make siting decisions for energy facilities. Congressional direction is also needed to assure balanced decision-making so that coastal consideration will reflect rather than control energy facility needs.
4. NOAA has not required such state assurance. Instead, NOAA has allowed states to define what constitutes unreasonable restrictions. Congressional direction is needed to direct NOAA to require such state assurance.

UNITED STATES CONGRESS, 93rd Congress, 2nd Session Committee Print, Outer Continental Shelf Oil and Gas Development and the Coastal Zone, U.S. Government Printing Office, Washington, DC, vii, 206 pp., (1974).

#### ISSUES

1. "Data on land use, growth patterns, and often socioeconomic problems in the coastal zone associated with offshore petroleum development are inadequate and sometimes quite contradictory." The need for information also affects employment, ocean resources and biological data, fisheries, and exploratory and geological data. Studies on these areas of interest are essential in order to facilitate decision-making.
2. "Oil and gas development on the outer continental shelf will have an environmental impact on the coastal zone of adjacent states." Various reports are mentioned and each stresses a particular aspect of the broader environmental issue. Several conclusions and recommendations are mentioned.
3. The impact of offshore oil and gas development on the coastal zone can be felt in the form of damage to wetlands, destruction of coastal areas, or competition with other uses of the coastal zone.
4. Socioeconomic impacts of OCS development vary according to local and regional structural differences. Employment, population growth, demands on social services and the infrastructure, and land use are specific issues that come under the broader socioeconomic issue.

5. The problem of assessing the environmental impact of OCS oil and gas development on the oceans comes from the lack of knowledge about these resources. This problem is complicated by lack of confidence or uncertainty in oil spill records.
6. Federal management and OCS leasing policies are examined as well as the problems inherent to them. The role of the state and its relations with the federal government (especially in terms of the CZMA) are also commented upon.

## RECOMMENDATIONS

Summaries of pertinent reports accompany the main study: Council of Environmental Quality, "OCS Oil and Gas - An Environmental Assessment"; University of Oklahoma, "Energy Under the Oceans". Major conclusions and recommendations of these individual reports are drawn in the appendix section and cover technological, environmental, institutional and socioeconomic issues of OCS development.

**UNITED STATES DEPARTMENT OF COMMERCE, The First Five Years of Coastal Zone Management: an Initial Assessment, Office of Coastal Zone Management, Washington, DC, ii, 60 pp., (1979).**

This report documents the results of state coastal management activities that address important concerns in the CZM Act: the protection of significant natural resources, the better management of development in coastal areas, the provisions of additional recreational access to the coast, and better coordination and simplification of government decision-making procedures. The report discusses basic questions about coastal zone management and examines the nature of work undertaken by the States before assessing the worth of this program and its future.

It is not an issue/recommendations-oriented document but a factual report on the accomplishments of the program in the first 5 years of its existence.

**UNITED STATES DEPARTMENT OF THE INTERIOR, Managing Oil and Gas Activities in Coastal Environments, Fish and Wildlife Service, Biological Services Program, Washington, DC, 66 pp., (1978).**

## ISSUES

1. Coastal zones are sensitive environments which make it necessary to pursue oil and gas development with the least possible disruption of natural land formations, water flows, and indigenous wildlife.
2. Petroleum development activities and their impacts vary according to the category of ecosystem involved: uplands, seasonally flooded wetlands, saturated wetlands, and open water.

## RECOMMENDATIONS

A number of mitigative measures can be introduced for activities taking place in individual ecosystems. Very specific and detailed comments accompany each activity (from preexploration to termination) and can be summarized in generic fashion.

1. Preexploration, site access and preparation, and drilling should be performed during the season of minimum waterfowl activity.
2. Minimize area affected and use space efficiently in order to avoid critical areas or sites, e.g. waterfowl and wildlife concentration.
3. Movement (travel) should take into account the more sensitive areas and should be minimized.
4. Use mechanisms (culverts, bridges, bulkheading) to prevent erosion and maintain waterflows.
5. Adequate planning of land uses: facilities should be located in ecologically less desirable areas or previously disturbed areas.
6. Minimize the release of pollutants to the environment.
7. Conservation is imperative to reduce the total area disrupted. Rapid restoration of the vegetation cover must be implemented.

8. In case of spills, knowledge and implementation of an efficient contingency plan is a must.

**UNITED STATES DEPARTMENT OF INTERIOR, State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, Washington, DC, vi + 94 pp., (January, 1977).**

#### ISSUES

1. The United States' program to develop the outer continental shelf (OCS) for petroleum resources could have significant impacts on coastal areas. The coastal states likely to be affected expressed serious concerns about the availability and adequacy of the information they needed to make planning and management decisions about onshore activities and impacts related to OCS petroleum development.
2. Five key concerns were common to all the coastal states:
  - (a) protecting the coastal environment, unique coastal ecosystems, and other nearshore and coastal resource areas;
  - (b) protecting existing basic industries and economic activities from OCS development-related resource damage and from competition for shoreland, labour, and local capital sources by OCS industries;
  - (c) improving state access to Federal agency and industry information regarding exploration, development, and production on the OCS;
  - (d) alleviating potentially significant local impacts from OCS development; and
  - (e) improving the OCS petroleum leasing and management process as currently administered by the Department of Interior.
3. The states identified seven priority needs for information: nearshore environmental baseline studies, improved oil spill trajectory models, estimates of recoverable resources, pipeline corridor management studies, industry requirements for employees, fiscal impacts on state and local governments, and industry requirements and siting criteria for onshore facilities.

#### RECOMMENDATIONS

1. Federal agencies should respond specifically to the states' concerns and information needs.
2. State capabilities to plan OCS-related onshore and nearshore impacts should be improved.
3. Industry should improve communications to meet state information needs.
4. The concept of proprietary data should be more clearly defined through a review of current codes and regulations.
5. All parties involved should establish a formal process of developing and sharing information.

**UNITED STATES SENATE, 94th Congress, 2nd session, Effects of Offshore Oil and Natural Gas Development on the Coastal Zone, U.S. Government Printing Office, Washington, DC, 396 pp., (March, 1976).**

#### ISSUES

1. OCS leasing and management: many states and environmental groups have advocated that exploration of the OCS should be separated from the subsequent development and production phases. The environmental impact statement or the preparation for onshore impacts are based only on estimates of potential resources which may differ greatly from the actual process. Due to experiences of exploration activities, it may prove to be undesirable to continue with development and production of certain parts of the OCS. Opponents maintain that this expensive and gradual process cannot be broken easily.
2. It is recognized that the potential accidental release of oil into the marine environment represents, from an ecological viewpoint, the most critical aspect of OCS development.
3. The environmental impact of OCS oil and gas operations is likely to be most critical in the coastal zone because of its importance to the entire marine ecosystem. The primary adverse impact on wetlands would probably arise from channel dredging for pipelines and the creation of dredge spoil banks and

access roads for workers and equipment. Other onshore environmental impacts include land development disruptions, various types of pollution, and changes in plant and animal life.

4. Multiple use and competing claims over use of the coastal zone present the major problem regarding socioeconomic and land use impacts. Careful planning of activities in coastal areas has become imperative.
5. Public expenditures arise from the infrastructure requirements of those local areas affected by OCS developments. The state and local governments want some compensation for the social and economic cost of OCS developments.
6. Projections of onshore impacts in terms of employment and population, and in terms of secondary industrial and commercial activity, are difficult to make as few data are available.
7. The impact of OCS oil and gas developments on fisheries is an issue that has not received a great deal of attention. Preliminary results of studies indicate that no serious damage has been done to the fishery resources of the Gulf of Mexico; however, so far no conclusive evidence pro or con appears to exist.

## RECOMMENDATIONS

This document is mainly concerned with presenting a series of facts about the effects of OCS developments on the coastal zone. However, a few specific recommendations of a technological nature are presented in the scope of the offshore environmental impact.

1. The use of blowout preventers has been successful in bringing a number of near accidents under control.
2. During the transport from offshore to onshore facilities, improved coating and cathodic protection of pipes can reduce pipeline corrosion rates and prevent leaking.

**WARREN, R., "Coastal Communities - Partners or Puppets in Outer Continental Shelf Development?", Coastal Zone Management Journal, 4 (1/2), pp. 119-125, (1978).**

## ISSUES

1. The adoption of the policy to develop the oil and gas resources of the U.S. outer continental shelf (OCS) generated considerable controversy over its onshore and offshore socioeconomic and environmental impacts.
2. The third tier in the federal government system was effectively excluded from the OCS development process by "artificially" compartmentalizing decisions on leasing offshore sites from exploration and development phases.
3. In their formulation of policies, the federal and state governments have treated local governments as a "residual category" that is capable and willing, or could be forced, to create and manage the onshore infrastructure needed to implement national, state and corporate decisions.

## RECOMMENDATIONS

1. To induce local governments to adopt positive attitudes, or at least to be neutral, and also to compensate local areas for absorbing negative spillovers associated with OCS development, CZMA was amended to provide starting funds to local communities to establish support facilities.
2. The assumption by the federal and state decision-makers that the agreement and understanding reached would be automatically accepted by local governments led to a number of surprises - local governments exercised veto powers over facilities within their boundaries. This assumption has been attributed to the fact that the Secretary of Interior and his staff totally misunderstood the powers held by state and local governments in a federal system or that they deliberately choose to ignore them.
3. Coastal communities differ in varying degrees from one another in socioeconomic characteristics, resources, and preferences for facilities. Local government officials often operate in a complete vacuum with respect to information about the locational intentions of companies. The net result is that there is a high degree of uncertainty concerning the future location of forward bases and subsequent support facilities and little incentive to invest money and personnel in anticipatory planning related to possible impacts and infrastructural needs.

### III FACILITY TYPES AND REQUIREMENTS

AHERN, W.R., "California Meets the LNG Terminal", Coastal Zone Management Journal, 7 (2-3-4), pp. 185-221, (1980).

#### ISSUES

1. The proposal to site a liquefied natural gas (LNG) terminal on the coast of California has raised the issue of "birds versus people". An LNG terminal in an industrial area would spare an environmentally sensitive area from negative impacts but would pose a greater risk to people.
2. Public agencies with responsibilities for LNG-related activities develop "cascading risk aversion" where there are perceptions of public safety and environmental risks.
3. Because companies "shop" for expert consultants and because there is a natural desire on the part of consultants to please clients, the issue of safety is often not resolved with any credibility.
4. Professional orientation is an important factor that affects attitudes towards risks. To engineers, LNG risks are acceptable and controllable; to biologists, LNG terminals pose a chemical threat to life; planners, on the other hand, attempt to minimize LNG risks through land use control and remote siting.

#### RECOMMENDATIONS

1. To generate public confidence in the LNG siting process and to provide a reasonable level of public safety, responsible federal agencies should first develop a wide range of standards and regulations on LNG terminals.
2. A public agency should be charged with the responsibility of conducting an open LNG terminal site screening, evaluation, and ranking before terminal applicants settle on a site.
3. Any decision regarding LNG terminal siting should have three objectives:
  - (a) protect the public from safety risk;
  - (b) ensure adequate energy supplies;
  - (c) protect coastal resources.

ALASKA CONSULTANTS, INC., Marine Service Bases for Offshore Oil Development, Report prepared for the Division of Community Planning, Department of Community and Regional Affairs, State of Alaska, Anchorage, AK, 87 pp., (1976).

This study describes the types of service bases (characteristics and operating requirements) that have served the needs of the offshore oil industry in settings similar to the Gulf of Alaska. Topics covered include the following: location of service bases, materials and service requirements, service base facilities, and land and labor requirements. Experiences in the North Sea are used throughout the document. The basic issue behind this study is that "marine bases carefully conceived and efficiently operated can make positive contributions to a community's economic diversification and stability" whereas "poorly planned facilities can be detrimental to a community's interest and cause negative onshore impacts associated with OCS development."

DUCSIK, D.W., "Integrating Coastal Zone and Electric Facility Planning: Weak Links in the Institutional Chain", Coastal Zone Management Journal, 8 (4), pp. 263-288, (1980).

#### ISSUES

1. While plans for energy-related development along the coast must pay special attention to a number of societal objectives, including wise use of the shoreline, it is doubtful whether present institutional mechanisms are "adequate" in dovetailing coastal zone policies with the site selection process.
2. Because location at preferred sites may generate adverse impacts on aquatic ecosystems, the siting of major energy facilities at or near the water's edge is one of the difficult conflicts involved in the use of coastal resources.

3. Questions of intragovernmental cooperation and coordination can become important problems in integrating coastal policies with the existing bureaucratic machinery responsible for the licensing of facilities.
4. The regulatory process is a tangled web which is at "best complicated or at worst borders on total disarray", partly because jurisdiction over the siting and design of coastal energy facilities is often diffused across a number of separate agencies.
5. Coastal facility siting process is based on comparative evaluation of a variety of parameters which can be grouped as follows:
  - (a) power supply factors - e.g. geographic distribution, location;
  - (b) engineering design factors - e.g. proximity to large water supplies, soil conditions;
  - (c) environmental factors - e.g. land use compatibility, susceptibility to air or water pollution;
  - (d) institutional/political factors - e.g. demography, public attitudes, zoning restrictions.

#### RECOMMENDATIONS

1. The problem of loose interagency coupling has commanded the attention of coastal zone management policy analysts for some time. Three approaches have been put forward to help improve the deficiencies in the interface among agencies:
  - (a) designating a state coastal zone management agency as the lead regulatory body for coastal energy facility siting;
  - (b) establishing a formal means to assure input and consideration of the coastal zone management agency's views in the decision-making process;
  - (c) adopting a procedure whereby coastal zone management policies are incorporated into the various licenses, permits and zoning approvals.
2. While a number of options are considered in a coastal facility siting process, the number and scope of options can be arbitrarily limited because the site selection usually takes place subsequent to capacity planning. This eliminates a whole class of options which may be less susceptible to environmental damage.
3. The siting process tends to devote the bulk of the analysis in the early phases to engineering/economics and coordinating issues and to postpone environmental issues until after a preferred site is identified. As a result, there may not be adequate information available to evaluate broad candidate areas or potential sites.
4. Analytical techniques used in facility siting should not obscure but rather should highlight tradeoffs involving the environment.

**FRIED, D.B. and W.F. HEDERMAN, "The Benefits of an Alaskan Natural Gas Pipeline", The Energy Journal, 2 (1), pp. 19-36, (1981).**

#### ISSUES

1. Despite the desire of the United States to develop domestic energy resources to replace uncertain imported energy, the construction of the pipeline to transport natural gas from the Alaskan North Slope to the lower 48 states has been delayed. There are several reasons for the delay, including doubts about the economic viability of the project and the extent to which the Alaskan gas compares with other energy alternatives.
2. While the construction of the pipeline could provide major economic benefits to the countries involved, "fair" distribution of the benefits among the participants cannot be guaranteed.

#### RECOMMENDATIONS

1. The net national economic benefit (NNEB), that is the value to the United States of the Alaskan gas project, has been estimated to be \$22 billion. This should provide sufficient incentives to the sponsors of the project. Thus, the authors recommend that the necessary changes to the Alaskan Natural Gas Transportation System (ANGTS) legislation be made so that the project can be undertaken.



2. Based on their analysis, the authors concluded that imported fuel will likely be part of the domestic United States energy supply for the life of the ANGTS. Alaskan gas should therefore not be considered as an "either-or" alternative to Mexican or Canadian gas supplies.

HALL, C.A.S., R. HOWARTH, B. MOORE and C.J. VOROSMARTY, "Environmental Impacts of Industrial Energy Systems in the Coastal Zone", Annual Review of Energy, 3, pp. 395-475, (1978).

#### ISSUES

1. The coastal zone, being rich in biotic resources, should be able to provide society with aesthetic, recreational and fishery resources indefinitely. However, the provision of these resources is threatened by the siting of large-scale energy facilities in the coastal zone because of mismanagement and the lack of proper consideration of negative environmental impacts on the ecosystem in the decision-making process.
2. Diminishing domestic energy supplies have led to the development of such large-scale energy facilities as oil, gas, and electric power plants in the coastal zone. The continuation of such a trend will likely lead to further deterioration of coastal waters, lands, and salt marshes.
3. There is a possible synergistic interaction between pesticides, PCB, and oil and gas hydrocarbons in coastal sediments. It has also been noted that formation waters released during drilling operations contain heavy metals. However, very few studies are devoted to the specific investigation of synergistic effects by hydrocarbon and other contaminants on organisms.
4. The construction of electric generating facilities can produce short- and long-term adverse environmental impacts on sensitive bottom-dwelling organisms.
5. The impact of petroleum products and petroleum-related energy facilities on the coastal environment may be measured by the damage done to birds and to the larvae and/or eggs of fish. Oil spill cleanup techniques are still crude and largely ineffective, and they often contribute to worsen the damage done.

HILDRETH, R.G., "The Coast: Where Energy Meets the Environment", The San Diego Law Review, 13 (2), pp. 253-305, (1976).

#### ISSUES

1. Four coastal-dependent energy development programs (deep water ports, liquefied natural gas (LNG) terminals, floating nuclear power plants and OCS oil and gas development) seem to generate the greatest number of environmental and socioeconomic impacts on the coast.
2. While some OCS development activities may result in minor or short-term impacts, others, such as dredging and filling of wetlands, and air and water pollution from refineries, can cause serious long-term environmental damage. Thus, the long-term impacts on the coastal environment could be significant enough to outweigh any short-term gains from OCS oil and gas exploitation.
3. While large communities appear to absorb OCS development much better because of their diverse economic base and greater planning resources, their pollution problems are much worse than those in small communities. Small communities also do not have sufficient schools, housing, roads, and other facilities to enable them to cope with the rapid increases in jobs and population that accompany OCS oil and gas development.
4. The four principal components of the legal framework in the United States, within which OCS development takes place, are:
  - (a) Truman Proclamation (1945) and 1958 Geneva Convention on the Continental Shelf;
  - (b) Submerged Lands Act (1953) and Outer Continental Shelf Lands Act (1953);
  - (c) National Environmental Policy Act; and
  - (d) Coastal Zone Management Act (CZMA).

However, the legal framework does not encourage local governments to plan for onshore impacts of OCS development.

MARCUS, H.S., "Port Reception Facilities and the Coastal Zone", Coastal Zone '80, American Society of Civil Engineers, New York, NY, Vol. 11, pp. 1594-1607, (1980).

#### ISSUES

1. Port reception facilities are designed to receive three main types of wastes from vessels: sanitary wastes, oily bilge water, and tank washings. Of these three, tank washings wastes are the most difficult to handle because they usually contain chemicals.
2. The 1973 international convention for the prevention of pollution from ships (MARPOL '73) was modified by protocol in 1978. As a result, the current governing regulations require that ports provide facilities to make adequate reception easier without undue delay to ships. There is, however, a problem regarding the definition of "adequate facilities".
3. There is also the problem of disposing of the wastes received. The disposal question brings the international convention into conflict with domestic pollution regulations.

#### RECOMMENDATIONS

1. Under a proposed regulation, the U.S. Coast Guard will compensate chemical carrier operators when undue delay takes place in port because of the international regulations.
2. The U.S. Resources Conservation and Recovery Act (RCRA) governs all aspects of hazardous waste disposal, including tank washings from chemical carriers. However, off-site disposal may be difficult and expensive in some geographic areas. Besides, local restrictions on siting of hazardous waste disposal facilities further contribute to the delay in the development of new sites.
3. In general, the author believes that MARPOL '73 (as modified in 1978) and federal legislation regarding chemical tank washings will not have a significant impact on the coastal zone as a whole, but could have severe impacts in specific areas.

MORELL, D. and G. SINGER, Alternative Energy Facility Siting Policies for Urban Coastal Areas: Executive Summary of Findings and Policy Recommendations, Princeton University, Center for Energy and Environmental Studies, Princeton, NJ, iv, 121 pp., (November, 1980).

#### ISSUES

1. Multiplicity of interest in various aspects of the coastal zone raises conflicts in three particular policy areas: energy facility siting, coastal zone management, and urban development. These pose difficult choices between growth, equity, and environmental preservation.
2. "Conflicts arise between rural and urban interests along the coast. Both groups disapprove the siting of facilities with major environmental impacts in their respective area of the coast and those seeking sites for energy facilities find themselves whipsawed from one area to the other."
3. Principal issues of the proposed energy facilities rejected in the Jersey City area are: (a) citizen opposition to increased industrialization on the waterfront at the expense of additional amenity and recreational activities; (b) pollution and safety hazard, and public concern and degree of acceptance of energy development; (c) economic concerns like low employment rate (per acre), unattractive tax returns, etc., and (d) permitting procedure and regulations.

#### RECOMMENDATIONS

1. "Overall national policy is needed to achieve three basic goals: greater energy self-sufficiency; urban revitalization; protection of fragile rural coast lines.
2. Energy facility siting decisions must be made within the framework of national policy and state and regional plans, so that government initiative can be established.
3. Coastal zone and other government regulations should enforce a distinct preference for inland (as opposed to coastal) siting and permitting of new energy facilities. Only truly coastal-dependent operations should be allowed to locate at the water's edge.

4. To allow maximum public participation, local permit approval should take place first, or at least simultaneously with state and federal permit approval. A clearly structured sequence of decision making is preferable to centralization of authority by a single agency.
5. Compatibility of new facilities with existing and planned land uses in urban waterfront areas is essential if nascent revitalization efforts are to succeed. If any new energy facilities are indeed introduced into such areas, their scale, design and adjacent land use patterns become crucial so that they do not come to dominate the urban coastal landscape.
6. Siting policy must distinguish among facility types and community characteristics, so that overall principles are sensitive to individual factors.
7. Innovative siting should receive greater government and corporate attention. Alternate site plans could be required as a supplement to more traditional proposals.
8. Government should adopt procedures to lessen permitting or mid-construction delays, both of which are costly to industry.
9. Deep water ports should be considered as an alternative to onshore siting, especially in densely developed metropolitan regions. Environmental impact, however, should receive close scrutiny.
10. Any new energy facilities in urban areas should be labor intensive, have low levels of pollution, and be compatible with other land uses, including waterfront renewal. Appropriate scale is essential to avoid domination of the urban landscape by energy facilities and to maintain public access to the waterfront.
11. Clustering of energy facilities may be preferable in rural areas, but should be avoided in the urban setting because of already dense development, population and pollution.
12. Buffer zones around major energy facilities should be ensured by explicit government policy and where safety issues are the dominant concern remote siting with adequate buffer zones should be enforced by government regulations.
13. The EPA's regulations to protect environmentally-sensitive areas under the Resource Conservation and Recovery Act should be integrated into the early stages of the energy facility siting process.
14. Alternate energy technologies, such as cogeneration, should be encouraged by national policy, especially in urban areas where the existing industrial infrastructure is conducive to their development and where such energy sources may attract needed economic development".

**MORELL, D.L., "Energy Facility Siting in the Urban Coastal Zone: Compatible or Not?", Coastal Zone Management Journal, 6 (2/3), pp. 215-232, (1979).**

#### ISSUES

1. Federal statutes and state coastal laws were framed with a distinct emphasis on the preservation of rural/recreational areas. The reasons for this emphasis included the desire to protect fragile wetlands, beaches and dunes from indiscriminate urban development. In recent years, programs have been devised to redevelop urban waterfronts as a means of revitalizing local economies and also to prevent further degradation of the urban environment. Thus, the rural/urban coastal dichotomy of facilities siting emerged.
2. Citizen activists have played leading roles in opposing the siting of energy facilities in urban areas. Growing sentiments to recapture the waterfront for people (not for exclusive industrial development), intertwined with the drive to revitalize the city, enflame citizen opposition. Potential taxes and employment opportunities did not win over arguments about pollution and potential accidents.

#### RECOMMENDATIONS

1. City dwellers are beginning to view waterfronts as foci of urban renaissance, and as places where activities should be oriented towards people not industry. Failure by site planners and government officials to gauge the changing perceptions and expectations of city residents can be very costly.
2. Coastal zone management policies should encourage certain facilities such as refineries, oil storage tanks and power plants to locate in clusters away from the coastal zone. "Net adverse impact" payments and tax sharing programs could be used to encourage interior location of energy facilities.

**NEW ENGLAND RIVER BASINS COMMISSION, Onshore Facilities Related to Offshore Oil and Gas Development: Estimates for New England, Boston, MS, 287 pp., (1976).**

This report presents detailed scenarios of offshore activities and onshore facilities which might be expected in New England from three sizes of oil and gas discoveries on the Georges Bank: high find, medium find, and exploration activity with no find. Each of these situations implies a different level of both offshore and onshore activity. The report includes sections on scenario development and estimation of the levels of activity (service base, platform fabrication and installation, pipelines, etc.) associated with each level of find.

**NEW ENGLAND RIVER BASINS COMMISSION, Onshore Facilities Related to Offshore Oil and Gas Development: Fact-Book, Boston, MS, 750 pp., (1976).**

The fact book is a detailed reference document which describes principal onshore facilities related to offshore oil and gas development. "Each facility chapter has three sections:

1. Description of facility: a detailed description of the facility and the activity or processes that take place there.
2. Timing, trends and options in facility siting: a discussion of the factors that influence, and the steps involved in siting in a frontier area.
3. Siting characteristics, requirements and impacts: a comprehensive description of land, waterfront, water, energy, transportation, labor, and capital requirements, site alteration and construction impacts; and environmental impacts."

Facilities covered within the report include: service bases, repair and maintenance yards, transportation facilities, gas processing and treatment plants, refineries, platform fabrication yards, pipe coating yards, petrochemical plants, partial processing plants, ancillary industries, district offices, and land pipeline systems.

**NEW ENGLAND RIVER BASINS COMMISSION, Onshore Facilities Related to Offshore Oil and Gas Development: Methodologies for OCS-Related Facilities Planning, Boston, MS, ix, 151 pp., (March, 1978).**

"Methodologies is designed as a management tool aimed primarily at State officials responsible for developing strategies for managing OCS-related onshore development in frontier OCS areas." Three related methodologies are documented in this volume and they deal with the planning issues summarized below:

- (a) timing and scale of offshore activity from exploration through field development and production stages;
- (b) kinds and numbers of facilities which may be sited in a region adjacent to a particular OCS resources province given a level of offshore development activity;
- (c) identification of alternative sites for the onshore facilities associated with OCS development -sites which are capable of meeting industry's requirements and satisfying public policy criteria for facility development.

**NEW ENGLAND RIVER BASINS COMMISSION, Onshore Facilities Related to Offshore Oil and Gas Development: Case Studies in OCS Planning, Boston, MS., ix, 80 pp., (July, 1978).**

## ISSUES

Several conclusions about the nature of the OCS planning effort at the state level are drawn from these case studies. The use of the various NERBC methodologies is suggested to solve or alleviate these eventual problems.

1. Long-range planning is usually far beyond usual political horizons and is most difficult because of the absence of hard data. In this context, planners are forced to gamble and are pressured to make sweeping judgemental generalizations.
2. "Use of any of the NERBC/RALI Project methodologies will require a fairly substantial allocation of time and manpower." However, this should be a minor problem for large state or city planning departments.

3. There will always be a need for additional and updated data for OCS-related facility planning, either for determining the requirements of the facilities or for assessing and planning for their impacts. Estimates are based on assumptions that may sometimes prove to be invalid.
4. "It should be assumed that existing policies will overlap and conflict, and that some mechanism will be needed to determine which policies are going to be most rigorously enforced to serve as a guide to the relative suitability of sites and coastal communities for development."
5. Regulatory changes are time-consuming; identification of desirable areas of modification must take place at as early a stage as possible.

#### RECOMMENDATIONS

1. "Wherever possible federal agencies should strive to provide the state and local official and planners with the tools and techniques to carry out their responsibilities (e.g. methodologies to assist them)."

**NIERING, F.E., "Alaska Gas Line at Crucial Juncture", Petroleum Economist, XLVII (3), pp. 97-100, (1980).**

#### ISSUES

1. Financing has been the main problem impeding the conclusion of an agreement on the proposed 7 649-km pipeline network to condition and transport natural gas from the North Slope of Alaska to the "Lower 40" states.
2. While the oil companies were excluded from existing participation in the pipeline for antitrust reasons, the Carter Administration looked to them for guarantees. Financing by the federal government was also ruled out. The oil companies have objected to such terms and are unwilling to become involved in the financing unless they have an element of the ownership and control.
3. Delays in regulatory approvals and energy legislation have also delayed the project for another 2 years.

#### RECOMMENDATIONS

1. The oil companies (EXXON) have proposed that they would require 40% equity in the pipeline and that gas conditioning facilities should be made part of the overall transportation system, so that their cost could be passed on to consumers. This position has formed a basis for further negotiations.
2. The construction of the pipeline would provide an incentive for stepped-up exploration in Alaska. There is also scope in the pipeline to expand capacity by about  $9.06 \times 10^7$  m<sup>3</sup>/day to accommodate additional flows from Alaska and Canadian gas from the Mackenzie Delta. In addition to providing a tie-in for Mackenzie Delta gas, the 3 268.5-km Canadian segment of the pipeline would provide between 50 000 and 100 000 jobs. The pipe, which would be made in Canada, provides an other \$1 billion in business for Canadian steel works.
3. The pricing of Alaskan gas, under the U.S. Natural Gas Policy Act (NGPA) 1978, at \$1.45 per million BTU, with an escalatory clause that is tied to rate of inflation, has provided an important breakthrough in pipeline project negotiation.

**RANDLE, R.V., "Coastal Energy Siting Dilemmas", Natural Resources Journal, 21 (1), pp. 125-159, (1981).**

#### ISSUES

1. Environmental, social, legal, and safety factors often intertwine to make political decisions about coastal energy facility siting a very complex issue.
2. The potential threat of violation of environmental standards and degradation of air and water quality by refineries and oil terminals, and the risk posed to human lives by liquified natural gas (LNG) terminals in urban areas, as well as the threat to tourism, fishing grounds, aesthetics, pollution and social values in rural areas often combine to generate angry political confrontation on the construction of coastal energy facilities.

3. The tradeoff principle could be used to resolve coastal energy facility siting disputes in both rural and urban areas.
4. The multitude of federal agencies with exclusive regulatory jurisdiction and the fragmentation of state and federal environmental permitting procedures make principled tradeoffs and intelligent coastal energy facility siting very difficult.
5. Another important factor which makes the development of a workable trade-off policy for coastal energy facility siting difficult is the lack of adequate liability protection insurance/fund to cover such catastrophic accidents as a large explosion or major oil spills.

#### RECOMMENDATIONS

1. To ensure that intelligent decisions are made, the coastal energy facility siting process should be sufficiently flexible to enable detailed analyses to be made. Siting processes should also be able to respond to the concerns of coastal residents.
2. In developing a workable tradeoff principle, an attempt should be made to ensure that multiple tradeoffs with respect to such issues as safety, liability insurance, siting of energy facilities and protection of wilderness areas are possible.
3. To streamline the coastal energy facility siting process, the federal regulatory authority, the state permitting procedures and court reviews should be consolidated. This consolidation would also help to minimize the adversary nature of the siting process.

**SAM, K., Production, Transportation, and Onshore Activities of Offshore Oil and Gas Development in the Beaufort Sea, Northern Assessment Group, Ottawa, Ont., 28 pp., (1975).**

#### ISSUES

1. As production progresses further out in the Beaufort Sea, the operating environment becomes increasingly more hazardous. Increasing water depths and the presence of multi-year pack ice are formidable problems. This will necessitate some changes in the design of production facilities.
2. The problem of transportation requires similar advances in technology. It is reasonable to expect that the industry will probably depend upon the use of the pipeline system. Such a scheme will face enormous problems. Apart from the tough environmental operating conditions posed by wind, waves, ice, low temperatures, darkness in winter, and fog, there are essentially three major technological problems: ice-scouring of the sea bottom, permafrost, and year-round maintenance.
3. The development of production and transportation facilities in the Beaufort Sea region will generate substantial onshore activity. The major concern from all of the onshore activity is the increase in population. Sudden demographic growth will have certain socioeconomic environmental impacts as the demand for expanded facilities and services increases. Any decision over the development of offshore oil and gas in the Beaufort Sea will affect the use of land, water, timber, fish, wildlife, and other resources of the area.

**UNITED STATES CONGRESS, Office of Technology Assessment, Transportation of Liquefied Natural Gas, U.S. Government Printing Office, Washington, DC, xii, 101 pp., (September, 1977).**

#### ISSUES

1. The possibility and consequences of a major spill due to a ship accident are the most serious concerns. Therefore, while the tankers appear to be well-designed and constructed, better control of vessel traffic in U.S. ports and waterways, improved inspection procedures after the ship has been commissioned, and mandatory crew and inspector training are needed.
2. A major issue deals with the siting itself of the onshore facilities. There is a need for establishing guidelines for choosing sites. Public safety is an important aspect of the question.
3. Regulation of LNG systems is hampered by jurisdictional overlaps, some gaps in enforcement, and the lengthy government procedures which do not result in timely decisions for the applicant and do not give the public adequate participation in decisions.

4. Planning is made difficult by the lack of firm and clean government policy and jurisdiction. The question of impact levels, pricing mechanisms, and siting criteria are all basic issues which should be determined before individual project decisions are made.
5. Risk assessment methods for LNG facilities have not been consistent in the past and have produced conflicting results. Public policy decisions about LNG systems should be made according to prudent siting criteria and strict design, construction, and operation standards.
6. The liability issue regarding LNG accidents is a complicated one. It seems possible that a ship accident, for example, could leave injured parties with little or no effective compensation.

## RECOMMENDATIONS

These recommendations come under the form of "actions desired" by various interested parties who consist of the following: gas utility companies, organized labour groups, state and local officials, related industries, and public interest groups. Basic recommendations relevant to all groups deal with the following aspects of LNG issues:

- (a) definition of clear policies on the part of the federal government;
- (b) acceleration of the regulatory process;
- (c) consolidation of the permitting process (one-stop permit process) and coordination between levels of government;
- (d) establishment of siting criteria on a generic basis and consideration of safety issues;
- (e) use of federal perception on environmental and siting issues; and
- (f) undertaking of a whole range of additional studies and promotion of research on various aspects related to LNG issues.

**UNITED STATES DEPARTMENT OF COMMERCE, Coastal Facility Guidelines, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, Washington, DC, xix, 96 pp., (August, 1976).**

This report provides information and recommendations on setting forth guidelines for facility development in the coastal zone. Section A of the report presents a methodology for identifying and initiating implementation procedures for management recommendations on specific facility types. Sections B and C apply the methodology to marinas and power plants in the states of Florida and Maryland.

The methodology is simple and flexible and can be modified to analyze different facility types or to develop performance standards. Although the methodology deals with environmental concerns, the approach can easily be adapted to include social and/or economic factors. The two case studies from Florida and Maryland provide a useful coastal zone management reference source on environmental mitigation techniques and clarify the format, intended information content, and applications envisioned in the methodology.

Coastal zone management agencies can influence facility developments by:

- (a) developing performance standards for particular resource categories (e.g. beaches, wetlands, parks, flood plains, urban areas, etc.);
- (b) defining guidelines and recommendations for activities that are common to many coastal developments (e.g. site selection, dredging, filling, landscaping, project design, etc.); and
- (c) defining guidelines and recommendations for types of facilities (e.g. marinas, power plants, roadways, refineries, housing developments, etc.).

These methods may also be applied in combination as local situations warrant. The methodology can be applied to derive guidelines, recommendations, or standards under each of these three approaches, and can be applied independently for each resource category, activity, or facility type. The methodology is designed for application at a state level so as to focus on regional facilities and problems while taking into consideration the state's unique political, social, physical and economic conditions. The methodology itself is a three-step process which includes: (a) an analysis of impacts and available management alternatives for that facility, activity, or resource category, (b) an evaluation of management alternatives in light of the existing state situation, and (c) tailoring the facility management program to meet the impact by implementing any additional regulations and policies needed.

The following methodology outline shows one approach which coastal management programs may wish to consider:

Step 1. Analysis of Impacts and Identification of Available Management Alternatives:

- Task a) Define the facility type under investigation;  
define a working definition of the facility and its components;  
describe its function and operation;  
identify recent trends in its development (e.g. demand, numbers, size, site locations, etc.).
- Task b) Describe briefly both positive and negative impact categories including social, environmental, and economic impacts;  
determine the mechanisms creating impacts;  
estimate the probable results and significance of impacts;  
identify facility components linking impacts and causative mechanisms.
- Task c) Develop a matrix of facility components vs impact categories.
- Task d) Identify management alternatives for each impact category that will reduce negative impacts and promote positive impacts.
- Step 2. Initial Selection of Workable Management Alternatives in Light of the Existing State Situation:
  - Task a) Select those alternatives (identified in Step 1, Task d) that collectively form an environmentally, economically and politically acceptable management program.
  - Task b) Review and summarize existing federal, state and local authorities and policies relevant to the facility.
  - Task c) Compare the effectiveness of existing authorities and policies (identified in Step 2, Task b), with the selected management alternatives (identified in Step 2, Task a) to identify additional authorities and policies deemed necessary to achieve an adequate management program.
- Step 3. Tailoring the Facility Management Program to Meet the Impact:
  - Task a) Implement additional authorities and policies,  
acquire new legislation and/or  
amend existing legislation and revise existing regulations; and/or  
alter state agency policies related to existing legislation and regulations.
  - Task b) Modify or develop an industry and public information program.

Although the outline is oriented toward a facility review, substitution of words "activity type" or "resource category" for the term "facility type", will direct the outline toward those subject areas.

**UNITED STATES DEPARTMENT OF COMMERCE, The CTARP Energy Facility Siting Study, Vol. 1 Coastal Facility Siting and the National Interest, National Oceanic and Atmospheric Administration, Office of Coastal Management, Washington, DC, xxvi, 161 pp., (April, 1979).**

#### ISSUES

1. Energy facility siting controversies occur because of the multiplicity of individuals and groups able to influence decisions on siting proposals. The siting of energy facilities will continue in the future according to a complex multi-party decision process.
2. The substance of facility siting controversies comprises three interrelated issues: supply alternatives, conservation, and siting issues. The decision-making process doesn't often follow a smooth course. Objectives of the various groups are not generally mutually compatible, each protecting its own interests. Conflicts arise from the different perception of or the different information on the nature and distributions of effects of the siting of energy facilities.
3. Complex technical, economic, and environmental issues are raised by the siting of energy facilities. They do not warrant the creation of radically new institutions but suggest improvements to be made within the context of coastal management and the existing permit system.
4. Bargaining is a method of conflict resolution in situations such as energy facility siting controversies. Each party involved can, by acting in its own self-interest, help bring about an outcome that is in everyone's interest.
5. The national interest provision of the Coastal Zone Management Act has brought about many discussions: what exactly is the "national interest" in a facility? How can one determine whether or not the siting of



a facility is "in the national interest"? What might constitute adequate consideration of this national interest?

6. Other pertinent issues discussed include the issue of regional benefits, federal consistency, and impact assistance.

#### RECOMMENDATIONS

1. "The thrust of federal coastal management policy regarding the national interest should be in the direction of improving the ability of the relevant agents to bargain and to reach accord on an energy facility siting proposal."
2. "Each management program should require that in making their management decisions, the program executors reveal and open to public scrutiny their analysis of the costs and benefits of their energy facility siting decisions."
3. "Integration and innovation of the traditional permit process is urged, rather than the establishment of public agencies engaged in detailed economic and environmental planning."

**UNITED STATES DEPARTMENT OF COMMERCE, The CTARP Energy Facility Siting Study, Vol. II, Impact Analysis and Case Studies, National Oceanic and Atmospheric Administration, Office of Coastal Management, Washington, DC, xviii, 403 pp., (April, 1979).**

#### ISSUES

1. It is important to separate the effects of or controversy over an energy facility siting decision from the values one attaches to those effects.
2. The direct economic effects of siting an energy facility must be assessed; "economic analysis provides a way of judging whether a potential change in the economic system is a beneficial change and assessing the amount of benefit or loss that can be attached to the change."
3. Indirect effects of siting an energy facility cannot be directly measured and valued within a market framework. The siting of a large energy facility in the coastal zone raises a number of interrelated issues, including environmental change, ecological effects, creation of a safety hazard, land use changes, local economic effects, and socioeconomic change. Externalities can be both positive or negative.
4. Each region of interest or each group of interest will feel the effects of an energy facility siting option differently and will value those effects differently.
5. The siting of an energy facility entails a complex set of effects. An analysis of the decision requires modeling. Adequate use of modeling techniques and data is a key issue with respect to national decision-making.
6. Analysis in the multi party context is an important problem. It arises from the "current tendency to convolve perspectives in the analysis".
7. Other specific issues are discussed in the case studies and include the following: impact of the siting of an oil terminal on air quality, on the supply of natural gas (to California) and on the nearshore marine environment (oil spills); and ownership of the outer continental shelf, (California).

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND NEW ENGLAND RIVER BASINS COMMISSION, Choosing Offshore Pipeline Routes: Problems and Solutions, NERBC, Coastal Programs Division, Boston, MS., 110 pp., (May, 1979).**

This report was undertaken to provide concise information on the environmental impacts associated with outer continental shelf pipelines. It is designed to be used by scientists or engineers involved in offshore petroleum pipeline planning, including pipeline corridors and pipeline landfalls.

The report discusses the environmental and fisheries problems associated with offshore pipelines. There are two major environmental concerns: leaks or spills of hydrocarbons from pipelines into ocean water, and potential damage to sensitive environmental areas on and near the pipeline route. Fisheries concerns centre on potential losses of fishing areas or gear due to offshore pipelines, resulting in loss of fishing time,

catch, and revenue. The report focuses on how these problems can be addressed during the pipeline planning and route selection process. Items which are discussed in the last section include criteria to be used in analyzing a proposed pipeline route, general industry siting criteria, geological and environmental areas to avoid in pipeline siting, and methods to minimize unavoidable impacts. Under the general industry siting criteria, the pipeline industry considers the most and least desirable features of a pipeline route. These considerations are grouped under four headings which include:

- (a) coastal waters - which consider submarine topography, sediment and sand waves;
- (b) shorelines - which include shoreline sediments, barrier islands, beaches, onshore sand dunes, wetlands, and bluffs;
- (c) special coastal uses - which include commercial fishing areas, wrecks, ship channels and anchorages, and areas of unexploded ordnances;
- (d) other special uses - which consider buoy testing areas, areas of surface and bottom activity, restrictions, and prohibited areas.

In addition to studies examining the technical feasibility of installing a pipeline along a proposed route, it is important to identify those areas which should be avoided because of geological instability or environmental sensitivity. Geological hazard areas to avoid include areas with adverse sediment conditions, areas subject to scour, sand waves, eroding shorelines, active faults, deltas, heads of submarine canyons, slump areas, and buried channels and valleys. Environmental areas to avoid include wetlands, spawning and nursery areas, barrier beaches and islands, unique habitats, rare or endangered species habitats, and small habitats.

Finally, to locate "avoidance areas", existing information may provide much of the necessary data for route assessment. For example, information may be obtained from lease sale environmental impact statements, data records, federal agencies or state agencies. In some cases, however, data may not be sufficient, and field and/or laboratory studies may be necessary. Data for geological purposes can be obtained by such methods as bottom current determination, bottom and sub-bottom profiling, bottom obstacle detection, sediment sampling, and seismicity.

**WOODWARD-CLYDE CONSULTANTS, Oil Terminal and Marine Service Base Sites in the Kodiak Borough, Summary Report, Alaska Department of Community and Regional Affairs, Pouch B-Juneau, (December, 1977).**

#### ISSUES

1. OCS oil and gas lease sales in the Western Gulf of Alaska by the U.S. Department of Interior could result in the operation of as much as eight exploratory rigs offshore, the installation of oil production platforms in 3-5 years, and oil production for 20-30 years.
2. There is no firm estimate of the oil potential in the Western Gulf of Alaska; the guess is between 250 million barrels and 2 billion barrels. A 250 million barrels find would not justify a commercial production since development costs could not be recouped. It is generally agreed that the area contains no commercial quantities of natural gas. Of the three sites (Northern, Middle and Southern), the Northern and Middle fields appear to have a better prospect of a commercial find.
3. Two basic methods of transporting oil from a production platform to an oil tanker are a pipeline to a shore-based oil storage terminal (this includes docks and transfer facilities) at an estimated cost of 4.8-17.7 million per kilometre, and Single Point Mooring (SPM) which does not need pipelines to shore or a shore-based terminal. Technological feasibility and economics will determine the method of transportation.
4. OCS exploration and production activities in the Western Gulf of Alaska will need two types of onshore facilities support which may be constructed on Kodiak. These are marine service bases and an oil terminal. Marine service bases will provide materials and logistic support to ships which will service exploratory rigs and production platforms. The total area needed for marine service bases would be 12-16 hectares, including docks for three to five vessels of the 53-76 metre class. An oil terminal would be needed if the oil is to be piped to shore for storage and transfer to tankers. An oil terminal would require 40.5-121 hectares of land, bordering water of sufficient depth. In addition to docks, a number of large oil storage tanks and a 1 524 metre airstrip would also be needed.

#### RECOMMENDATIONS

1. The method used in evaluating the various potential sites for marine service bases and oil terminals included reconnaissance, use of observations and other available data, and examination of impact potentials. Various groups in the Kodiak Island Borough Fishermen Marketing Association and petroleum company representatives were also interviewed. The potential sites were selected from each of the

major bays from Izhut to Three Saints. Pipeline routes were hypothesized from different find locations to each oil terminal site.

2. Technical areas considered included the disciplines of biology, socioeconomics, and engineering. Biological factors considered were the disruption to streams, especially salmon streams, from onland pipelines, and the value of bays in terms of ecological productivity. The sociological factors that were considered included the potential influx of people and increased demand on Kodiak municipal services, disruption to fishing, and impacts to native cultures.
3. Five sites were ranked highest for the Northern find scenario: Izhut, Kalsin, Monashka, and two Kazakof sites. For the Middle find scenario, there were four potential sites: Kiliuda-12 and 13, Kalsin, and Ugak-9. Kalsin was ranked highest for both Northern and Middle find scenarios. For the Southern find scenario, Three Saints and Barling sites were ranked highest.
4. The consultants point out that the amount of money that a petroleum company may actually spend to select a favourable site may vary among companies. Besides, state facility siting policies and regulatory authority will influence siting decisions.
5. The consultants further suggest that, before any sites are selected, additional data be obtained on the following: population and facility demands, impacts on alternative sites, economic feasibility of alternatives, and impact hazards on bays.

#### IV SOCIOECONOMIC IMPACTS

**ALASKA CONSULTANTS, INC., Northern Gulf of Alaska Petroleum Development Scenarios: Local Socioeconomic Impacts, Bureau of Land Management, Alaska Outer Continental Shelf Office, Anchorage, Alaska, xx + 336 pp., (October, 1979).**

##### ISSUES

The objective of the report is to analyze how the growth and infrastructure of Yakutat, Cordova, and Seward might be affected as a consequence of proposed Northern Gulf of Alaska OCS lease sale No. 55. In order to assess the range of possible community impacts of the proposed lease sale over two decades, the scenario method was used to construct and compare four different growth cases: a base or non-OCS case and three distinct petroleum development cases. To identify the significant community impacts of the different petroleum scenarios, the following analyses were done:

- (a) a baseline description of current economic, social, and other pertinent community conditions (primarily public facility and service levels, and municipal government operations) was completed for each community;
- (b) using techniques of economic base analysis and employment and population multipliers, local forecasts of future annual employment by economic sector and of future population were prepared for each of the three development scenarios;
- (c) a set of uniform standards and assumptions were developed for forecasting, for a given population, future public service and facility requirements, and local governmental revenues and expenditures to facilitate comparisons among the different communities and alternative scenarios;
- (d) the standards and assumptions were used to quantify population-related community impacts of the various scenarios for the purpose of analysis.

##### RECOMMENDATIONS

1. This methodology has limited validity for predicting the services and facilities that will actually be provided in the future or for predicting actual expenditure and revenue patterns.
2. The methodology imposes common standards for public service levels and assumes a continuation of current local fiscal practices; it cannot account for local decisions to alter the assumed pattern of services or the pattern of taxation and expenditures.
3. The methodology does provide comparisons, within the framework of the assumptions, suggestive of the trend of growth impacts on the settlements under study.

**CANADA DEPARTMENT OF REGIONAL ECONOMIC EXPANSION (DREE), The Impact on the Regional Economy of Eastern Canada Resulting from the Potential Development of Offshore Oil and Gas, Summary Report, Economist Intelligence Unit Canada Ltd., Toronto, Ont., (1972).**

##### ISSUES

1. While the potential development of offshore oil and gas and the associated economic impact have been discussed at some length in Atlantic Canada, there have been no reliable data to support the arguments.
2. Other concerns with respect to offshore oil and gas in Atlantic Canada relate to the number of jobs that would be created at various stages of offshore oil and gas development and the concentration of the jobs.

##### RECOMMENDATIONS

1. Using published data, professional judgement, and different offshore oil and gas reserves, this 14-year simulation study attempted to provide a scientific basis for discussing the extent and magnitude of the economic impact of offshore oil and gas development on the regional economy of Atlantic Canada.
2. The 14-year multiple simulation run indicated that direct employment generated by offshore oil and gas development for the Atlantic Region was: exploration, 43.3%; construction, 54.5%; and production, 2.2%.

The provincial direct employment distribution was: Nova Scotia, 27.8%; New Brunswick, 18.3%; P.E.I., 2%; and Newfoundland, 51.9%.

**COLLINS, M., Social and Economic Aspects of Dome/Canmar's Beaufort Sea Project, Mary Collins Consultants Ltd., Toronto, Ont., 109 pp., (December, 1977).**

#### ISSUES

1. The enticement of wage employment takes people away from hunting and trapping activities; this is detrimental to them in terms of being able to provide native foods for their families and retain an interest in their cultural activities.
2. The wages offered by Canmar were too high and brought too much money into the community, which was not well used by the wage earners.
3. The introduction of the operation in the Tuktoyaktuk area, along with the increased money which it brought into the community, in turn contributed to increased use of alcohol with resultant abuse, family neglect, and general disruption of the social fabric of the community.

#### RECOMMENDATIONS

1. Several suggestions are offered within the context of long-term goals which are important in the responsible development of human resources in the North and which are conducive to the achievement of the objectives of both Canmar and northern people and the maintenance of good relationships between them:
  - (a) assist northern people in the achievement of their own goals, including the encouragement of individual responsibility and community pride;
  - (b) development of an increasing skilled work force from the North, with emphasis on training and encouragement of career opportunities for those interested, and encouragement of reliability and continuity of employment among northern employees;
  - (c) minimize any adverse impacts of Canmar's operations on northern communities and facilitate the development of leadership within these communities;
  - (d) assist, whenever possible, in the alleviation of social problems which may directly or indirectly arise from the intrusion of industrial activities. The major concerns here have been alcohol abuse which, while a problem throughout Canada, appears often more evident within a small community, and which can lead to other social or family problems;
  - (e) adoption of a long-term commitment to the development of a marine-oriented offshore drilling industry which will provide a gradually increasing component of northerners, particularly native northerners, in the marine aspects of its operation.

**CONSERVATION FOUNDATION, Anticipating and Planning for the Impacts of OCS Oil and Gas Development, Introduction to Source Book on the Onshore Impacts of Offshore Oil and Gas Development, The Conservation Foundation, Washington, DC, 11 pp., (1977).**

#### ISSUES

This paper addresses essentially key issues and concerns about the onshore facilities and their associated impacts.

1. No reliable analyses of the impacts of OCS development are possible until discoveries of oil and/or gas resources and identification of their characteristics are made.
2. The greatest amount of offshore activity, and thus the greatest potential for onshore impacts, is during the development phase.
3. Characteristics of the fields, local, social and economic conditions, legal controls, existing land use, and physical characteristics of the land/water interface environment will determine the quality, design and siting of onshore facilities.
4. Ports close to offshore operations attract staging and support facilities. They provide employment and added business, and tend to have moderate environmental and fiscal effects.

5. One of the most important questions in OCS development is whether to pipe or ship produced oil to shore. In general, where feasible pipelines are preferred to tankers for environmental and safety reasons.
6. Large-scale facilities (platform fabrication yards, refineries, etc.) are often located in rural areas on large waterfront sites, and may have significant employment, socioeconomic, and environmental impacts.
7. Because rural areas generally do not possess the necessary infrastructure, available housing supply, labor pool, planning and management capabilities, and fiscal resources, the impacts of OCS-related development are likely to be more intense there than in urban areas.
8. The greatest onshore and nearshore impacts on the natural environment from OCS facilities and activities will result from site alteration for waterfront and large-scale oil spills.
9. The early development stage corresponds to the period of greatest fiscal impact, when demand for local services is greatest and revenues from OCS-related facilities lag behind required expenditures.
10. A multitude of agencies at various levels of government are involved in the regulatory aspect of development onshore related to or induced by OCS development.

#### RECOMMENDATIONS

1. To be prepared to influence siting and to manage impacts, states and communities will have to plan in advance for events that may never occur, creating contingency plans to be used when proposals are made for onshore facilities.
2. Some of the most effective local development controls used to date on OCS-related facilities are the following: industrial zoning and performance standards, contract zoning, and waterfront industrial district zones.
3. A ports and harbours management strategy can assist coastal communities in developing siting strategies and improvement programs that anticipate or encourage OCS-related activities.

**DAMES & MOORE, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Petroleum Scenarios - Natural Physical Environment Impacts, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 100 pp., (June, 1978).**

#### ISSUES

1. Impacts from OCS development may affect fish and wildlife resources, present and future subsistence hunting and fishing as well as commercial and sport hunting and fishing. Also, impacts may occur to fish streams from sand and gravel mining operations. Other impacts such as disturbance of critical wildlife habitats may occur. Marine traffic routes and the timing of such traffic may create significant impacts to marine mammal populations.
2. Water quality, water resources, and sanitation may be affected due to increased population and industry in the Beaufort Sea region. Water resource availability is a major concern in Arctic petroleum development since water is required in large quantities during every phase of petroleum development. The water supply problem on the North Slope is compounded by the environmental problems of its withdrawal in some areas (for example, winter extraction from portions of rivers and from deeper lakes where fish winter).
3. Sand and gravel resources will be affected by current and future needs of local communities and the petroleum industry, and future demands due to development of other hydrocarbon resources and minerals. Environmental concerns regarding sand and gravel extraction include: siltation of fish spawning streams, siltation in offshore fish habitats, and acceleration of erosion on beaches, river and coastal bluffs, barrier islands, and the tundra surface.

## RECOMMENDATIONS

1. In selecting base camp/staging area sites, the location and timing of marine mammal and fish migrations must be considered. Onshore habitats have to be evaluated in the planning of ports and pipelines, and in the timing of onshore construction. Regulatory protection of these marine and terrestrial wildlife resources is essential.
2. Orientation of above-ground pipelines to an alignment immediately adjacent to the beach or increased use of undersea pipelines could significantly reduce their adverse impacts on the distribution and movements of the caribou.
3. The barrier islands form critical wildlife habitats. With few exceptions, they should not be used as drilling platforms, as staging areas, or as sources of gravel materials.
4. Siltation is a significant impact associated with gravel extraction. Siltation problems can be avoided or corrected by the use of settling basins, diversionary channels, stabilization of borrow stockpiles, and site rehabilitation measures such as replacement of top soil, restoration of pre-mining vegetation and contours, and various erosion control procedures.

**DAMES & MOORE, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Petroleum Development Scenarios for the State-Federal and Federal Outer Continental Shelf, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 387 pp. + appendix, (April, 1978).**

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**PEAT, MARWICK, MITCHELL & Co., URSA, CCC/HOK, Alaska OCS Socioeconomic Studies Program Task Report: Beaufort Sea Petroleum Development Scenarios Interim Report, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 382 pp., (May, 1977).**

## ISSUES

1. The physical environment, especially oceanography, places engineering constraints on offshore petroleum development. Foremost of these is sea ice, which places considerable loads on fixed structures.
2. The continental shelf of the Beaufort Sea is generally too shallow for the operation of such drilling platforms as semi-submersibles or drill ships.
3. In shallow waters, ice scours are common but are generally less than 2 metres deep. Offshore pipelines have to be buried with sufficient cover to provide protection from ice scour.
4. Potential engineering problems are related to ice-rich subsea permafrost. They include "differential thaw subsidence with related problems for foundations and buried hot oil pipelines, difficult dredging operations, and frost heaving".
5. During exploration and development, areas of special sensitivity for fish and wildlife may be encountered. In general, the summer period is most sensitive because of the striking increase in numbers of animal species, particularly migratory birds, caribou, and endangered whales that make relatively brief use of nearshore and coastal areas for reproduction.
6. The development of permanent or temporary facilities and other associated developments require the greatest attention in planning and operation to avoid critical fish, bird and mammal habitats.
7. The environmental impacts of the various offshore drilling structures, their construction, and their operation will have to be taken into consideration in the selection of offshore drilling platforms. Particular attention will have to be given to the problems of borrow extraction, as well as dredging and related siltation problems that are involved in the construction of artificial soil islands.

**GRIGALUNAS, T.A., Offshore Petroleum and New England: A Study of the Regional Economic Consequences of Potential Offshore Oil and Gas Development, University of Rhode Island Press, Kingston, RI, 114 pp., (1975).**

A number of scenarios involving a host of assumptions are postulated in order to simulate the future development of Georges Bank.

## ISSUES

1. One dimension of the petroleum potential of Georges Bank is underlined by the following questions: can the offshore oil reservoirs be tapped at economic and environmental costs that are less than the cost of imported oil, and what would be the size and the distribution of the returns from offshore oil development to the nation as a whole and to the coastal areas?
2. To what extent will offshore oil and gas leasing and production help the U.S. achieve greater national energy self-sufficiency?
3. In addition to national considerations, the potential development of OCS petroleum resources is of interest at local, state and regional levels. What is the magnitude and what are the kinds of impacts associated with offshore development and petroleum refining activity in the region?
4. Compatibility of uses of the ocean and shoreline has to be taken into consideration. We need to know how the various activities associated with the coastal zone might be affected by petroleum development and to what extent such development might disrupt coastal ecosystems or alter aesthetic assets of coastal areas.

## RECOMMENDATIONS

1. If refinery activity is to take place, contingency plans to deal with spills of crude oil or products would have to be developed by state, federal and company officials.
2. Additional work is necessary to examine in detail the activities and demands that are likely to be made on coastal areas as a result of alternative offshore scenarios, and to inventory the stock of port, transportation, social service and other facilities and resources. This should help identify possible constraints encountered by potential developments, the adequacy of existing leasing arrangements, and coastal planning mechanisms to deal with these problems.
3. Specialized studies of the potential onshore effects of OCS developments would also provide more refined measures of the true social gains from offshore development and would indicate the onshore cost of petroleum developments to coastal regions.

**GRIGALUNAS, T.A. and B.W. MATTOX, "Regional Impacts of Potential Offshore Oil Activity: Economic and Institutional Considerations and the Implications for New England", Marine Technology Society, 8th Annual Conference Preprints, Department of Resource Economics, University of Rhode Island, Kingston, RI, pp. 491-497, (April 29, 1974).**

An understanding of the regional economic-environmental implications of potential offshore and related onshore oil developments is an important issue and one which can be expected to become more important. This paper is a preliminary report on work to evaluate the potential impacts on New England of offshore petroleum activity.

## ISSUES

1. In general, it may be argued that federal policies and market distortions have not been neutral, and have had the effect of encouraging offshore activity which might not have been undertaken without some form of "preferential treatment".
2. The regional economic impacts of any offshore oil and gas recovery will depend on:
  - (a) the scale of extraction operations;
  - (b) considerations dealing with the economics of location;
  - (c) the type and scale of the distribution and production system which evolves;
  - (d) possible price reductions in some petroleum products;
  - (e) the amount, if any, of royalties which regional governments will receive; and
  - (f) the negative economic impacts resulting from any environmental side-effects.



## RECOMMENDATIONS

1. The results of this study, when viewed in conjunction with the findings of other regional efforts, will provide basic and currently lacking information for public understanding and policy making prior to any federal-regional commitment to develop potential offshore stocks.

**HABITAT NORTH, Inc., Alaska OCS Socioeconomic Studies Program - Socioeconomic Impacts of Selected Foreign OCS Development, Part II, Canadian Beaufort Experience, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 314 pp., (April, 1979).**

## ISSUES

1. Up to 1976, Canmar's operations in the Beaufort Sea had taken place exclusively during the summer, with Canmar's proposition to extend its operations into fall and winter months. The potential for direct conflict with traditional activities will grow significantly since many of these activities involve hunts on the ice, or access to hunting or trapping areas via Tuktoyaktuk Bay, which would need to be kept open by icebreakers.
2. Canmar has recorded a number of well control difficulties in their operations thus far. These have resulted in water or gas flows from submarine wells to the surface; thus, the possibility of a blowout involving crude oil in the Beaufort Sea may have international as well as regional implications.
3. The global issue of development in the Beaufort Sea can be examined from two points of view:
  - (a) environmental caution: the potential socioeconomic harm resulting from damage to the physical environment is high enough to warrant a delay in arctic offshore oil development, at least until reliable technology is available to safeguard against catastrophic spills or other negative environmental impacts;
  - (b) socioeconomic priorities: a suspension of energy development will result in damage to the local communities and economies through unemployment and spare capacity.

## RECOMMENDATIONS

1. The use of socioeconomic agreement between Dome/Canmar and the Canadian authorities must be regarded as a good idea both from the company's as well as the communities' perspective. This agreement sets out performance criteria in several areas of potential social impact: employment and training, use of local services and social and cultural considerations, public information, local subcontract preference, etc.

**HERSHMAN, M.J. and J.H. FELDMAN, Environmental Planning for Offshore Oil and Gas, Volume V: Regional Status Reports, Part 5, Alaska, Washington, Oregon The Conservation Foundation, Washington, DC, 127 pp., (1978).**

## ISSUES

1. Alaska
  - (a) Serious controversies have arisen from disputes between state and federal officials regarding the development of petroleum resources on the Alaska OCS. Each has a distinct approach to OCS development. The specific conflicts between federal and Alaska officials are: offshore land ownership, adequacy of petroleum technology, Alaska's role in OCS decision making, and revenue sharing.
  - (b) Extensive petroleum operations will occur in pristine but hostile environments which may become contaminated and/or destroyed by oil spills. There is also the danger of destroying some of the world's most productive and valuable fisheries and an abundance of birds and wildlife during the construction and operation of onshore and seashore support facilities.
  - (c) Oil development and production and the related onshore support operations may disrupt local economics and lifestyles. Increases in population will tend to overwhelm present community services (e.g. additional housing and infrastructure requirements).
  - (d) Alaska is lacking in planning expertise and management authority to face such massive and rapid offshore petroleum development.

## 2. Washington

- (a) Development of onshore and offshore Alaskan petroleum resources will have important implications for Washington State. The economics of both states are tied closely together. Landing of Alaskan oil by tanker in the Puget Sound area has become an important issue of controversy from an environmental point of view. The debate has focused on the threat of massive oil spills in the productive and intensely used waters of the Sound.

## RECOMMENDATIONS (Oregon)

The Land Conservation and Development Commission is the principal state agency involved in OCS and coastal management. Goals and guidelines have been formulated to deal with OCS petroleum development:

- 1. "Giving clear priority to the management and protection of renewable resources over the development of non-renewable resources like petroleum."
- 2. "Establishing permit-review procedures which require a developer wanting to explore, extract, store or transfer petroleum on the OCS to specify the methods and equipment to be used, to finance the cost of monitoring and inspecting such operations, to use the best pollution abatement technology available, to be held liable for individual or public damage and to describe the extent and magnitude of onshore support and operation facilities and their social, economic and environmental impacts on the Oregon Coast."

**INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH, University of Alaska, Outer Continental Shelf Oil Development in the Beaufort Sea: the Economic Effects in Alaska, Institute of Social and Economic Research, University of Alaska, Anchorage, AK, 144 pp., (March, 1978).**

## ISSUES

- 1. Development of petroleum resources in the Beaufort Sea OCS will affect both the structure and size of the Alaska economy:
  - (a) the direct effect of OCS development occurs because of increases in construction and petroleum employment. Increases in employment and incomes lead to increased demand for goods and services and labour, and finally to growth in the economy;
  - (b) OCS development indirectly leads to growth by increasing the revenues to the state government. How the state government chooses to spend the extra revenues will lead to growth in the economy. State expenditures increase employment and incomes and lead to growth in much the same way as changes in mining employment.

## RECOMMENDATIONS

- 1. For all the scenarios examined, the qualitative nature of the influence of development on growth is similar. The development program generates a wave of direct employment activity in the construction and petroleum sectors, building to a peak several years after the start of development, then declining to a stable, long-term level as production commences.
- 2. These activities generate streams of new private incomes and public revenues, which induce a set of impacts which may be separated conceptually into two parts:
  - (a) the expenditure of wages and salaries earned in direct employment generates further income and employment in the endogenous sectors of the economy through the multiplier effect;
  - (b) the expenditure of new public revenues by state and local governments generates a first round of employment in both government and the construction industry (through capital expenditures), which in turn induces multiplier effects throughout the endogenous sectors.

**JAMES LINDSAY AND ASSOCIATES, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Petroleum Scenarios: Summary of Socioeconomic Impacts, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 113 pp., (December, 1978).** This report is a summary of six reports prepared for the Alaska OCS Socioeconomic Studies Program between 1977 and 1978:

- 1 - "Beaufort Sea Petroleum Development Scenarios: Impacts on Anchorage, Alaska"
- 2 - "Beaufort Sea Petroleum Development Scenarios: Economic and Demographic Impacts" by Institute of Social and Economic Research
- 3 - "Beaufort Sea Petroleum Development Scenarios: Man Made Environment Impacts" by Alaska Consultants
- 4 - "Beaufort Sea Petroleum Development Scenarios: Transportation Impacts" by Dooley and Associates
- 5 - "Beaufort Sea Petroleum Development Scenarios: Natural Physical Environment Impacts" by Dames and Moore
- 6 - "Beaufort Sea Petroleum Development Scenarios: Sociocultural Impacts" by Worl and Associates

#### ISSUES

1. Before siting onshore facilities, a number of environmental and engineering criteria, such as avoidance of environmentally sensitive areas, availability of fresh water, proximity to gravel, soil stability, and barge access, have to be met.
2. The shallow waters along the Beaufort Sea coast generally require that freight be lightered from deep-draft vessels to shore in barges that draw less than 2.5 m of water. Therefore, important factors in port location include submarine topography, type of bottom sediments, coastal erosion, and nearshore sediment transport.
3. In selecting base camp and staging area sites, the location and timing of marine mammal and fish migrations must be considered. Onshore habitats, such as polar bear dens, caribou calving areas, and waterfowl nesting and molting sites, must be evaluated in the planning of ports and pipelines and the timing of onshore construction.
4. Exploration development and production of oil and gas in the Beaufort Sea region may intensify change to the sociocultural system. The primary impacts likely to occur as a result of this development include:
  - (a) population: potential conflicts exist over hunting and fishing. Interpersonal contact between Inupiat and non-Inupiat can be expected to occur. Human influences on the environment within the enclave area can be expected to affect neighbouring communities;
  - (b) employment: employment opportunities may be created within traditional communities. The expanded tax base and the increased business opportunities open to native corporations may stimulate increased expenditures and investments in the communities. This may stimulate immigration of non-Inupiat populations resulting in the disturbance of the socioeconomic subsistence complex;
  - (c) housing: development of new housing units and increasing construction of multifamily units are expected to affect subsistence, as increasing responsibilities may necessitate permanent employment that restricts subsistence activities;
  - (d) natural physical environment: negative impacts on the environment and natural resources as a result of water pollution from offshore drilling and waste disposal would affect the subsistence activities (fishing, hunting) of the native population;
  - (e) transportation: increasing traffic may affect the migrating patterns of wildlife populations. Because of the season and limited period of migration, compounded by restrictive quotas on caribou and bowhead whales, marine traffic which disrupts the harvest of marine mammals could result in serious impacts to Inupiat food supplies;
  - (f) lifestyle: Inupiat may feel that their lifestyle is threatened by potential environmental impacts. The potential exists for deterioration of social health caused by conflicts and tensions from cumulative impacts on the sociocultural system. Possible results are increases in alcohol and drug abuse, intrafamily violence, and other crime.

**KRAMER, L.S., V.C. CLARK and G.J. CANNELOS, Planning for Offshore Oil Development Gulf of Alaska OCS Handbook, Department of Community and Regional Affairs, Pouch B-Juneau, Alaska, (1978).**

#### ISSUES

1. OCS oil and gas development in Alaska is confronted with several environmental factors, among which

are storm-ridden seas, and pack and shear ice conditions. Moreover, Alaska's OCS is one of the world's most seismically active areas. The use of concrete drilling platforms is therefore ruled out.

2. Alaska will not be able to take full advantage of the multiplier opportunities associated with petroleum extraction because of low population and the lack of supportive industrial complexes (steel production and fabrications).
3. The State of Alaska has set five OCS petroleum development objectives: optimum location and sufficient use of industrial facilities, balanced development and protection of natural and human resources, increased employment opportunities for the resident labour force, sound and equitable public expenditure, and timely coordinated development decisions.
4. Factors such as physiology, climate, geology, oceanography, hydrology, soil and vegetation, fish and wildlife, land tenure, and land use may combine to restrict options for siting facilities, impose delays on labour operations, or necessitate costly technology.
5. Criteria for siting marine service bases, oil terminals and LNG liquefaction plants are derived from basic industrial requirements of safety and economy and state development policies. Proximity is, however, an important criterion.

#### RECOMMENDATIONS

1. The State of Alaska's OCS development policies will ensure that onshore/nearshore sites for petroleum-related facilities will be protected from adverse environmental and social impacts. Development impacts on renewable resources with a high commercial, recreational, cultural, and aesthetic value will be carefully evaluated.
2. To help communities cope with adverse effects of OCS petroleum development, the state will provide assistance. Local planning, fiscal, and management roles will be strengthened.
3. To help achieve the OCS petroleum development objectives, new legislation would have to ensure: that the definition of taxable property includes oil refineries, gas processing plants, LNG and petrochemical operations; that there is state participation in joint federal-state surveillance of OCS activities; that there is a sharing of petroleum revenues; that local governments can collect prepayment of taxes and that energy facility siting legislation provides for a definition of energy facility; early information disclosure; site identification and site selection.
4. In the Gulf of Alaska, the hundred-year wave is estimated at 28-metres. The probability of a 28-metre wave is 1% in any given year. Exploratory rigs in the Gulf have been designed to withstand waves of 30 metres or more. Furthermore, when waves exceed 2 metres, loading and unloading of supply boats will be difficult.
5. The Gulf of Alaska is a seismically active area and siting decisions have to take into consideration the destructive force of earthquakes. Tsunami or earthquake-generated sea waves can be very destructive. For this reason, onshore facilities exposed to tsunami should be sited at elevations sufficient to escape the highest tsunami run-up of 15 metres. Pipelines that cross active faults or areas of potential ground failure (slides and slumps) could rupture if movement takes place along the fault or if mud-slides occur. Pipeline routes should be aligned away from active faults.

**NATIONAL ASSOCIATION OF COUNTIES RESEARCH FOUNDATION, Serving the Offshore Oil Industry: Planning for Onshore Growth, Northampton County, Virginia, National Association of Counties, Washington, DC, iv + 55 pp., (1976).**

#### ISSUES

1. Platform fabrication, the construction of drilling and production rigs, is an integral part of the offshore oil industry. Companies prefer to build new facilities as near as possible to the oil fields. The social and economic impacts resulting from this activity are important:
  - (a) the issue of training local residents or bringing in skilled workers became a major controversy;
  - (b) compatibility of a large industry with agriculture was also a major issue. On one side, it was argued that the two were compatible and that agriculture had shown that it could not sustain the economy of the county. On the other hand, opponents wanted the protection of prime farmland. They also argued that more time was needed to develop important safeguards;
  - (c) Residents were confronted with major and immediate disruptions and with no opportunity to develop gradually.

## RECOMMENDATIONS

Several guidelines designed in this study are based on energy developments in other areas.

1. Review your status ahead of time. A base of information should be prepared in order to study the potential impacts of new development. This would include information on current land use and demographic patterns in the county.
2. Act on the proposals immediately, even before formal applications have been received.
3. Encourage the industries to provide precise employment projections. Information should be available on the movement of workers and growth of the population.
4. Get an independent analysis of the project. Local citizens and officials often have a built-in credibility problem.
5. Prepare a comprehensive land use plan, including zoning and sub-division controls. Encourage growth within incorporated areas that already have necessary services. Controls are especially important for the immediate surroundings of the industrial site; a mobile home park ordinance can help prevent haphazard sprawl. Enforcement capabilities should be developed for the planning controls.
6. Negotiate with the industry to get the best possible offer before making a decision.
7. Plan well in advance for the increased demands that will be placed on physical as well as social services. Examine the road network and assess whether the present system will handle the projected increase in traffic from the commuters and the heavy equipment traveling to the site.
8. Open channels of communication between all levels of government. Also, cooperation between local government and industry is crucial. Encourage industry to take an active role in the community by reminding it of the benefits to its employees, but do not let it become overly paternalistic.
9. New industry should be encouraged to hire local labor whenever possible. Guarantees should be developed so that as many jobs as possible will go to local residents.
10. Work with the appropriate local, state and federal agencies from the outset. They can help alert you to potential problems as well as provide some technical and financial assistance when necessary. If this assistance is not offered, don't be afraid to act. "All decisions should be yours."
11. Above all, conduct an extensive public information program with full public debate of the issues. Citizen participation is essential for effective planning.

**NEW HAMPSHIRE DEPARTMENT OF RESOURCES AND ECONOMIC DEVELOPMENT, The Impact of Offshore Oil: New Hampshire and the North Sea Experience, Concord, NH, xiii, 197 pp., (1975).**

## ISSUES

The following set of issues deals specifically with New Hampshire.

1. Because New Hampshire has less sea coast than any other state, it will be particularly affected by potential OCS-related onshore activities. The fragile landscape of the coastal zone is of great concern in assessing the eventual impact of present and future activity.
2. "Offshore oil development must be viewed in the larger context of a total regional development plan, a significant portion of which is influenced by an integrated energy policy." Conservation of the state's resources is an important issue.
3. The eventual siting of energy facilities (oil refineries, pipelines, terminals, deepwater port) exerts certain pressures on the coastal zone. This situation suggests provision of preliminary land-use plan and invites the state of New Hampshire to cooperate with other state governments in the planning of such development.

The analogy of the Scottish experience in OCS development with that anticipated in New England is a central theme of the document and it is important to mention briefly the pertinent issues discussed: lack of adequate housing, strains on the social fabric of towns, concern over the disruption of the fishing industry, competing employment.

## RECOMMENDATIONS

Recommendations are formulated at four levels in the best interest of the state of New Hampshire.

1. At the international level, state government may be able to contribute to the U.S. delegation on the representatives of U.S. industry at the United Nations Law of the Sea Conference on issues that could have significant impact on plans for OCS development off the New England coast.
2. New Hampshire officials must familiarize themselves with offshore oil and gas activities and development in order to protect the state's interest in an effective and informed manner at eventual federal agency hearings.
3. Despite divergent attitudes toward OCS development and planning between regional authorities, some effort in regional cooperation is noticeable; it is in the interest of the state to encourage future joint efforts.
4. The lack of expertise and knowledge about OCS activities is critical at the state level. A better understanding of how the industry works would permit the state officials to deal effectively with new petroleum development. Increased contacts with neighbouring experienced states should be encouraged.

**OREGON STATE UNIVERSITY, Sea Grant Program, Oregon and Offshore Oil, Corvallis, OR, 54 pp., (1978).**

This report brings insight to the Oregon situation regarding its offshore oil activities. It briefly examines the different stages of exploitation and the associated onshore requirements. Although the report does not focus on specific key issues, it does document areas of possible impacts (e.g. land use, environment, fisheries, effect on communities, etc.).

**PEAT, MARWICK, MITCHELL & CO., Alaska OCS Socioeconomic Studies Program - Beaufort Sea Region Socioeconomic Baseline, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 636 pp., (July, 1978).** This study is a summary of the following reports:

- Dames & Moore, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Region Natural Physical and Biotic Baseline, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 40 pp., (May, 1978).
- Schultheis, M.C. and G. Smythe, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Region -Manmade Environment, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 282 pp., (April, 1978).
- Worl Associates, Alaska OCS Socioeconomic Studies Program - Beaufort Sea Region Sociocultural Systems, Alaska OCS Office, Bureau of Land Management, Anchorage, AK, 168 pp., (1978).

This baseline study is, to a certain extent, a compilation of quantified facts by which certain OCS-induced changes can be assessed. However, the greater proportion of the report is devoted to highlighting and analyzing the critical socioeconomic and sociocultural elements and relationships which comprise the socioeconomic environment of the Beaufort Sea region. Both qualitative and quantitative methods are used to examine many areas of social, economic, political, and cultural concern. While investigating the impacts flowing from OCS events and activities, the report attempts to analyze and convey the links between social facts (quantitative approach) and residents' perceptions and feelings (qualitative approach). The report is essentially made of three sections: a description of the man-made environment of the Beaufort Sea region generally and of four of its member communities in particular; an assessment of the sociocultural dynamics of the region; and a short analysis of the susceptibilities of the natural physical environment.

**REEDS, C. and W.D. TRAMMELL, "Economic Criteria for Analyzing Subsea Field Development", Ocean Industry, pp. 43-47, (July, 1976).**

## ISSUES

Recent developments in offshore production have highlighted the cash flow advantage of obtaining early revenues from subsea wells. It is apparent that the conventional fixed platform approach frequently involves excessive delays with resulting economic penalties.

1. Geopolitical factors - location, water depth, weather and sea conditions, and governmental regulations initially affect the choice of a field development approach.
2. Exploratory data - selection of a field development approach will be influenced by geophysical studies and a review of geological data. This information provides insight into reservoir size, shape, and depth.

#### RECOMMENDATIONS

1. Selection of development plan - an economic analysis of the above factors over the projected life of the field should indicate the preferred development plan for any given offshore field.
2. Effective implementation - in order to be acceptable, any field development approach must be compatible with geopolitical factors and must satisfy drilling and producing requirements as indicated by explanatory data.

**RESEARCH AND PLANNING CONSULTANTS, INC., Outer Continental Shelf Oil and Gas Development, A Survey of Selected Modeling Techniques, The Coastal Management Program, General Land Office of Texas, Austin, TX, 17 pp., (May, 1976).**

This report, prepared by Research and Planning Consultants, Inc., for the Texas General Land Office, is a survey of selected modeling techniques. It was not intended to be totally comprehensive either in types of models or in the entire range of models of any selected type. The report includes regional economic models, input/output models, environmental impact identification models, infrastructure cost models, estuary water quality models, ecological models, outfall models, spill models, groundwater models, and others. In each case, the models' use, capabilities and products are discussed.

This report was prepared as a part of a project to develop a methodology to determine the impacts of outer continental shelf oil and gas development.

**RESEARCH AND PLANNING CONSULTANTS, INC., Outer Continental Shelf Oil and Gas Development: An Impact Bibliography, Austin, TX, 35 pp., (May, 1976).**

The following bibliography was developed by Research and Planning Consultants, Inc., for the Texas General Land Office as part of a project to develop a methodology to determine the impacts of outer continental shelf oil and gas development and, using that methodology, evaluate the Texas onshore and nearshore impacts of outer continental shelf oil and gas development.

The bibliography is divided into two groups, each of which is further broken into two sections. Group I contains entries for impact studies - environmental, economic, demographic, social, or infrastructural - including those related specifically to Texas and those not directly related to outer continental shelf oil and gas development. Group I also contains a section of annotated entries for documents which are considered highly significant. The non-annotated entries, the second section of Group I, are works which are similar in content to those in the annotated section but which are not as widely available or are to some extent duplicative of those detailed in the annotated section. This non-annotated section also includes documents associated with outer continental shelf reserve estimates and other general Gulf of Mexico studies.

Group II of the bibliography contains entries for documents which are considered to be inventories or descriptions of baseline data on the environmental, economic, demographic, social, or infrastructural characteristics of the Texas Gulf Coast. Group II is divided into two sections: 1. Natural Resources; and 2. Social, Economic, Demographic and Infrastructural.

**RESEARCH AND PLANNING CONSULTANTS, INC., Outer Continental Shelf Oil and Gas Development: an Impact Methodology, Austin, TX, 39 pp., (June, 1976).**

An impact methodology is developed to determine impacts of outer continental shelf oil and gas development. The overall methodology is separated into seven key areas of concern and each of these methodologies is divided into tasks. The approach doesn't provide a comprehensive identification and explicit analysis of the variety of economic, social and environmental effects of the postulated OCS development scenarios, but "the methodologies provide the fullest accounting of effects and costs consistent with project scope."

**RESEARCH AND PLANNING CONSULTANTS, INC., Offshore Oil: Its Impacts on Texas Communities, Volume I-Executive Summary, Austin, TX, ix, 60 pp., (1977).**

**ISSUES**

1. The impact of offshore activities on the nearshore and onshore areas of Texas is the broad issue discussed in this study. Other questions within this context which are being underlined are the effects of such activities on economic systems and on the environmental, infrastructural and sociocultural systems of the state and of specific coastal communities of Texas.
2. Since no expansion of the offshore-related industry sector is expected in Texas, the most pronounced effect of OCS development on the state will be fiscal deficits for local affected governments.
3. Environmental effects of OCS oil and gas development are likely to be limited to marginal increases in air and water pollutants, intensification of commercial, industrial and residential land developments, and short-term effects of pipeline laying.
4. Sociocultural impacts are likely to be more pronounced in a less populous area which lacks experience with OCS development and the capabilities of coping with it.
5. The accurate prediction of the state and local impacts of future Texas federal OCS oil and gas development is a virtually impossible task. Rather, specific coastal areas seem to be a better scale to evaluate these impacts.
6. There are needs for more extensive and centralized information on existing facilities, both offshore and onshore.
7. It is important for policy makers to make the distinction between areas of Texas lacking OCS experience as opposed to the more traditional producing areas of the state when calculating impacts and formulating policy addressed at ameliorating any adverse impacts.

**RECOMMENDATIONS**

1. The fact that sociocultural impacts in many cases are difficult to project or are expected to be minimal should not be taken to mean that no such impacts could ever occur. Policy makers should be constantly aware of changing perceptions of the quality of life or of sociocultural values in the affected coastal sites.
2. Projecting the fiscal effects in some local, affected sites is important. Site-specific data should be used to the greatest extent possible in order to avoid misinterpretation of results observed elsewhere.
3. Each coastal locality, county, and council government should make an effort to periodically review any literature which provides indications of current or prospective oil activity offshore in their area.
4. Affected coastal communities are encouraged to take full advantage of CEIP (Coastal Energy Impact Program) funds and to work closely with the state agency designated to be responsible for intrastate allocations of such funds.

**RESEARCH AND PLANNING CONSULTANTS, INC., Offshore Oil: Its Impacts on Texas Communities, Volume II-Local Impact Scenarios, Austin, TX, xvii, 599 pp., (June, 1977).**

This study is designed to calculate the impacts of three given outer continental shelf development scenarios from the local community perspective. The first part of the document provides a description of each scenario. It is followed by an analysis of each, first in terms of the different methodologies used (exploration, development, production, net onshore effects, environmental and social impact assessments) and second, by an application of these methods to individual scenarios.

**RESEARCH AND PLANNING CONSULTANTS, INC., Offshore Oil: Its Impacts on Texas Communities, Volume III-Aggregate State Impacts, Austin, TX, v, 45 pp., (June, 1977).**

This analysis of various sectors of oil and gas activities in the Texas federal OCS is directed toward determining if an expansion of existing facilities or construction of new ones is necessary given the production



5. Energy projects are significant property taxpayers, usually generating enough revenues to cover the costs of the impacts they cause. However, there are important mismatches in time and space. While benefits are long-range and regional, impacts are often immediate and local.

## RECOMMENDATIONS

1. Specific local information is essential and should be obtained for each community and each project proposal. Studies should identify ranges of impacts in order to be responsive to likely changes in magnitude and timing.
2. Companies and local governments must cooperate and recognize their mutual interest, e.g. low labor force turnover and high productivity on one hand, and growth at a manageable rate on the other.
3. Guidelines for growth management:
  - (a) General goals have to be determined and can only be set by the community as a whole.
  - (b) Specific objectives and targets must be set so that progress can be effectively monitored.
  - (c) Preparation of a plan ("Rapid Growth Plan") is a must. It has to define what impacts are expected and set up a program for responding to those impacts.
  - (d) Recognize that the local governments that are going to be affected have to take the lead in making major decisions and seeing that they are carried out.
  - (e) Area-wide districts can be a major source of growth planning assistance. If several counties are affected, it makes sense to combine efforts for various tasks: collection of information and analysis, overall planning and coordination, securing of government funds, and assigning responsibility.
  - (f) States and agencies of the federal government can provide technical assistance and money for growth management staffs and plans.
  - (g) The private sector must be involved through the planning process. The companies have the greatest influence on the timing and extent of the impact.
  - (h) Responsibility for the action must be assigned. Those with the responsibility must have sufficient authority, money and staff.
4. Guidelines for land use and housing:
  - (a) Whatever the outcome of the projects, the planning process will be useful. Identifying community problems and resources, setting goals and objectives, adopting land use controls, and setting up a system for cooperation will be of long-lasting value.
  - (b) Permanent housing and facilities should be provided only for the level of population expected after the project is built. Mobile homes provide the best alternative for temporary housing. Temporary facilities and services should be utilized for the construction phase.
  - (c) Added growth may be accommodated in three ways: growth in existing communities; creation of a new town (when the project is remote from existing communities); construction of a company town.
  - (d) Land use controls are imperative and must be enforced effectively.
5. Other impacts on the community: integration of new households into a community should be encouraged by various mechanisms such as community relations commissions, welcome wagons, hospitality hostess. Providing recreation/activity centres and counseling centres can also satisfy a major need for these people.
6. Guidelines for financing:
  - (a) In setting financial objectives and financing plans, communities should exert a full local effort to provide for new residents.
  - (b) Financial plans should be integrated into the adopted plan for growth.
  - (c) States and federal governments can assist in many ways; a sound plan for managing growth and understanding of the workings of the "financial machinery" will increase the possibilities of communities getting state and federal money.

**UNITED STATES DEPARTMENT OF THE INTERIOR, Onshore Impacts of Offshore Oil: A User's Guide to Assessment Methods, Washington, DC, 68 pp., (1979).**

The User's Guide discusses three principal methodologies for assessing and planning the onshore impacts of offshore oil:

- (a) "Onshore Facilities Related to Offshore Oil and Gas Development", prepared by the New England River Basins Commission (NERBC);

**RESEARCH AND PLANNING CONSULTANTS, INC., Offshore Oil: Its Impacts on Texas Communities, Volume I-Executive Summary, Austin, TX, ix, 60 pp., (1977).**

**ISSUES**

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This analysis of various sectors of oil and gas activities in the Texas federal OCS is directed toward determining if an expansion of existing facilities or construction of new ones is necessary given the production

of oil and gas in the state. Specifically, the analysis deals with the impact of capacity increases in terms of refining and the effects of OCS development on the gas processing, mobile rig construction, platform construction, and petrochemical processing sectors.

**ROBADUE, D.D. and V.K. Tippie, "Public Involvement in Offshore Oil Development: Lessons from New England", Coastal Zone Management Journal, 7 (2-3-4), pp. 237-270, (1980).**

#### ISSUES

1. The main issues in New England concerning offshore oil development are: energy benefits, onshore impacts, environmental effects, and fishing industry conflicts.
2. New England fishing industry concern with offshore oil and gas development relates to:
  - (a) chronic and major oil spills - which could affect fishing stocks and disrupt fishing activities;
  - (b) offshore conflicts - such as loss of fishing grounds because of rigs, pipes, debris and gear damage;
  - (c) onshore conflicts - competition for labour facilities and services.

#### RECOMMENDATIONS

1. To facilitate effective participation in the decision-making process, New England Governors established the New England Regional Commission (NERCOM) to develop information on all aspects of the potential impacts of offshore oil development.
2. The ability to translate public concerns about environmental risks into an agenda of specific issues supported by administrative and legislative action enabled New England to address a full range of concerns regarding the utilization of a physiographic area beyond the legal jurisdiction of state government and any single federal agency.

**ROBERTS, P. and T. SHAW, "Onshore Planning Implications of the Offshore Development of Mineral Resources", Marine Policy, 4 (2), pp. 128-141, (April, 1980).**

#### ISSUES

1. The need to provide suitable sites for the onshore facilities required by the offshore industry generated considerable controversy in the U.K. The difficulties brought about by the absence of clear policies for the planning of onshore facilities have been exacerbated by the rapidity of the offshore development process and the lack of previous experience among many planning authorities in dealing with the oil and gas industry.
2. There has been growing concern about the potential hazards of the movement of highly combustible substances and liquids carried in such bulk that any accident is likely to result in pollution on a massive scale. Conservationists as well as the tourist trade are concerned by this type of environmental threat. There is growing public concern about the potential hazards of onshore petrochemical installations. Additional environmental issues are raised during the operational phase of bringing the gas ashore.
3. One type of problem associated with the impact of development relates to the physical impact of a plant and new construction. There will be local opposition to any new development which poses a threat to local environmental conditions. Other problems are those which are connected with the industry's demand for a specialist and highly paid work force (influx of migrant workers).

#### RECOMMENDATIONS

1. Planning authorities at all levels should be aware of the requirements of offshore operators at an early stage in the development program and should, through a cooperative approach, attempt to make the required facilities available.
2. Prior to oil and gas associated developments entering the production phase, it would be advantageous if an environmental monitoring system were devised to predict accurately the environmental problems likely to be rendered, as well as to scrutinize the actual operation of oil and gas exploitation to identify and cope with environmental pollution.

**UNITED STATES DEPARTMENT OF COMMERCE, Economic Impact of Oil Resource Development on the Alaskan Economy 1975-1985, Federal Energy Administration, Regional Impact Division, Office of Economic Impact, Washington, DC, x, 31 pp., (April, 1976).**

This report examines the impact of oil resource development on the private sector of the Alaskan economy over the period 1975-1985. Impacts are measured in terms of changes in output, labour and proprietors' earnings, and employment by industry. Primary impacts (final demand changes) consist of oil development activities in five industrial sectors: (a) pipeline construction, (b) oil exploration and development, (c) oil extraction, (d) oil pipeline transportation, and (e) oil transportation over water. The estimated changes in final demand expenditures (1973 dollars) during an 11-year period are said to be \$4 billion for pipeline construction (1975-1977), \$7.4 billion for oil exploration and development (1977-1985), \$26.7 billion for oil extraction (1978-1985), \$3.4 billion for oil pipeline transportation (1978-1985), \$1.9 billion for water transportation (1978-1985), and \$43.5 billion total primary impact (1975-1985). The estimated change in total gross output (1973 dollars) for all industries during the 11-year period is supposed to be \$51.1 billion, an addition of 17.4% to the primary impact.

Changes in total gross output ranged from \$1.6 billion in 1975 to \$6.8 billion in 1985, but the industrial composition of these changes will vary considerably over the years. The period 1975-1977 was to be dominated by pipeline construction activity; major exploration and well-development were to begin in 1977, reach a peak around 1980, and diminish thereafter. Oil extraction was expected to begin in 1978 and to dominate oil activity thereafter.

The expected changes in the composition of output would have important consequences for the pattern of employment and earnings impact in Alaska. Changes in earnings and employment in the transportation and utilities industry would grow eightfold between 1977-1985. In contrast, impacts on earnings and employment for the mining industry would be expected to decline by 1985 to about two-thirds of their 1977 levels. Employment changes in the wholesale and retail industry would grow gradually over the period as a reflection of the expected impacts on total earnings. Overall earnings per impacted worker, according to the report, would fall from a high of \$17 246 in 1975-1976 to \$13 530 in 1985 (1973 dollars). This decline reflects a shift in employment changes from the pipeline construction and oil exploration sectors to transportation, trade, and services, where wage rates are lower.

The impact of petroleum development has already been felt in Alaska. The public and private sectors are attempting to meet the housing and service requirements of the many people who have moved to Alaska. This study suggests that the planning process must seriously consider not only total changes in output and employment but also the composition of those changes.

**UNITED STATES DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, Rapid Growth from Energy Projects: Ideas for State and Local Action, Office of Community Planning and Development, Washington, DC, 59 pp., (1976).**

## ISSUES

1. The start of an energy project in a community is usually associated with a surge in population as workers and their families move into the area. However, the number of workers needed to run the energy project after it is built is generally less than the construction force. As a result, providing housing and services is difficult with a temporary build-up and decline.
2. Growth management presents great difficulties for energy impacted communities. There is great confusion about the roles of the various levels of government involved, with little coordination of effort. Impacted communities typically have no professional staff, and there are few concerted efforts for planning and management between the industry and the community. The U.S. government system is not geared to handling rapid and temporary problems such as the construction phase of energy projects in communities.
3. Land use planning in communities impacted by boom growth is usually as follows: (a) there is a general absence of plans for land use; where they exist, they seldom are backed by land use controls. Enforcement of these controls is not always effective; (b) planning and land use controls are difficult to determine when the energy project is in one jurisdiction and the impact in another; (c) building of houses is also a problem because of the following elements: time factor for getting subdivision and zoning approvals, prices of land, materials and labor, and financing.
4. Other impacts on the community: (a) rapid growth brings rapid changes in the quality of life; the elderly and the wives especially feel the impacts; (b) expansion of human services program capabilities (medical, education, recreation and public safety) always lags behind the influx of people; (c) roads rapidly become congested and utilities become overloaded during project construction.

5. Energy projects are significant property taxpayers, usually generating enough revenues to cover the costs of the impacts they cause. However, there are important mismatches in time and space. While benefits are long-range and regional, impacts are often immediate and local.

## RECOMMENDATIONS

1. Specific local information is essential and should be obtained for each community and each project proposal. Studies should identify ranges of impacts in order to be responsive to likely changes in magnitude and timing.
2. Companies and local governments must cooperate and recognize their mutual interest, e.g. low labor force turnover and high productivity on one hand, and growth at a manageable rate on the other.
3. Guidelines for growth management:
  - (a) General goals have to be determined and can only be set by the community as a whole.
  - (b) Specific objectives and targets must be set so that progress can be effectively monitored.
  - (c) Preparation of a plan ("Rapid Growth Plan") is a must. It has to define what impacts are expected and set up a program for responding to those impacts.
  - (d) Recognize that the local governments that are going to be affected have to take the lead in making major decisions and seeing that they are carried out.
  - (e) Area-wide districts can be a major source of growth planning assistance. If several counties are affected, it makes sense to combine efforts for various tasks: collection of information and analysis, overall planning and coordination, securing of government funds, and assigning responsibility.
  - (f) States and agencies of the federal government can provide technical assistance and money for growth management staffs and plans.
  - (g) The private sector must be involved through the planning process. The companies have the greatest influence on the timing and extent of the impact.
  - (h) Responsibility for the action must be assigned. Those with the responsibility must have sufficient authority, money and staff.
4. Guidelines for land use and housing:
  - (a) Whatever the outcome of the projects, the planning process will be useful. Identifying community problems and resources, setting goals and objectives, adopting land use controls, and setting up a system for cooperation will be of long-lasting value.
  - (b) Permanent housing and facilities should be provided only for the level of population expected after the project is built. Mobile homes provide the best alternative for temporary housing. Temporary facilities and services should be utilized for the construction phase.
  - (c) Added growth may be accommodated in three ways: growth in existing communities; creation of a new town (when the project is remote from existing communities); construction of a company town.
  - (d) Land use controls are imperative and must be enforced effectively.
5. Other impacts on the community: integration of new households into a community should be encouraged by various mechanisms such as community relations commissions, welcome wagons, hospitality hostess. Providing recreation/activity centres and counseling centres can also satisfy a major need for these people.
6. Guidelines for financing:
  - (a) In setting financial objectives and financing plans, communities should exert a full local effort to provide for new residents.
  - (b) Financial plans should be integrated into the adopted plan for growth.
  - (c) States and federal governments can assist in many ways; a sound plan for managing growth and understanding of the workings of the "financial machinery" will increase the possibilities of communities getting state and federal money.

**UNITED STATES DEPARTMENT OF THE INTERIOR, Onshore Impacts of Offshore Oil: A User's Guide to Assessment Methods, Washington, DC, 68 pp., (1979).**

The User's Guide discusses three principal methodologies for assessing and planning the onshore impacts of offshore oil:

- (a) "Onshore Facilities Related to Offshore Oil and Gas Development", prepared by the New England River Basins Commission (NERBC);

3. Planning agencies must enter into an earlier dialogue with government, offshore operators, and onshore consumers to be able to cope with the demands of the offshore industry and to assist the local economy in maximizing the benefits offered by this new industry.
4. Cooperation between planning authorities and offshore developers is essential in elaborating a strategic framework for the development of offshore mineral resources. This strategy should represent a series of agreements between the various scales of planning competence.
5. The scenario approach proves to be the optimum solution to the problems inherent in the extraction of offshore minerals. Scenarios are an alternative method of resolving the dilemma between the offshore operator and the planning authority as they represent an apolitical strategic approach.

**STACEY, G.S. and M.L. DUCHI, "Analyzing the Socio Economic Effects of Large Energy Projects", *Environmental Impact Assessment Review*, 1 (3), pp. 267-286, (1980).**

#### ISSUES

1. In order for local decision-makers to find ways of determining how to address and mitigate negative impacts, they must be provided with a "best estimate" scenario of how construction and operation of large energy projects could affect their communities.
2. Labour force, housing, economic impact, public services, and community finance are important factors in estimating yearly impacts of large energy projects.
3. Because a baseline provides a set of present and future estimates for the important variables, any analysis of the socioeconomic impacts of large energy projects must first determine the baseline of the area likely to be affected by the construction and operation phases of the development.
4. Analysis of the labour force and housing requirements needed for the construction and operation of a large energy facility provides an indication of future demands for public services.

#### RECOMMENDATIONS

1. Two important factors that generate socioeconomic impacts are labour force and material requirements. An increase in the labour force leads to an increase in demand for housing, and private and public services; the need for materials stimulates economic activities. To determine the impact of the labour force associated with a large energy facility, a three-part analysis must be carried out:
  - (a) estimation of demand for labour - number and types of workers needed for construction and operation;
  - (b) analysis of supply of labour - availability and source of skilled labour; and
  - (c) analysis of the characteristics of the labour force - family size, number of school-aged children, and income level.
2. Very often, housing needed to accommodate both the temporary and permanent work force may not be sufficient or close to the facility site. A profile of the housing supply must be developed through contact with appropriate agencies in the area and by determining the desirability of the work force to live in specific communities.
3. The demand for services associated with the construction and operation of a large energy facility can be estimated by using utilization rates in existence before the beginning of the project.
4. By examining revenue sources and expenditure items and changes that might occur with population influx, local governments would be able to take active rather than reactive measures in dealing with the impacts of large energy facilities on their communities.
5. A base input-output table provides an analytical procedure for determining the direct economic impacts and intraregional material purchases associated with the construction and operation of a large energy facility.

URBAN LAND INSTITUTE, *Environmental Comment*, 20 pp., (February, 1978). OCS Development and its Onshore Impact, includes: "Onshore planning for Offshore Oil and Gas Development", "Energy Facility Siting: A Case Study of Changing Perceptions", "Comment at Law", "Offshore Energy Development and the Impact on Land Use Patterns and Processes in Louisiana", "Critical Onshore Siting Decisions".

The many authors contributing to this paper account for the variety of issues and recommendations brought to light.

#### ISSUES

1. Local waterfront communities face a major problem in dealing with the implication of OCS development: the uncertainties in estimating potential offshore oil and gas reserves.
2. Governmental regulations pose numerous constraints regarding the development of the OCS and the environmental impact of onshore facilities. The regulations are fragmented and overlapping, and thus could result in construction denials or delays.
3. The planning response to offshore activity will vary in quality (lack of staff and resources needed for adequate decision-making, lack of experience) and with the location (some representatives of economically depressed urban waterfronts will seek out the related business opportunities, as will some less-populated areas intent on diversifying the economic bases of their communities). However, in terms of the quality of life in these communities, the question as to how long the oil and gas resources will hold out and continue to pump vitality into the locality is a major concern.
4. The acceleration of energy development activities has brought with it an expanding information gap between planners, private industry, and the public. Information on the implications of OCS development has often failed to reach the authorities most responsible for making decisions. Local planners and managers have to consider simultaneously the economic and engineering aspects, and environmental, fiscal, and social impacts.
5. Since nearly half of the U.S. population lives within 80.5 km of the coast, energy facility siting in coastal areas has become an important issue. Would these areas become the dumping ground for locating the environmentally burdensome facilities not wanted elsewhere?
6. The major environmental effects associated with OCS development result either directly from extraction of oil and gas, gaining access to the site, or transporting the product to refineries.
7. In the end, most of the siting decisions regarding onshore facilities will represent value judgements based not only on locational studies but on the political tug-of-war which seems inevitable when the "not in my backyard" outcry achieves political salience.
8. Siting of onshore facilities related to the OCS requires careful balancing between demands for environmental quality and regional economic development and the adequacy of energy supplies. The overall development pattern of an environmentally sensitive region is at issue.

UNITED STATES CONGRESS, Committee on Commerce, *Hearings before the National Ocean Policy, Study of the Committee on Commerce United States Senate on Outer Continental Shelf Oil and Gas Extraction and Environmental, Economic and Social Impact upon the Coastal Zone*, U.S. Government Printing Office, Washington, DC, v, 450 pp., (1974).

#### ISSUES

These hearings brought together representatives from various levels of government, industry, and the academic world. Statements and discussions are centered around the outer continental shelf oil and gas extraction, and their environmental, economic, and social impact upon the coastal zone. These broad issues are examined at different levels of detail, with different approaches because of the heterogeneity of the participants. Additional articles and letters are an evidence of the most current issues evolving around the question of OCS-related activities and their impacts.

- (b) "Methodology for Assessing Onshore Impacts of Offshore Outer Continental Shelf Oil and Gas development", prepared by Ray F. Weston, Inc.;
- (c) "Environmental Planning for Offshore Oil and Gas", prepared by the Conservation Foundation.

Each of the methods has a particular emphasis; the guide helps in the selection of an OCS method which meets the user's information assessment and planning needs by describing and comparing the different methods. This report can help resolve time and financial issues related to the initiation of an assessment method by a particular body or agency.

## RECOMMENDATIONS

- I. The following criteria are recommended as a basis for devising a siting strategy in New Jersey:
  - (a) accomplish as much as possible on the offshore rigs themselves - storage, initial separation, and so on;
  - (b) minimize the number of separate pipeline landfalls;
  - (c) hold to an absolute minimum the construction of any facilities at pipeline landfall, on beaches or in wetlands;
  - (d) minimize the total number of OCS-related onshore support areas to perhaps a single complex for supply service, and support of the rigs (or at most two such areas) and a single coastal-dependent processing complex for each major pipeline (clustered siting of OCS support facilities).

**UNITED STATES DEPARTMENT OF THE INTERIOR, Geological Survey, The Use of Best Available and Safest Technologies (BAST) During Oil and Gas Drilling and Producing Operations on the Outer Continental Shelf, Washington, DC, 21 pp., (April, 1980).**

The oil industry has been drilling for and producing oil and gas from federally leased lands offshore the United States since 1954, and from lands leased by coastal states for many years before that. Since passage of the Outer Continental Shelf (OCS) Lands Act in 1953, the U.S. Geological Survey (USGS) has had the responsibility of developing, administering, and enforcing a regulatory program to ensure that drilling and production operations are conducted in a safe and environmentally sound fashion.

Following the oil embargo of 1973, Congress undertook an extensive review of the OCS Lands Act of 1953 in response to a presidential proposal to increase OCS leasing. The Act and the regulatory program it established were reviewed to determine their adequacy in addressing the increasingly complex technological, environmental, and political problems associated with OCS oil and gas operations, particularly in frontier areas. After years of debate, this effort culminated in the enactment of the OCS Lands Act Amendments in 1978.

Provisions of these amendments enhanced the USGS' regulatory authority to assure that oil and gas exploration, development, and production activities on the OCS are conducted in a safe and pollution-free manner. One distinctive provision of the legislation was the emphasis it placed on the need for a program to ensure that OCS technologies be continuously and systematically reviewed so that the best available and safest technologies (BAST) are applied to OCS operations. The BAST requirement is stated in the OCS Lands Act as follows:

"... the Secretary (of the Interior) and the Secretary of the Department in which the Coast Guard is operating shall require on all new drilling and production operations and wherever practicable on existing operations, the use of the best available and safest technologies which the Secretary determines to be economically feasible, wherever failure of equipment would have a significant effect on safety, health or the environment, except where the Secretary determines that the incremental benefits are clearly insufficient to justify the incremental costs of utilizing such technologies".

What follows in this document is a breakdown as to how this program is applied to the offshore industry as a whole and the other regulations which fall under this program.

**WESTON, R.F. INC., Methodology for Assessing Onshore Impacts for Outer Continental Shelf Oil and Gas Development, Volume II Methodology, (July, 1978).**

This volume contains the detailed description of a set of methodologies capable of assessing the onshore implications of outer continental shelf oil and gas exploration, development/production, and well workover. An outline of the important portions of the report reflects the variety of issues documented.



1. Industry requirements: scenarios for the various phases of OCS activities are generated; means for estimating the number of jobs, salaries, materials, land requirements, facilities, capital investments, and environmental factors resulting from offshore development are provided.
2. Locational analysis: the analysis developed is a systematic approach to identifying the most probable locations for primary and secondary onshore facilities.
3. Economic analysis: description of the methodologies to be utilized in estimating the economic impacts on regions affected by OCS oil and gas development. Issues and difficulties of economic analysis include the distribution of indirect and induced effects and the determination of the area of impact.
4. Demographic impact: provides a method for predicting changes in population and demographic characteristics of a region resulting from OCS development (e.g. population locations and density, population change, migration pattern, urbanization, and composition). "Analysis and projections of population trends are one at the base of all major development decisions on a regional or local level."
5. Environmental impact: the purpose of this portion of the study methodology is to understand the types and extent of OCS-related environmental impacts. Impact assessment techniques deal primarily with the short-term direct impacts associated with the construction and operation of OCS facilities. The overall procedure relies heavily on other sources.
6. Fiscal impact: the objective of this analysis is to estimate the direction and magnitude of the pressure exerted by OCS activity on state and local governments. Issues relevant to fiscal matters include compensation and distribution, and relative importance of impacts within several jurisdictions.

**WESTON, R.F. INC., Methodology for Assessing Onshore Impacts for Outer Continental Shelf Oil and Gas Development, Volume III: Baltimore Canyon Test Case, (July, 1978).**

The methodologies described in volume II are tried out on a test case of the Baltimore Canyon leasing areas. This volume deals with the impacts related to this geographical area and follows the approach and structure of the preceding volume: industry requirements and assessment of their location, followed by a projection of economic, demographic, environmental and fiscal effects. "The results contained in this volume have been structured primarily to validate the methodology of volume II, and do not necessarily represent real life results."

**ZINN, J., Environmental Planning for Offshore Oil and Gas, Volume II: Effects on Coastal Communities, U.S. Fish and Wildlife Service, Biological Services, and the Conservation Foundation, Washington, DC, 60 pp., (1977).**

**ISSUES**

1. OCS development requires considerable industrial activity on land as well as at sea. A number of techniques are available to forecast the effects of OCS-related actions. They will bring insight to the kinds of development likely to take place and the magnitude of their impact. Uncertainties usually are unavoidable in making forecasts, so rough approximations are the rule. Another limitation comes from the regional boundary selected which means that the process chosen will be confined to a defined study region. A third limitation is the importance of considering whether particular OCS-related facilities are likely to be built at all.
2. Total population added to the region is important in determining the potential demand for public and private community facilities. The location, design, construction, and operation of community facilities can affect existing ecosystems as they may require substantial land areas.

## V ENVIRONMENTAL IMPACTS

### **BEAUFORT SEA PROJECT, Offshore Drilling for Oil in the Beaufort Sea: A Preliminary Environmental Assessment, Beaufort Sea Project, Victoria, B.C., 42 pp., (1975).**

"This report is an environmental assessment and by assuming hypothetical oil well blowout scenarios, examines the nature of the transport and fate of oil in the Beaufort Sea and draws conclusions regarding the impact of the oil on the environment, including climate, sea birds, marine mammals and other marine organisms."

Even though the scale of activities is small in 1976, the possibility of a blowout occurring cannot be ignored. Assuming a worst-case sub-sea oil well blowout, major conclusions are as follows:

- (a) the blowout would run wild for at least 1 year, until a relief well could bring it under control;
- (b) access to either site for relief well drilling in any summer is not guaranteed;
- (c) even though a wild well could discharge oil for a year or more into the Beaufort Sea's ice, any premature melting which would be caused would be indistinguishable from natural ice-cover fluctuations; hence, no climate changes should be attributed to oil in the volumes expected;
- (d) oil spill countermeasures for 1976 will not greatly decrease the impact of oil on wildlife;
- (e) the wildlife most seriously damaged would be seabirds;
- (f) it is judged that none of the damage would be irreversible but that recovery could take up to a decade in some cases;
- (g) except for birds, the economic values of Beaufort Sea wildlife are small compared to oil industry expenditures. The birds are a continental resource with a high indirect economic value. The major values threatened must be judged primarily on sociological and environmental grounds, not on economic ones.

### **BLAICKLEY, D.R., "Environmental Protection in North Sea Exploration and Production Operations", Marine Policy, 1 (2), pp. 143-155, (1977).**

#### ISSUES

1. Lack of adequate preventive, precautionary or remedial measures could result in the pollution of the environment by oil from petroleum explorations: refining, crude oil transportation, and exploration and production activities. Environmental protective measures employed in the North Sea during petroleum exploration and production have been developed based on worldwide experiences.
2. It has been determined from a number of studies on marine life that the most toxic components of crude oil are the lighter, water-soluble components, the aromatic and the light paraffins. The effects of these toxic components are limited since they are the components that are likely to be lost through evaporation, biodegradation and photo-oxidation.
3. Because of its insolubility and high molecular weight, weathered oil from coastline spills tends to have a smothering effect on intertidal shell fisheries. In general, the extent of ecological impact of offshore crude spills is determined by the volume of spilled oil, the concentration of toxic components, and the effect of storms or heavy surf on the spilled oil.
4. The primary objective with respect to oil spills originating from North Sea offshore exploration and production activities is to remove or disperse the oil before it reaches shallow waters or shoreline areas. This approach is in recognition of the fact that the greatest ecological risk or aesthetic damage occurs when the oil reaches the shoreline.

#### RECOMMENDATIONS

1. Four essential operations should be carried out in any oil spill cleanup and control:
  - (a) limiting the size of the spill in case of a blowout by bringing the well under control or permitting the oil to burn at the well head;
  - (b) containing the spill - prevent the spilled oil from breaking up near the shoreline or drifting to sensitive areas;
  - (c) recovering the spilled oil through containment or use of mechanical pickup devices;
  - (d) treating the oil that could not be recovered.

Booms are usually used to contain an oil spill while gravity separation methods are used to remove the oil layer.

2. A number of precautionary measures are taken to minimize the environmental impact of exploration and production operations in the North Sea. For example, sea-bottom surveys using side-beam sonar, detailed diver inspection, core sampling, and seabed analysis, are carried out to ensure safe rig operation and to avoid poor siting and equipment failure.
3. All companies operating in the North Sea have developed contingency plans to ensure rapid, coordinated response to any emergency. The contingency plans ensure that:
  - (a) all jobs to be done for potential emergencies are listed;
  - (b) jobs are assigned prior to an emergency and an appropriate chain of command is established;
  - (c) both internal and external communications patterns are established;
  - (d) materials and equipment that could be needed are available.
4. Crude oil from North Sea fields is transported either by pipeline or by tanker loading offshore at single-buoy moorings (SBM). Both modes of transportation pose potential environmental hazards. To reduce the potential for spillage, SBM operations flush hoses before disconnection, and automatic systems are used to ensure failsafe pump cut-off. Offshore pipes are also subjected to rigorous specifications. The pipes have anticorrosion coatings and concrete coatings to provide weight and to protect against damage.

**BRADLEY, P.G., "Marine Oil Spills: A Problem in Environmental Management", Natural Resources Journal, 14 (3), pp. 337-360, (1974).**

#### ISSUES

1. Ocean transport of petroleum and offshore production are the primary sources of marine oil spills. Transportation accidents may be caused either by collision or stranding, and by loading or discharging.
2. Oil spillage is often intermittent and unpredictable with respect to time and place. Thus, detection becomes one of the important functions of any agency charged with the responsibility of marine oil pollution prevention.
3. In order to introduce pollution-reducing investment by oil companies, the penalties levied must exceed the value of the environmental damage.

#### RECOMMENDATIONS

1. Two types of institutional bodies are proposed for managing marine oil pollution: a tribunal responsible for setting environmental quality standards, and an enforcement agency responsible for ensuring compliance with the standards.
2. The establishment of standards to govern tanker construction and rules for tanker operation would also help to reduce the incidence of marine oil spills. The establishment of such regulations should be combined with the imposition of a uniform tax on operation to provide funds for accident compensation.
3. To provide incentives to liable parties and to prevent recurrence of oil spill accidents, the author also suggests the establishment of absolute liability for vessel operators and offshore drillers.
4. To provide some mechanism for dealing with externalities or spillover effects resulting from marine oil spills, the development of amenities rights has also been suggested. This would provide the authority to limit polluting activities.

**BROWN, S., Environmental Impacts of Arctic Oil and Gas Development, Inuit Tapirisat of Canada, Ottawa, Ont., 86 pp., (1975).**

This report contains an abbreviated review of the findings of selected environmental impact studies related to Arctic oil and gas development. Four general areas of interest are examined: the effect of oil and gas development on Arctic vegetation, on birds and mammals, and on freshwater resources, and the impact of offshore oil and gas exploitation on marine ecosystems. Within each of these topics, several specific areas of concern are identified, and a series of recommendations focussing upon these problem areas follow each discussion. Here are several examples of issues raised in the report:

- (a) Permanent road construction may alter vegetation patterns through drainage modifications and erosion. Temporary hauling may lead to thermokarst, rotting and vegetation destruction through cutting and scattering. Grass-, sedge-, and moss-dominated communities are most susceptible to damage from vehicular traffic.
- (b) The increase of oil-related activities accelerates forest and scrub clearing.
- (c) Since half of northern forest fires are caused by people, it is probable that, as settlement and development expand, the proportion of forest fires caused by human carelessness will increase.
- (d) The effect of an accidental introduction of non-indigenous species into established Arctic ecosystems is unknown. Should this occur, ecological repercussions may be significant.
- (e) An oil or gas spill would have a significant effect on soil and vegetation, depending upon the magnitude of the spill. Freshly spilled oil is extremely phytotoxic. Contamination may retard vegetation growth for several years.
- (f) Development may increase stress levels on fauna. Primary stress sources may be linked to harassment by aircraft, construction and compressor station noise, interference with migration routes, ingestion of oil following spillage, and habitat loss or impairment following forest cutting, construction activities, and fires.
- (g) Because Arctic freshwater ecosystems are low in species diversity, small environmental disturbances could precipitate great changes in biotic characteristics.
- (h) The shock wave and accompanying pressure changes following seismic testing in stream channels are major causes of fish death and injury. Similarly, the removal of gravel from stream channels may destroy eggs and mobilize gravel-retained silt, leading to the destruction of similar habitats downstream.
- (i) The large volume of fill withdrawn from the sea floor for the construction of artificial islands from which to drill for oil and gas may have adverse biological implications for benthic biota.

DE GROOT, S.J., "An Assessment of the Potential Environmental Impact of Large-scale Sand-dredging for the Building of Artificial Islands in the North Sea", Ocean Management, 5 (3), pp. 211-232, (1979).

#### ISSUES

- 1. Most of the damage to and disturbance of life in the area where the island will be situated will occur during the building phase; disturbances will occur in the marine sand extraction area itself.
- 2. Several methods of marine sand and gravel extraction are available, but the most commonly used method is the trailing suction hopper dredger. In general, the extraction method selected is determined by the cost of operation, the storage capacity of the dredger, and the distance between island location and source of sand.
- 3. Irrespective of the mining method used, there will be an increase in turbidity in the area of operation. The oxygen level in the water column may decrease during sand extraction. Sand dredging may also result in the release of  $H_2S$  (strong smell) which, being toxic, may poison fish.
- 4. Pesticides and PCBs adsorbed to the bottom sediments may be released into the water during sand extraction.
- 5. Zooplankton and phytoplankton will be greatly affected because of decreased light intensity and changes in the spectral composition of the light. When turbidity increases, entering particles will scatter more blue shortwave light than red light.
- 6. The visual feeders of fish, e.g. mackerel and turbot, will avoid the turbid waters of the dredging area.

#### RECOMMENDATIONS

- 1. The marine biological environment of the dredged area will be restored after operations cease.
- 2. If the sand in an area is completely removed, entirely different animal communities will appear, thus destroying the source of food for bottom fishes.
- 3. Despite the release of PCB during sand extraction, the PCB content in animals in the area did not increase significantly. Most trace metals return to baseline levels in about 6 months.
- 4. After dredging, the fish will return soon after the fine sediments settle.
- 5. The stone and concrete protection of the shores of the island will form a habitat for a type of ecosystem not previously found in the area.

DE GROOT, S.J., "The Potential Environmental Impact of Marine Gravel Extraction in the North Sea", Ocean Management, 5 (3), pp. 233-239, (1979).

#### ISSUES

1. The main users of marine sand and gravel of the southern North Sea and channel are the London and Rotterdam metropolitan areas.
2. Another major user is the offshore oil and gas industry which uses marine gravel and sand to bury pipelines.
3. Marine sand and gravel dredging alter considerably the bottom topography of the sea bed, with a resultant interference on the trawling of various bottom trawl gears.
4. Studies have shown that herring return to parent gravel grounds to spawn using sound characteristics of the sea bed for direction. The alteration of the sea bed topography through marine gravel extraction, therefore, has a serious impact on herring spawning.
5. Non-migratory species like sand-eels lay their eggs in the sand; however, embryo development stops when the eggs are covered with fine material. Thus, outwash fine released during dredging results in less successful hatching.

#### RECOMMENDATIONS

1. Changes to spawning grounds through dredging will negatively influence the return of herring to the spawning sites, and thus their successful reproduction. The increase in marine gravel extraction in the southern North sea, especially of the English east coast and channel, therefore constitutes a serious threat to the existence of the already depleted stocks of herring in this area.
2. Any area designed for marine gravel extraction should first be surveyed; only lower concentrations of gravel should be licensed for extraction. Programmed dredging should be used to help reduce the extent of alteration to the sea bed, the ecosystem, and spawning sites.

DOWALL, D.E., "U.S. Land Use and Energy Policy - Assessing Potential Conflicts", Energy Policy, 8 (1), pp. 50-60, (1980).

#### ISSUES

1. Policy decisions reflect several trade-offs. For this reason, sound administrative judgment requires that energy planners determine how the various energy technologies interact with other criteria.
2. Energy planners must expect significant resistance to policies and programs that imply environmentally undesirable changes in land use pattern can arise. The primary land use issues which are relevant in an energy policy include:
  - (a) land use patterns best suited for meeting energy and environmental policy objectives;
  - (b) existing land use controls and environmental policies which influence energy production and consumption;
  - (c) land use and environmental policies needed to create energy-efficient and environmentally desirable land use patterns;
  - (d) second-order effects which energy-efficient land use and environmental policies and actions will have on various social, ethnic, and economic classes.
3. Land use issues exist when the values of divergent groups cause conflict over the design, development, and siting of settlements and their related facilities. Energy planners should therefore concentrate on identifying and analyzing the relationships between energy technologies and land use and environmental values.
4. Unlike technical or economic criteria, land use policies do not rely on consistent and immutable benchmarks or levels of performance. Moreover, land use regulations are largely determined by other policy objectives. Land use patterns are regulated in order to achieve environmental, social, economic and energy policy goals. These goals and their interrelated land use policies, however, can conflict; for example, land use policies aimed at achieving environmental goals may not be comparable to those aimed

at achieving energy policy objectives. Policy analysts must therefore understand the interplay of policies and how they can limit the range of feasible energy technologies.

#### RECOMMENDATIONS

1. The author lists four general categories of policies and regulations that directly or indirectly influence land use patterns. These are:
  - (a) generic land use and environmental regulations;
  - (b) air quality controls;
  - (c) water quality controls;
  - (d) housing and transportation policies.
2. Outer continental shelf oil exploration, liquefied natural gas (LNG), nuclear, and coal power plants are four technologies whose future depends largely on siting issues. However, federal involvement with these energy facilities sitings should be based on the principle that all siting decisions are local issues. Thus, if there are situations where there is no natural consensus, the federal government should not undertake unilateral action.
3. It is suggested that a good siting process should contain the following generic qualities:
  - (a) knowledge of local politics;
  - (b) participation by local interests;
  - (c) clear lines of communication between parties;
  - (d) ability to adapt to changing conditions;
  - (e) ability to mitigate adverse effects where possible;
  - (f) compensation of individuals and groups adversely affected where mitigation is not possible.

**EISMA, D., H. VAN HOORN and A.J. DE JONG, "Concepts for Sea-use Planning in the North Sea", Ocean Management, 5 (4), pp. 295-307, (1979).**

#### ISSUES

1. The increase in the number and scale of traditional activities (shipping, fishing and naval warfare), and new activities (the exploitation of oil and gas deposits, the dredging of gravel and sand, and the dumping of waste), has generated a need to plan for existing as well as for future activities in the North Sea.
2. The increased activities in the North Sea have created a number of problems which can only be solved within a national or international (or EEC) governmental policy framework. The present arrangements which are limited in nature, isolated from each other, lacking an enforcement system, and operating within different jurisdictional zones have failed to solve pressing problems.

#### RECOMMENDATIONS

1. For an effective planning of the North Sea, it is essential that all the countries bordering the North Sea adopt a coherent set of policies. Such planning policies must be based on the concept of sea-use planning, which includes spatial planning, environmental planning, and separate activities planning.

**ENGELMANN, R.J., "The Alaskan Outer Continental Shelf Environmental Assessment Program", Environmental Conservation, 6 (3), pp. 171-180, (1979).**

#### ISSUES

1. There is no generally accepted definition of the word "assessment". The involvement in the assessment process by several agencies has also not contributed to the development of a general definition of the term.
2. The search for new sources of petroleum, especially in frontier areas, and the need to provide predictions of the environmental effects of oil and gas development in these areas led to the establishment of the Outer Continental Shelf Environmental Assessment Program (OCSEAP) to spearhead marine environmental research in Alaska. OCSEAP was charged with a number of responsibilities:

- (a) interagency coordination of research;
- (b) specification of environmental data, maps and models for OCS hydrocarbon development;
- (c) monitoring of contracts;
- (d) evaluation of performance;
- (e) integration and synthesis of data.

## RECOMMENDATIONS

1. "Assessment" may be defined as the gathering, collating, and synthesis of information. The term also involves prediction and evaluation.
2. An outer continental shelf environmental assessment program should be designed as a multidisciplinary study to provide inputs for offshore hydrocarbons development. Such input should include the location and character of biological populations, the impact of oil spills on organisms, and the identification of physical hazards posed to human safety and installations.
3. If timely and relevant predictions are to be provided on the environmental effects of oil and gas development, then the assessment program must be able to furnish three types of information:
  - (a) stresses on man-made structures by the environment: this kind of information is necessary in judging how well engineering designs can withstand the environmental stresses and in establishing minimum requirements for industry to comply with;
  - (b) identification of wildlife habitats: onshore-related facilities can be directed away from sensitive habitats;
  - (c) information relating to new monitoring techniques and the impact of pollutants on the environment.
4. The information-gathering program for OCS environmental assessment should involve six basic tasks:
  - (a) determination of the baseline contaminants commonly associated with oil and gas development;
  - (b) determination of the nature and magnitude of contaminants;
  - (c) identification and estimation of potential hazards;
  - (d) transport of contaminant discharges and the impact of physical, chemical and biological processes on the contaminants;
  - (e) inventory of biological populations likely to be impacted by petroleum exploration and development activities;
  - (f) prediction and determination of the effects on populations and ecosystems of contaminants associated with oil and gas exploration and development.

**FEDER, H.M., D.G. SHAW and A.S. NAIDU, The Arctic Coastal Environment of Alaska, Volume II: A Compilation and Review of Scientific Literature of the Arctic Marine Environment, University of Alaska, Institute of Marine Science, Fairbanks, AK, iv, 201 pp., (May, 1976).**

This publication, the second volume of a report on the Arctic coastal environment of Alaska, is a compilation and review of scientific literature of the Arctic marine environment. The document is divided into eleven chapters as follows:

1. Physical Oceanography
2. Chemical and Geological Oceanography
3. Plankton
4. Benthic Algae
5. General Ecological and Biological Studies
6. Ice Algae, Benthic Microalgae and Primary Production
7. Benthic Invertebrates
8. Fishes
9. Marine Birds and Mammals
10. Environmental Impact
11. Oil Pollution: Environmental Effects of an Oil Spill at Prudhoe Bay

Each chapter consists of a short narrative reviewing key literature. All chapters except Chapter 2 contain a table of important annotated references. Each chapter closes with a reference section which includes citations, and supplemental references. Most chapters make specific references to the Beaufort Sea, depending on the topic being discussed.

HOUGHTON, D.R., "Marine Fouling and Offshore Structures", Ocean Management, 4, pp. 347-352, (1978).

#### ISSUES

1. As experience from the North Sea has shown, fouling will occur on the external parts and in the sea water services of platforms. Principal fouling organisms include barnacles, ascidians (sea-squirrels), annelids, algae, bryozoans (sea mats), sponges, sea anemones, mollusks, and tunicates. These species may be transported to offshore structures by sea currents, or may colonize them while the structures are anchored or being towed away from coastal waters.
2. Fouling is seasonal and extends from April to October in the temperate waters of the Northern Hemisphere. The season is shorter towards the polar region and longer towards the Equator. Some fouling species are geographically restricted while others are widespread. The ascidians are found in the North Polar regions and the Mediterranean areas, while the barnacle is restricted to the Arctic/Boreal regions and along the English Channel coast.
3. Fouling causes a number of problems: it increases the diameter of structures and, as a result, increases the stress on offshore platforms; it also makes inspection of the platform difficult. Removal of fouling may cause damage to the protective coating of the platforms.

#### RECOMMENDATIONS

1. All the methods used to control or prevent fouling have environmental impacts because anti-fouling paints are poisonous or have a copper base. Anti-fouling poisons can be accumulated by sedentary fouling organisms. This can be serious if these organisms enter into the food chain or are consumed as food.
2. Coast of copper-containing paints have been known to prevent fouling up to 10 years. However, copper can be anodic to steel. Restoration of the copper coating after it has worn out can be a problem since the safety of divers can be threatened.
3. Fouling can also be removed by divers using retrojects, scrubbers or other mechanical aids. Fouling organisms can also be killed by spraying poison on them.
4. It is also suggested that chlorination of the water can be effective in preventing fouling.

KEILLOR, J.P., "The Hazards of Tank Ships and Barges Transporting Petroleum Products on the Great Lakes", Coastal Zone Management Journal, 8 (4), pp. 319-336, (1980).

#### ISSUES

1. Because of the arctic and subarctic environment of the Great Lakes, the greater persistence of oil under ice and in sediments, and the slower growth and lower productive rates of organisms, the risk of oil spills from tank ships and barges has become a coastal zone management issue in the Great Lakes, especially in view of a proposed extended navigation season.
2. Seasonal start-up problems, adverse effects of cold weather, and collision with ice fields are some of the major causes of the significant oil spills during the winter. Other causes of oil spills include ships striking bridge piers, docks and lock approaches, groundings, collision with other vessels, and personnel errors.
3. Any large spill poses a threat to adjacent shorelines because of the enclosed coastlines of the Great Lakes.

#### RECOMMENDATIONS

1. The restriction of the petroleum distribution system on the great Lakes to a well-regulated Canadian and United States fleet poses less risk to the environment than a distribution by a multinational assortment of tank vessels with varying degrees of skills and operating conditions.
2. The one-third decline in the fleet of Great Lakes tank vessels facilitates inspection, regulation, and safety improvements of the fleet.



3. As a result of an extended navigation season, the stress of winter conditions will likely result in an increase in the incidence of oil spills. Personnel must therefore be trained and equipment prepared for arctic and subarctic conditions.
4. To reduce the principal causes of oil spills on the Great Lakes, management objectives should include improved training and supervision, better equipment reliability, and safer navigation. An economic incentive should also be provided to encourage safer tank vessel operation.

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Department of Ocean Engineering, Primary Physical Impacts of Offshore Petroleum Developments, MIT Sea Grant Program, Cambridge, MS, 440 pp., (April, 1974).**

Four major issues are addressed in this research; they are approached with the following objectives:

1. To estimate the amount and type of development activity which would be engendered by a series of hypothetical finds on the outer continental shelf.
2. Using past spill experience, to estimate the likelihood of spillage by number and size of individual spills for a range of hypothetical offshore petroleum developments on the Atlantic and Gulf of Alaska continental shelf.
3. To obtain insight into the likely behaviour of oil spill trajectories emanating from each of the 13 potential Atlantic continental shelf production regions.
4. To examine the present state of knowledge with respect to mass transport and its effect on the composition of petroleum in an oil slick.

**MATTHEWS, J.B., "Observations of Under-ice Circulation in a Shallow Lagoon in Alaskan Beaufort Sea", Ocean Management, 6 (2/3), pp. 273-280, (1981).**

While ecosystem studies in the Beaufort Sea region have been carried out during the summer months, very little research has been devoted to the study of winter conditions. Some of the studies carried out during the summer have shown, for example, that the persistence of easterly and northeasterly winds is caused by a strong sea breeze. It has also been shown that summer storms in the Beaufort Sea area can result in sea-level surges of more than 3 metres. This article, however, examines under-ice ecosystem processes in late November.

The study was carried out in Stefansson Sound, a typical lagoon of the Beaufort Sea coast protected by offshore barrier islands, east of Prudhoe Bay. Using Aanderaa current meters fitted with conductivity and temperature sensors and Aanderaa tide gauges to measure salinity, temperature and current vectors in the Stefansson Sound area, the study found the existence of a shoreward current under the ice. The author suggests that the existence of such a current has several implications should oil be spilled in the winter in the Sound as a result of petroleum development in the Beaufort Sea:

- (a) oil moving along the bottom of the ice would eventually move landwards, thus fouling the beaches;
- (b) oil may remain trapped in pockets under the ice sheets;
- (c) oil reaching the ice-sea floor could be carried seaward by lower briny currents.

**MATTSON, J.S., "Compensating States and the Federal Government for Damages to Natural Resources Resulting from Oil Spills", Coastal Zone Management Journal, 5 (4), pp. 307-332, (1979).**

#### ISSUES

1. Damage to natural resources from oil pollution has cost society uncounted millions of dollars each year. The annual input of petroleum to the marine environment was estimated at  $6 \times 10^6$  tonnes in 1973. Of this, 10% was due to natural submarine seepages, 10% to atmospheric "rain out", and 44% to municipal and industrial sewage facilities and land runoff, for a total of 64%. The remaining 36% is due to oil spills which are usually discrete and readily identifiable, caused by operational discharges, blowouts, pipelines, and vessel groundings and collisions.
2. Damages to the natural environment take several forms: to commercial and non-commercial species, and to irreplaceable and replaceable resources. Ecologically, the environmental effects can be grouped into five classes: (a) those causing hazard to humans because of contaminated food; (b) those decreasing the fishery resources or damaging such wildlife as seabird and marine mammals; (c) those decreasing the

aesthetic value, due to oily beaches and unsightly areas; (d) those modifying the marine ecosystem by eliminating certain species or decreasing their diversity and productivity; and (e) those modifying the habitat by developing or preventing recolonization.

3. While fishermen, for example, have received compensation damages caused by oil spills, until recently there has not been a provision under statutory or common law to allow a government to recover for damage to the environment. The determination of a replacement cost or the value of a seabird has been one of the difficult problems to resolve.

#### RECOMMENDATIONS

1. Existing compensation schemes have paid damages for cleaning costs and loss of income to those who depend directly (fishermen) or indirectly (tourist-oriented business) on the natural resource damaged as a result of the oil spill, except for damage to natural resources that the state or federal government holds in public trust. Under the theory of Parens Patriae, which allows the courts to act in their capacity as public trustees, compensation has been paid for damages to natural resources. Proposed amendments to the super fund legislation would also allow for compensation to the natural resources.

**M'CONIGLE, R.M. and M.W. ZACHER, "International Problem of Marine Pollution", International Perspectives, (March/April), pp. 8-12 (1978).**

#### ISSUES

1. The environmental crisis is worldwide, thus presenting serious challenge to current diplomatic approaches.
2. Because states are reluctant to accept international controls over domestic activities, international negotiations on marine-pollution control have been restricted to pollution caused by ships (oil pollution). For this reason, pollution from land-based sources (air, river run-off) has been ignored even though these sources contribute a great deal to the total quantity of pollutants.
3. Part XX of Canada's Shipping Act (which sets standards) was extended to cover the 322-km zone on January 1, 1977. However, the Powers conferred on Canada by the Shipping Act exceed those allowed under the Informal Composite Negotiating Text (ICNT) of the UNLOS. This conflict between Canada's legislation and the provision of ICNT could prevent Canada from ratifying the law-of-the-sea treaty.

#### RECOMMENDATIONS

1. The authors point out that in a "global village", the distinction between domestic and international concerns is no longer relevant, especially regarding the global nature of environmental issues. Failure to recognize this will, therefore, prevent the development of any imaginative response to global environmental pollution problems.
2. The challenge in finding solutions to international marine pollution does not lie with developing higher standards but rather with implementing and enforcing standards that have already been agreed upon. For example, Canada, like most countries, has not taken steps to ensure that existing standards are enforced, nor has any major surveillance program been financed.

**McKELVEY, V.E., "Environmental Protection in Offshore Petroleum Operations", Ocean Management, 1, pp. 119-128, (1973).**

#### ISSUES

1. With the use of seismic profilers and the abandonment of explosives as the energy source in seismic surveys, Outer Continental Shelf (OCS) geological and geophysical explorations no longer present serious environmental problems. OCS oil and gas production and transportation to onshore facilities by pipeline or barge are activities that can be undertaken with significant environmental impacts. However, accidents and operational and equipment failures do occur, often resulting in serious consequences to personnel and the environment. The damage done is often the result of explosion, fire, or oil pollution.

## RECOMMENDATIONS

1. Any safety system designed for OCS petroleum operations must achieve three objectives: (a) prevention of accidents; (b) containment and minimization of accident effects; and (c) repair and elimination of permanent environmental effects.
2. Two safety-engineering procedures used in the identification of risks can be employed in designing an operational system to avoid failure and in designing back-up systems. The first procedure is "Hazard Analysis", which is the identification of hazardous or undesired events and the tracing back of these events to sources in equipment failure or operational error. The second procedure is "Failure Mode and Effects Analysis". This procedure, which is the opposite of the first, involves an evaluation of the consequences of a failure in the whole system.
3. The principles involved in the above procedures and a revision of offshore operation regulations are the basis of several contingency plans designed to deal with OCS oil and gas operations. Redundancy is the key factor that has been built into the measures dealing with OCS oil and gas operations. Thus, redundancy serves as a fail-safe device and/or procedure that provides for safety when others fail.

**MELLINGER, P.J., J.W. ANDERSON and J.R. VANDERHORST, Evaluation of Environmental Impacts of OCS Petroleum Development in the Pacific North-West and Alaska, Pacific Northwest Laboratory, Richland, WA, (June, 1979).**

## ISSUES

1. Routine discharges to the marine and estuarine environment resulting from the petroleum resource development of the OCS include metals in produced water, drilling muds, and borehole cuttings and chemicals in drilling mud. Hydrocarbons and oils are discharged to the ocean from ships' bilges and produced water, and to the atmosphere as combustion products from ships and platform power generation sources and as evaporation products from offshore and landbased storage tanks. The long-term effect of this type of pollution is not well understood.
2. No environmental data gathered to date are sensitive enough to test a scientific hypothesis of the nature or magnitude of impact that would occur to a site-specific population or ecosystem from routine discharges.

## RECOMMENDATIONS

1. Chemical analysis of hydrocarbons and toxic substances in specific regions of the Alaskan OCS should be continued. These efforts must be intensified in site-specific areas of known developmental interest.
2. It is necessary to survey specific sites planned for lease activities to record species composition and particularly the occurrence of endangered and/or threatened species and sport and commercially important species. This is particularly important because the habitat diversity found in Alaska is at least as great as that represented in the whole of the lower 48 states.
3. Sufficient data appropriate for the testing of hypotheses concerning the effects on marine biota must be collected from a given site. The expanse of sampling area must be limited while sampling intensity is increased.
4. At sites of specific interest, field experiments utilizing elevated levels of the hazardous components of the predicted effluents must be conducted to provide an assessment of safe versus toxic levels.
5. Sufficient quantitative data on refinery effluents, the receiving waters or sediments are not available to evaluate impacts from refining operations. Specific chemical data from analyses of refinery effluents and the environment into which they discharge are needed. It is likely that the effects from refineries in shallow water will be greater than those from platforms on the OCS.
6. Government/industry research and development and testing programs should be undertaken to ensure optimal regulations and rapid development of new equipment and procedures to fill any gaps that are identified in the OCS technology and environmental areas.

MILNE, A.R., Oil, Ice and Climate Change, Institute of Ocean Sciences, Sidney, B.C., 103 pp., (1977).

#### ISSUES

1. Drilling in the Beaufort Sea has a number of associated hazards, including bottom scoring by ice, intruding ice floes, and drilling through a subsurface layer containing permafrost.
2. The effects of oil pollution resulting from random accidents such as tanker spills and pipeline breaks are often factors to be considered. Many questions, dealing with the effect and behaviour of oil in Arctic waters, remain partly or completely unanswered.
3. By far the most important single cause of blowouts and spills is human error. "Experience has proven that blowouts happen because of mistakes with equipment or because of improper human reaction."
4. Transporting oil extracted offshore in the Beaufort Sea by pipeline or tanker poses numerous threats to the environment. Ice keels and ice islands and their fragments are common concerns within the Arctic environment.

MILNE, A.R. and B.D. SMILEY, Offshore Drilling in Lancaster Sound: Possible Environmental Hazards, Institute of Ocean Sciences, Sidney, B.C., 95 pp., (1978).

#### ISSUES

1. The probability of an oil well blowout in Lancaster Sound is somewhere between 1 in 1 000 and 1 in 10 000 wells drilled.
2. A logistic support base and its infrastructure are likely to produce more environmental disturbances than offshore drilling, provided an oilwell blowout does not occur.
3. Icebergs constitute the major hazard to drillships in eastern Lancaster Sound. More data are needed on their distribution and size variations, as well as on the prevalence of their sea-bottom scouring.
4. A sea-bottom oilwell blowout may threaten the wildlife of Lancaster Sound. Threats to wildlife depend not only on expected oil pathways, but also on the volumes of oil which would escape each day, its initial composition, and the length of time the well remains uncontrolled, if it is not bridged naturally.
5. A major data gap is the absence of an inventory of countermeasure designs needed to protect critical wildlife habitats along coasts. There are also several data deficiencies which seriously hamper the immediate understanding of the oil threat in the Lancaster Sound region ecosystem.

#### RECOMMENDATIONS

1. Prediction of ice and iceberg drift will be inadequate if based on meteorological observations alone; monitoring of ice and drift is necessary because of unpredictable water currents.

O'NEIL, T., "Oil Spill Contingency Plans and Policies in Norway and the United Kingdom", Coastal Zone Management Journal, 8 (4), pp. 289-317, (1980).

#### ISSUES

1. Tankers and offshore exploration and production facilities are the major sources of marine oil spills in the North Sea. Tanker oil spills which are more difficult to predict and prepare for pose a greater threat to the coastal resources of North Sea countries.
2. Norway and the United Kingdom have established comprehensive programs to deal with offshore oil spills. Norway uses mechanical containment and recovery with booms and skimmers as the basis for oil spill response; the United Kingdom, on the other hand, relies almost exclusively on the use of chemical dispersants.

## RECOMMENDATIONS

1. Statens forurensningstilsyn (SFT), the Norwegian national pollution control authority, is responsible for offshore oil spills policies, contingency plans, and preparations. Municipalities in Norway likely to be affected by offshore oil spills are required to submit oil spill contingency plans to SFT for review and approval. They are also required to maintain sufficient equipment and personnel to clean up spills. The chief of police, the fire chief, and the harbour-master or port authority are responsible for local oil spill cleanup preparations.
2. The Department of Trade (DOT), with broad responsibilities for maritime affairs, is responsible for organizing and conducting the United Kingdom's response to marine spills. To carry out this responsibility, DOT has subdivided the United Kingdom into nine Marine Survey Districts, each administered by a Principal Marine Officer (PMO). Local authorities are responsible for removing oil spills reaching shores in the United Kingdom. Local authorities prepare oil spill contingency plans and designate an oil pollution officer to oversee both pre-spill preparations and spill cleanup operations.
3. In addition to stockpiling equipment at regional centres to respond to marine oil spills threatening coastal areas, both countries have established national programs for systematic research, development, testing and training in oil spill cleanup technology.
4. The response and preparation of Norway and the United Kingdom have been shaped by past experiences with oil spills. Norway uses mechanical containment and recovery with booms and skimmers because equipment already exists or can be developed for effective use in Norwegian waters. Besides, Norway's position is that containment and removal of spilled oil are preferable from an environmental standpoint. On the other hand, the United Kingdom's use of chemical dispersants is based on a policy to minimize pollution damage to seabird, fisheries, ecologically sensitive areas, and amenity beaches.

PERCY, J.A. and T.C. MULLIN, "Effects of Crude Oil on the Locomotory Activity of Arctic Marine Invertebrates", Marine Pollution Bulletin, 8 (2), pp. 35-40, (1977).

The effects of petroleum hydrocarbons on marine animals have often been studied by short-term lethal toxicity tests. However, it has been suggested that rapid lethality tests are poor criteria for assessing the long-term ecological significance of physiological changes in marine animals. Moreover, highly mobile animals that must hunt for their food may be affected to a greater extent by hydrocarbon pollution. Using two arctic marine invertebrates, an amphipod (*Onisimus affinis*) and a coelenterate (*Halitholus cirratus*), this study was carried out to examine the effects of northern crude oils on the locomotory activity of marine animals.

Using the annular chamber technique to measure locomotory activity, the researchers noted a significant reduction in activity of both amphipods and coelenterates after exposure to fresh crude oil. While the researchers noted that the magnitude of reduction in activity increased with increasing concentration of oil, Norman wells and Pembina oils were found to have the most pronounced effect on amphipods; the disruption of activity was not reversible. Disruption of activity in coelenterates exposed to light and medium dispersions of crude oil was reversible after a 24-hour recovery in clean seawater. Because a number of behavioural and physiological dysfunctions may occur during exposure to crude oil, the researchers concluded that the long-term ecological effects of locomotory activity impairment in marine animals are difficult to ascertain.

PIMLOTT, D.H., D. BROWN and K.P. SAM, Oil Under the Ice, Canadian Arctic Resources Committee, Ottawa, Ont., XIX, 178 pp., (1976).

"Plans to drill for gas and oil in the offshore regions of the Canadian Arctic developed quietly for more than a decade. The offshore operations both proposed and underway represent a wide spectrum of drilling technology: artificial islands, monopods, and drilling barges in the Beaufort Sea; conventional drilling rigs on ice in the Arctic Archipelago; semi-submersible rigs in Hudson Bay and dynamically positioned drillships in Lancaster Sound."

As planning progressed, both government and industry moved to prevent the Inuit of the N.W.T. and the Canadian public from becoming aware that the search for oil and gas was entering an entirely new and dangerous phase, according to the authors. The role of public interest organizations in informing the public about the social and environmental aspects of resource development programs, and about the programs themselves, is one of the themes of this book. The Committee for Original Peoples' Entitlement (COPE) and the Canadian Arctic Resources Committee reports changed the situation from one in which not even reporters or members of Parliament knew about plans for offshore drilling, to one in which members of the general public became aware of the hazardous search for oil and gas in Arctic waters. The adequacy of jurisdictional and administrative arrangements for protecting Arctic marine environments is questioned in almost every

chapter of this book. The authors maintain that the cooperation between government and industry to maintain secrecy, disregard for the interests of the Native People, the use of inadequate drilling systems, and the triumph of interdepartmental politics at the expense of environmental protection, are all part of the pattern of the rush to drill in the Arctic Ocean.

The book begins by looking at the physical environment of the Beaufort Sea, followed by the struggle for control of environmental protection by the Department of Indian and Northern Affairs and the Department of Environment. The concerns and interests of the Native Peoples are also highlighted in this chapter.

The next four chapters describe the environmental problems which are to be faced in different areas of the Arctic (drilling from ice islands in the Arctic Archipelago, production and transportation of offshore oil and gas in the Beaufort Sea, the environment of Lancaster Sound and the Northwest Passage); the technological problems to be faced by industry in drilling in these different environments are also delineated.

The final chapter discusses research and environmental assessment. A brief overview of offshore research by industry between 1970 and 1975 is given. The area of environmental assessment is discussed by looking at the policies of the Beaufort Sea Project; environmental assessment within the context of the Alaskan offshore areas is also discussed.

**SEGAL, J., "Drilling in Hostile Environments", Petroleum Economist, XLVIII (1), pp. 20-24, (1981).**

#### ISSUES

1. With the increasing desire to find new sources of oil and the development of sophisticated oil drilling technology, environments ranging from polar latitudes to the tropical zone pose no barriers to hydrocarbon drilling.
2. The only limiting factor to drilling in hostile environments is exploration costs. The cost of a deep offshore wildcat ranges from \$9 million on the Exmouth Plateau of Western Australia to \$50 million in the Beaufort Sea.
3. To lengthen the Arctic drilling period, several companies are conducting research into ice-melting, hovering drillbarges, dynamically positioned semi-submersibles, and heated gravity-type structure capable of withstanding ice pressures.
4. While drilling in hostile environments has not, in most cases, resulted in significant finds, the poor discovery rates are not likely to deter explorers. In the Norwegian sector of the North Sea, 33 wells were drilled before Ekofisk was found.

#### RECOMMENDATIONS

1. The technology needed to operate in hostile environments now exists. Most vessels can now operate in waters to 2 438 m, and corehole survey can even be carried out in depths of over 6 096 m. Semi-submersibles or drillships have also been designed to operate in waves up to 12 m and winds up to 60 knots. However, the main obstacle to an accelerated drilling in hostile environments is the gap between exploration technology and production technology.
2. The operations of the Dome and Imperial Companies in the Canadian Beaufort Sea and of Panarctic in the Canadian High Arctic have led to the development of cold-climate technology. In general, it is suggested that there are no significant constraints to Arctic production since onshore Arctic production technology would be an adaptation of existing technology elsewhere. The development of deep-water production technology for temperate regions presents the greatest problems.

**SHAW, D.G. and J.N. WIGGS, "Hydrocarbons in the Intertidal Environment of Kachemak Bay, Alaska", Marine Pollution Bulletin, 11 (10), pp. 297-300, (1980).**

#### ISSUES

1. To what extent are fossil hydrocarbons, transported in solution or suspension and degraded by biotic or abiotic processes, concentrated and metabolized by organisms?
2. Are the biological effects of oil spills minor and transitory, or severe and long-lasting?

## RECOMMENDATIONS

1. Based on the analysis of hydrocarbon concentrations found in some marine animals collected at five locations in Kachemak Bay, Alaska, it was found that some marine animals were coated with hydrocarbon while others had hydrocarbon in their tissues. The herbivorous limpet (*Collisella pelta*) collected at Coal Point, for example, had petroleum hydrocarbon in its tissues, but the intertidal algae (*Fucus distichus*) were only coated with hydrocarbon.
2. At Coal Bay, the filter feeding organisms (*Mytilus edulis*) contained petroleum hydrocarbon while the deposit feeding organisms (*Macoma balthica*) contained coal hydrocarbon.
3. The analysis also showed that animals higher in the food chain, e.g., the gastropod (*Nucella lima*) and the urchin (*Strongylocentrotus droebachiensis*) contained no concentration of petroleum hydrocarbons.
4. Oil incorporated into fine-grained intertidal sediments is released over a period of years while oil in a water column is rapidly dispersed.

**SINHA, E. and B. McCOSH, Coastal Estuarine and Nearshore Processes: An Annotated Bibliography, Ocean Engineering Information Service, La Jolla, CA, XV, 218 pp., (June, 1974).**

This bibliography was prepared for the Office of Water Resources Research, U.S. Department of the Interior. It contains 1 009 annotated references, listed alphabetically, to the literature on coastal-estuarine and nearshore processes. A subject outline identifies the geologic, geomorphic, meteorologic and oceanographic references which deal with the highly variable interactions in the estuarine and nearshore zones; references on models, methods, and instruments used in the study of coastal processes are also identified. References to studies in various parts of the world are specified in the geographic outline. All names of authors of each document are indexed. The subject index, using descriptors and identifiers, provides rapid access to abstracts dealing with specific subject matter.

**UNITED STATES CONGRESS, An Analysis of Oil Tanker Casualties 1969-1974, U.S. Government Printing Office, Washington, DC, 18 pp., (1978).**

This paper compiles and analyzes tanker accident data for the years 1969-1974. The analysis covers the worldwide oil tanker data by accident type, year of occurrence, flag of registry for the 10 major maritime nations outside the Eastern bloc, major size classes, and location off the three coasts of North America. The following is a sample of the findings:

1. Groundings and collisions together account for nearly half of the total accidents in the study period.
2. About one in seven tanker accidents has resulted in oil pollution.
3. Structural failures are the largest single cause of oil spills, followed by groundings.
4. Eighty percent of accidents and oil spillage in North America occurred on the Atlantic coast.

**UNITED STATES CONGRESS, Office of Technology Assessment, Oil Transportation by Tankers: an Analysis of Marine Pollution and Safety Measures, U.S. Government Printing Office, Washington, DC, xix, 1 288 pp., (1975).**

## ISSUES

1. "The pollution damage threat from any vessel to ocean ecosystem and surrounding environments is serious and substantial. Both short term and long term effects of oil pollution have been assessed, resulting in general agreement that oil spills must be reduced from their present level".
2. There is public concern about pollution of the oceans and of the safety of supertanker operations. Numerous improvements could be made to reduce oil pollution from the tankers and to increase the safety of their operations.

## RECOMMENDATIONS

Several findings directed toward reducing tanker-caused pollution of the oceans and improving the safety of their operation are presented in terms of three distinct approaches:

1. Pollution prevention and safety:
  - (a) need for additional and more accurate data on tanker-caused oil spills and accidents in general;
  - (b) need for additional research on the environmental effects of various levels of oil pollution.
2. Technical improvements:
  - (a) it is necessary to treat the oil pollution problem on a total systems basis in order to make meaningful improvements;
  - (b) fitting of double bottoms or double hulls on tankers;
  - (c) installation of inert gas systems;
  - (d) improvement of maintenance, inspection and survey procedures;
  - (e) need for improvements in the training and licensing of shipboard personnel;
  - (f) need to continually upgrade and improve vessel traffic systems and alter navigational aids.
3. Effectiveness of regulations.

**UNITED STATES DEPARTMENT OF COMMERCE - NOAA, Interagency Committee on Ocean Pollution Research, Development and Monitoring/Federal Coordinations Council for Science, Engineering and Technology, Catalog of Federal Ocean Pollution Research, Development and Monitoring Programs Fiscal Years 1978-80 Working Papers, U.S. Government Printing Office, Washington, DC, ix, 222 pp., (1979).**

## ISSUES

1. The ocean pollution problem has many facets and can be viewed from the following perspectives:
  - (a) pollutants of concern in the marine environment: research, development and monitoring of pollutants represent a major effort in federal expenditures;
  - (b) effects of ocean pollution on humans, marine living resources, and human use of the environment for recreational and aesthetic purposes: information of this sort "is crucial to rational regulation of polluting or potentially polluting activities and also for monitoring and effective response to polluting incidents";
  - (c) causes of marine pollution, including land use practices, marine waste disposal, marine energy, marine mineral resources, marine transportation, and others;
  - (d) tools for evaluating ocean pollution, including research monitoring, technology development, measurement technology, quality assurance, and data and information management;
  - (e) tools for controlling and minimizing ocean pollution.
2. The assignment of initial priorities for meeting national needs and problems in ocean pollution research, development and monitoring is essential. "Activity in these areas must be maintained at a level that will ensure that environmental information is available when needed for future decision making."

## RECOMMENDATIONS

1. Programmatic recommendations deal with the identification of broad areas in which a higher priority should be placed on the problem, as well as areas in which federal projects should be examined in detail in order to facilitate improved coordination and more effective funding.
2. Management and technical recommendations are directed toward the improvement of efficiency and timeliness of the overall federal effort. They cover the areas of research, monitoring, technology development, measurement technology, quality assurance, and data information dissemination. Specific tasks related to these areas of interest accompany the recommendations.



**UNITED STATES DEPARTMENT OF THE INTERIOR, Environmental Planning for Offshore Oil and Gas Volume V: Regional Status Reports Part 2: Mid and South Atlantic, Washington, DC, ix, 93 pp., (1978).**

**ISSUES**

1. Various environmental concerns have arisen from the activities related to OCS exploration in the Mid-Atlantic area. Of particular concern are the remaining productive wetlands of New Jersey, Delaware, Maryland, and Virginia. These areas are a valuable nursery and spawning area for most estuarine and nearshore fish and shellfish. The effects of OCS activities on offshore fisheries may present a major problem, and commercial and sports fishing could also be affected.
2. There has been a substantial lack of harmony in planning for offshore activity between state and federal jurisdictions. Many factors brought about this climate, chiefly the scarcity of data, the distance to share information, and the different staffing and operating practices that exist between operating companies. Consequently, planning for production from a coastal zone manager's point of view is mostly hypothetical until offshore reserves are located and qualified, the methods of extraction, collection and distribution are clarified, and operating companies have been identified.
3. There is considerable disagreement over the benefits and costs of OCS support activities. In spite of the potential threats to sensitive environmental management, recreation and tourism, the development of support and service industries onshore is viewed as desirable by some.

**UNITED STATES DEPARTMENT OF THE INTERIOR, Environmental Planning for Offshore Oil and Gas Volume V, Regional Status Reports Part 4: California, Washington, DC, xii, 154 pp., (1978).**

**ISSUES**

1. Oil spills and leaks are a major issue in the California coastal area following the Santa Barbara oil spill in 1969. Many factors (e.g. size, location, season of the spill, etc.) affect an oil spill. Consequently, the effects of an oil spill can vary widely, making it very difficult to predict its impacts.
2. Protection of the coastal ecosystem is an important concern in the Southern California area. Public interest is high and work is done to protect various habitats and/or species, and to prevent oil or oil-related damage.
3. Local governments are concerned with the federal government's proposal for accelerated OCS oil and gas development. A number of issues illustrate the concerns of Californians for damage to the coastal environment: fear of well blowouts and tanker collisions; lack of effective oil spill containment and cleanup technology; pollution of seabird breeding grounds and rookeries; impact of additional onshore facilities on land use; oiling of beaches; increased tanker traffic; reduction of land values and of tourism due to reduced aesthetic values caused by platforms.
4. Offshore oil and gas operations can harm the fishing industry by interfering with the use of the sea floor and adjacent pelagic areas through the creation of obstructions that damage fishing gear and by pollution of the marine habitat. These operations can also contribute to a reduction of available fishing grounds.

**WESCHLER, L.F., "Environmental Quality Within an Interorganizational Matrix: A Case Study of the SOHIO Project", Coastal Zone Management Journal, 6 (2/3), pp. 233-252, (1979).**

**ISSUES**

While historically the governments of cities have played significant roles in promoting, expanding and preventing industrial, commercial and recreational activities that take place within their coastal zones, their role is now being usurped by a growing number of policies that have been adopted by the national and state governments concerning environmental regulation and coastal management. The ultimate decision on whether an energy facility, a sports marina, a factory, or a high rise apartment will be located within a coastal zone depends in part or completely upon the decision of other units of government. A recent experience is the SOHIO project by the city, part of Long Beach, California, which illustrates the extent to which state and federal agencies have taken over the decision-making for use of coastal resources.

The existence of specific public organizations and arenas for planning, preparation, implementation and evaluation of environmental conditions and policies, or the widening of the function of such established

agencies like planning commissions and health departments to regulate the use of resources and potential environmental impacts, can lead to the institutionalization of environmental politics.

#### RECOMMENDATIONS

1. The establishment of an Environmental Impact Review (EIR) is one of the possible ways of providing a basic structure for the review of the coastal land use permit and air quality process. But, as the review process evolves, a number of actors can become involved either in support of or in opposition to a project. This can lead to a situation such as SOHIO, where the decision process was characterized by interaction and conflict of larger-scale public agencies with mandates well beyond the boundaries of the project area.
2. The involvement of support of other public agencies for a project may not necessarily help resolve problems or accelerate the review process. The emerging interorganizational matrix does not fit into the established political process; the politic emerging is bureaucratic rather than electoral, for which a new set of rules would have to be written.
3. The political and administrative overhead costs associated with such review processes are very high. This will be a major financial burden for coastal city governments since they will have to deal with complex decision systems in carrying out their coastal policies.

**WEST, G.C., "Environmental Problems Associated with Arctic Development Especially in Alaska", Environmental Conservation, 3 (3), pp. 218-224, (1976).**

#### ISSUES

1. Surface transportation in the Arctic and subarctic regions results in long-term changes in the vegetation. Removal of gravel from streams for road construction results in the spreading of dust, the alteration of river channels and the siltation of streams. The latter two processes could in turn affect the movement and the reproductive process of anadromous fishes.
2. Because the Native People are sparsely settled, their activities have not, relatively speaking, resulted in any significant impact on the Arctic ecosystem. However, all this may change with increased access to the region as a result of oil and gas development.
3. The attitudes to the development of the Arctic can be classified into three groups:
  - (a) those that regard the region as containing riches that will further increase their personal or corporate wealth. To this group, the Arctic should be conquered at all cost;
  - (b) the second group is opposed to any development of the Arctic. This group sees the Arctic as a wilderness that should be preserved;
  - (c) the third group prefers a selected development of the Arctic, especially the areas with the greatest potential for resource extraction. This group would also like to preserve the areas with high ecological and aesthetic values.

**WOLFSON, A., G. VAN BLARICOM, N. DAVIS and G.S. LEWBEL, "The Marine Life of an Offshore Oil Platform", Marine Ecology, 1 (1), pp. 81-89, (1979).**

#### ISSUES

The development of a more sophisticated marine production technology, coupled with the desire to find more hydrocarbon supply sources, has led to an increased number of offshore production platforms. The question that arises is to what extent do offshore platforms modify the surrounding marine environment.

#### RECOMMENDATIONS

1. Because offshore platforms are placed on soft-sediments, they form artificial reefs which serve as attachment sites for marine organisms. Invertebrate larvae and algae spores first colonize the submerged portions of offshore platforms. Serving as food for other fishes, they tend to attract other organisms.

2. Offshore platforms harbour a variety of marine animal communities which constitute a closed, self-contained system. Primary consumer (mussels) populations decrease toward the bottom where they are consumed by primary carnivores (asteroids). The concentration of sea stars around offshore platforms tends to be higher than that found in the surrounding marine environment.
3. Microscopic examination of near-platform sediments shows a dominance of sharp, angular, non-biogenic particles, with few shell fragments or other animal products.

ZINN, J.A. "Energy in the Coastal Zone: A Question of Risk", Coastal Zone Management Journal, 7, pp. 123-132, (1980).

#### ISSUES

1. The author suggests that the effects of oil spills and facility siting decisions are coastal energy issues which involve questions of risk; these activities, through discrete or cumulative events, can cause significant adverse effects.
2. The accurate measurement of risk, the determination of an acceptable level of risk, and the reduction of the threat from a risk, are important questions facing coastal zone management.

#### RECOMMENDATIONS

1. It is suggested that the risk concept serves to unify a number of significant coastal energy concerns to both humans and the fragile environments. The concept also helps to draw together qualitative and quantitative aspects of coastal management into a unified framework. Furthermore, the risk concept plays a useful role in the analysis of coastal issues by linking the effects of anticipated activities with management responses.
2. When it comes to questions of risk, the government has the responsibility of predicting, mitigating and compensating. With respect to coastal energy issues, the difficulty facing the government is one of prediction because of limited data and the fact that accidents involving coastal energy issues (e.g. tanker disasters) have been the result of human error and not technological failings. Loans and grants under the Coastal Energy Impact Program (CEIP) and joint public/private partnerships (e.g. flood insurance) are partial solutions.
3. The level of risk acceptance does not only vary from place to place but is usually determined in a political arena and after taking into consideration managerial, technical, social and fiscal factors. Notwithstanding the complexity of risk assessment, it provides a useful framework within which trade-offs can be made.

## VI EXPERIENCE OF THE UK

BALDWIN, P.L. and M.F. BALDWIN, Onshore Planning for Offshore Oil: Lessons from Scotland, Conservation Foundation, Washington, DC, 183 pp., (1975).

### ISSUES

1. Onshore development resulting from offshore oil activity causes immediate and long-term changes in community structures, shoreline resources, local labour-markets, and housing supply. Local political and economic structures can also anticipate equally inevitable general stress.
2. Decisions taken by the offshore oil operators and their supporting industries have a profound effect on planning. The protection of community, environmental, and other public interests suggests a cooperative effort between the industry, all levels of government, and the public.
3. Supply-oriented energy policies and promotional attitudes toward rapid offshore oil development at the national government level may conflict with traditional local planning prerogatives.

### RECOMMENDATIONS

1. Coastal states should anticipate and plan early to control the inevitable onshore effects of offshore development similar to those being experienced in Scotland. Such planning should begin before federal offshore leasing and the control should be effective when oil or gas is discovered.
2. Environmental impact statements should be prepared on a regional basis at the federal level, in close cooperation with state and local governments long before the selection of specific tracts to be leased offshore. A cooperative effort should be able to minimize duplication of information and analytical efforts and uncoordinated decision-making procedures at the state and federal levels.
3. Local and state governments should supplement federal impact statements with environmental statements of their own on each onshore development proposal of the oil operators and their supporting industries. These studies should focus on the direct and indirect effects of a proposal on community growth, employment, population shifts, and on other environmental effects.
4. States and local governments should receive enough of the economic benefits to offset at least the costs of accommodating support facilities and providing infrastructure needs. Federal funds should be provided in order to plan for and cope with the onshore impacts of offshore oil.

BEATTIE, N.R. "The Search for North Sea Oil: the Impact on the Port of Aberdeen", paper presented at a symposium held in St. John's, Nfld, November 1974, IN Consequences of Offshore Oil and Gas - Norway, Scotland and Newfoundland, Institute of Social and Economic Research, Memorial University, St. John's, Nfld, pp. 194-204, (1977).

### ISSUES

1. The port of Aberdeen has had to adjust to a rapidly changing situation due to the infusion of activity from the offshore oil and gas exploitation. The Harbours Board had to consider often vague enquiries of potential developers and in return had to convince government and the National Ports Council that all the projects on which they wished to embark were likely to be commercially viable.
2. Extensive examinations were called for other matters:
  - (a) integrating oil servicing activities into the traffic pattern of the port without prejudicing the established traditional industries;
  - (b) an estimation of the rate and extent of growth of each new development proposal would be held in deciding what new port facilities are required and how, where, and by whom they should be provided;
  - (c) general planning of the port area, e.g. space allocation, facility siting and types of investments required.

CARRE, F., "The Exploitation of Oil and Gas in the North Sea and the Onshore Consequence", Norvois, 25 (99), pp. 383-405, (1978).

#### ISSUES

Two potential dangers have to be avoided when dealing with offshore oil and gas development in the North Sea: (a) affecting, in an irremediable way, the natural environment and the quality of sites; (b) upsetting the local economy to a point where the foreseeable ending of the exploitation would become disastrous. Do we want to sacrifice durable assets like the fishery and tourism for ephemeral industrialization?

COCHRANE, S. and J. FRANCIS, "Offshore Petroleum Resources: A Review of UK Policy", Energy Policy, 5 (1), pp. 51-62, (1977).

#### ISSUES

1. The goals of the UK offshore oil and gas policy, as stated in the 1974 white paper, are to serve a fairer share of profits for the nation, to maximize the gains to the balance of payments, and to assert greater public control.
2. Petroleum companies operating in the UK continental shelf (UKCS) pay three taxes: (a) an initial royalty of 12.5%, (b) a petroleum revenue tax (prt) at 45%, and (c) a corporation tax (paid by all companies in the UK) of 52%. There is a "ring force" around the UKCS within which all profits are taxed. This prevents companies operating in UKCS to offset cost of operations outside the UKCS against profits from operations in UKCS waters. The following questions can then be asked:
  - (1) does the present fiscal structure directly deter petroleum activities in the long run?
  - (2) should tax levels be progressively increased to reduce the economic rent retained by low-cost producers?
  - (3) should the government establish a float price or grant additional fiscal concessive to future marginal producers?

#### RECOMMENDATIONS

1. Based on their review of the policy instrument used to achieve the goals of UK offshore oil and gas policy, the authors concluded that, although the government failed (in the case of oil) to remove all the economic rent, the resultant income distribution was a reasonable compromise between the best policy and the need to accommodate the imperfections of the market. The authors also found that the introduction of depletion controls may initially have increased rather than reduced the rate of depletion and that state participation marginally promoted UK ownership in their UKCS. They felt that the ownership could be significantly increased in future licensing; they also proposed that potential licensees should include BNOC as a majority partner.
2. Fiscal and pricing measures, depletion control and participation-commercial (joint ventures), discretionary licensing system, and state control (through BNOC) were the policy instruments employed by the UK to achieve its offshore oil and gas objectives.

GRAMPIAN REGIONAL COUNCIL, Department of Physical Planning, Planning for Dealing with Major Planning Applications, Aberdeen, 4 pp., (undated).

Both Grampian Regional Council and Banff and Buchan District Council support the principle that oil or gas products landed in the area should, whenever possible, be processed locally, to create the maximum number of jobs. To assist in achieving this objective, the Councils have established a joint industrial committee and have carried out a contingency planning exercise to guide potential developers to the most suitable sites and to reduce the time taken to deal with planning applications.

The procedure involved in dealing with a major application is that first a relationship between developer and planning official must be set up. Planning officials consider it vital to have several months of discussion with developers prior to the submission of an application for major development. The second step involves a project questionnaire which provides additional information not supplied on the application. The third step is making a planning application. When discussions between the developer and the local authority

have reached the stage where major planning issues arising from the proposal have been identified, it is advisable for the developer to lodge a planning application with the District Council. Fourthly, on lodging a planning application, the developer is required to advertize it by a notice on-site and in a local newspaper. During the fifth step, whether the application is "called in" by the Regional Council or by the Secretary of State, the next 6 to 8 months are spent in gathering and assessing information about the proposal and its likely economic, environmental and social impacts. The sixth step involves a public inquiry; and lastly a decision is made on whether to accept or reject the proposal. If accepted, it is normally subject to conditions such as hours of operation, flaring, emissions, effluents, control of noise and pollution, landscape, and public safety.

HOGG, A. and M.A. HUTCHESON, (eds), Scotland and Oil, Oliver and Boyd, Edinburgh, Scotland, 127 pp., (1975).

The development of the oil industry is characterized by four recognizable stages. Geophysical exploration, almost entirely an offshore activity, is followed by test drilling which requires substantial onshore service facilities. Discovery of oil and gas then requires the building of production installations, including pipelines and platforms which provide markets for manufacturing industry. Finally, there is the extractive phase, with opportunities for refining and petrochemical industries. In practice, the phases overlap considerably; before 1975 they were all represented in Scotland.

Chapter 5 raised certain issues with respect to the socioeconomic implications of the offshore oil and gas of the North Sea:

- (a) The impact of oil is often most immediately felt through its effect upon the labour situation. The greatest scope for oil-related employment occurred in areas lacking a large reservoir of skilled industrial manpower. This has meant that the demand for labour has had to be met, for the most part, by attracting manpower from existing local industries or by drawing labour from other parts of the country and beyond.
- (b) Incoming populations tend to differ from local populations in terms of structure, notably age composition, the relative balance in numbers between the sexes, and occupational groupings. In most oil-related industries, employment opportunities for men are greater than for women; an imbalance in the established pattern is likely to ensue as a preponderance of single males migrate into an area. The social consequences of this type of immigration is a subject of concern, particularly in small communities where the establishment of labour camps is viewed as a threat to the social fabric.
- (c) The consequences of a sudden population influx are apparent in the whole problem of housing provision and the availability of land. The latter is, of course, also pertinent to industrial development, with the result that a very strong upward movement in land and property prices has generally taken place. In this situation, industrial development hastened to take first priority so that the housing shortage has become more acute.

Chapter 6 takes a look at specific examples as to how the impact of the offshore oil and gas affected certain regions of Scotland (description of what sort of development is either planned or has taken place in the region). The areas described briefly in this chapter include Shetland, Orkney, Caithness, the Cromarty and Moray Firths, the North East and Tayside (including Aberdeen and district, the Peterhead area, Montrose and Dundee and district), Firth of Forth, West Central Belt and the Firth of Clyde, the North West, and Western Isles.

The final chapter discusses politics and planning. Oil-related issues of a political and planning nature occur and must be considered at a variety of scales from local through regional, to national and international levels. From the start of exploration of offshore geology, decision-making has proceeded simultaneously at all four levels, although with considerable shifts of emphasis as the scale of operations has grown.

At the local decision-making level, there is no constitutional power for decision-making, although it is often at this level that the impact of oil is most acutely felt. In practice (in Scotland), consideration of development proposals lies with town and county councils, major items or disputes being referred to the Secretary of State for decision.

In only a few cases were regional plans in existence in areas subject to pressures by the oil industry (for example, the Highlands and Islands Development Board's plans for the Cromarty and Moray Firths). Under the system of regional government, there is a statutory requirement for each authority to prepare a structure plan and a regional report for its area.

At the national scale, the key decision on which virtually all others hinge is that setting the rate at which exploitation of offshore resources is to be undertaken. In the UK case, the government decided, from the time of the first allocation of license blocks, to encourage companies to undertake exploration as rapidly as possible.

**LAW, R.J., "Hydrocarbon Concentrations in Water and Sediments from UK Marine Waters, Determined by Fluorescence Spectroscopy", Marine Pollution Bulletin, 12 (5), pp. 153-157, (1981).**

#### ISSUES

1. There are several sources of hydrocarbons that enter UK marine waters. These include: land runoff via rivers, refinery and sewage discharges, accidental shipping loss, dumping of waste at sea, and spillage from oil exploration and exploitation. However, there is very little information on the total hydrocarbon concentrations (THCs) in UK marine waters.
2. The lack of baseline information on THCs in UK waters and sediments makes it difficult to assess the potential effect of major oil pollution incidents like the Ekofisk blowout.

#### RECOMMENDATIONS

1. Using fluorescence spectroscopy to analyze THCs of subsurface (1 m) water and surface sediments collected from sites in the North Sea, English Channel, Irish Sea and estuarine areas, it was found that the hydrocarbon concentrations:
  - (a) increase with proximity to the shore, especially in areas of industrial and shipping activity;
  - (b) were higher in finer inshore sediments;
  - (c) were higher in both water and sediment samples collected in gas production areas.

**MACGILL, S.M., "Liquefied Energy Gases in the U.K.: What Price Public Safety?", Environment and Planning A, 13 (3), pp. 339-354, (1981).**

#### ISSUES

1. The hazards posed by liquefied energy gases (LEGs) to the public, especially by the large-scale liquefied energy gas facilities being developed in Fife, Scotland, far outweigh the safety measures practiced.
2. A rule of thumb used to define whether members of the public may be subjected to an unacceptable level of risk from LEGs is the possibility of one death or serious injury in a million, in any given year. However, quantifying hazard in order to calculate relevant probabilities is often very difficult because of the "lumpiness of events".
3. Balanced choice and decision-making cannot be made with respect to the hazard consequences of LEGs because of a lack of awareness within the planning profession of the hazard potential of handling LEGs installations and activities, a lack of in-house expertise in undertaken hazard assessments, and the time and expense involved in carrying out relevant hazard assessment.
4. There are no national mandatory regulations governing estuarine and coastal transshipment of LEGs, nor are cross-country LEGs pipelines strictly inspected.
5. Large LEGs facilities should be located in remote areas because the behaviour and risks posed by large volumes of leaked gas are not fully understood.
6. LEG facilities are prime targets for sabotage and terrorism.

#### RECOMMENDATIONS

1. The weakness of the United Kingdom's liquefied energy gases (LEGs) hazard control program, especially with respect to the Fife LEG facilities, is partly due to a number of serious policy deficiencies and inadequacies:
  - (a) lack of formal requirement for safety assessment for installations;
  - (b) absence of independent centrally funded assessment;
  - (c) independent and competent hazard assessments are not mandatory at public inquiries;
  - (d) government departments responsible for public safety issues are not bound to consider hazard evidence presented at public inquiries;
  - (e) assessments for hazardous installations, when performed, are undertaken by companies with vested interests in the projects;

- (f) lack of support by Advisory Committee on Major Hazards for a licensing system for LEG facilities.
- 2. Coordination among the various agencies responsible for LEG facilities should be developed. A unified code of practice and guidelines for LEG shipment and routes should also be drawn up.
- 3. Since industrial location may have an extra safety dimension while close proximity to populated areas may threaten public safety, criteria for the selection of LEG facilities sites by industry should be defined.

**MITCHELL, J.K., "Onshore Impacts of Scottish Offshore Oil: Planning Implications for the Middle Atlantic States", Journal of the American Institute of Planners, 42 (4), pp. 386-398, (1976).**

#### ISSUES

- 1. Although the decisions by the federal government to proceed with the leasing of potential offshore oil tracts have raised major land use and environmental management problems for residents of the Middle Atlantic states, existing environmental impact statements have failed to consider the possible onshore impact associated with offshore oil and gas recovery from the Baltimore canyon. The environmental statements have also ignored the cumulative effects of other coastal zone energy proposals. Some impacts completely ignore onshore impacts and concentrate on the physical and biological consequences of drilling in offshore waters. Secondary and tertiary consequences of onshore developments are also not explored.
- 2. While the United States Gulf Coast is one of the world's most developed offshore oil industry, the author suggests it is inappropriate for East Coast Planners because the Atlantic waters are deep and stormy. Moreover, the Gulf Coast oil industry has evolved slowly over the years. The Scottish North Sea has instead been suggested as the more appropriate model which may provide useful lessons.

#### RECOMMENDATIONS

- 1. Coastal management policies in Scotland and in Middle Atlantic states differ in detail rather than in general strategy. Moreover, the Scottish oil industry has experienced a very rapid build up. Both the North Sea and the Atlantic continental shelf exploration will depend on high world prices for oil. In these respects, the two regions are comparable.
- 2. Scottish experience indicates that the immediate impact of North Sea oil on power generation will be negligible because British Power stations burn coal and there is a greater national commitment to nuclear energy. Downstream industrialization trends were not clear but significant petrochemical plants were being developed. However, such petrochemical development could exceed the critical threshold levels of ecosystem tolerance in Middle Atlantic states. Other costs and benefits include increased cost for the provision of utilities and waste treatment plants, reclamation of wetlands, scenic impairment, and costs associated with contingency planning for such possible disasters as pipeline destruction or gas tank explosion. Social structure or environmental quality in local communities may be permanently altered.
- 3. East Coast planners must be aware that the speed and scale of successful offshore oil field development can easily exceed the coping capabilities of onshore planning organizations. While environmental impact statements can help identify onshore impacts, they do have limitations. The full potential of impact statements is realized when they relate to comprehensive land use and facilities planning programs.
- 4. The author cautions the areas in Middle Atlantic states, which may be tempted by employment opportunities and the possibility of revitalizing depressed economic areas, that they should be aware of the possible ecological, economic, and aesthetic impacts on their coastal areas; he points out that, compared to Scotland, Shetland, which refused to be cowed by the international oil companies, appeared to have had a better deal. Through their self-assured and up-to-date planning strategy, the Shetland regional council owns the oil facilities. They were able to plow back rental revenues to aid indigenous industries. Thus, Shetland's approach, and possibly the healthy fishing and textile industries operating at the time, helped to mitigate the undesirable onshore impacts of North Sea oil.

**NORTH EAST SCOTLAND DEVELOPMENT AUTHORITY, North East Scotland and the Offshore Oil Industry, Aberdeen, Scotland, 13 pp., (1974).**

NESDA's concern in this report is to update the existing information on the activities of the offshore oil industry in North East Scotland. The first part of the report deals with the industry's growth in



the region and the following aspects are examined: exploration, growth of onshore supply services, industrial land and buildings, equipment manufacturing, oilfield development, oil-related socioeconomic development in North East Scotland, and education and training. The second part examines the future prospects of the region in terms of the oil reserves, production requirements, industrial growth and marketing opportunities, employment prospects, and the overall economic picture of North East Scotland.

**NORTH EAST SCOTLAND DEVELOPMENT AUTHORITY, North East Scotland and the Offshore Oil Industry. A Summary of the Main Developments, The Waverley Press Ltd., Aberdeen, Scotland, 44 pp., (February, 1975).**

NESDA was set up in May 1970 by the local planning authorities of the City of Aberdeen and the Counties of Aberdeen, Banff, Kincardine, Moray, and Nairn to promote economic development throughout this region, which covers an area of 11 914 km<sup>2</sup> and contains a population of about 450 000.

The North Sea oil industry has now provided the region with new growth impetus; NESDA has been closely involved in its development by providing up-to-date information, organizing or participating in exhibitions and conferences to promote the region's growing economy, producing up-to-date lists of the companies involved in the industry in North East Scotland and a directory of the region's manufacturers, and advising incoming firms on the availability of sites, housing, and the whole range of government grants and financial incentives.

This publication describes briefly the North Sea oil industry's growth by looking at exploration, growth of onshore supply services, equipment manufacturing, oilfield development, oil in relation to North East Scotland, and education and training opportunities. There is also a section on future prospects which deal with such topics as estimates of oil reserves, production requirements, industrial growth and marketing opportunities, employment prospects, and finally what the future is for North East Scotland. (A list of firms in North East Scotland involved in offshore oil industry is provided.)

**ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT, Energy Production and Environment, Paris, France, 107 pp., (1977).**

#### ISSUES

In the area of environmental impacts of offshore oil and gas activities, the main problem is identified as the need to develop measures that will ensure that the environmental risks and impacts will be minimized while sustaining an accelerated development of offshore oil and gas resources during the next decade.

#### RECOMMENDATIONS

Recommendations extracted from the report are those which deal specifically with the exploitation of offshore oil and gas resources. "Recognizing that oil pollution of the ocean leads to harmful effects on marine life", member countries (of OECD) should:

1. Ensure that sufficient emergency arrangements be made on a national or international basis, that the necessary authority and responsibility be assigned in advance, and that the necessary equipment is readily available to deal with possible oil spills and pipeline ruptures.
2. Ensure that the best available construction, operation techniques and safety standards be applied to prevent oil spills.
3. Establish minimum training standards for workers on offshore platforms and cooperate with industry to provide the courses and facilities which are necessary for the training of these workers in order to prevent accidents and thereby safeguard the environment.
4. Examine the adequacy of the industries' regulations with respect to monitoring and enforcement procedures, and provide their monitoring and enforcement agencies with the necessary means to fulfill their tasks.
5. Evaluate, together with local authorities, the onshore impacts which may result from offshore activities with respect to land use, social, employment, economic and environmental patterns, before the decision is taken to lease offshore areas.
6. Develop, in close cooperation with local authorities, long-term coastal land use plans taking into consideration, among other factors, energy and environmental policies.

**SAMUELS, A., "Drilling for Oil Onshore: The Planning Law Problems", Journal of Planning and Environment Law, pp. 233-257, (April, 1981).**

#### ISSUES

1. Onshore drilling for oil and gas in Britain is likely to increase significantly in coming years, especially in such areas as Scotland, Yorkshire West, East Midlands, and Dorset. However, planning authorities in these areas do not have a hydrocarbon drilling policy or guidelines with respect to environmental protection, environmental impact analysis, or safeguard.
2. Onshore hydrocarbon drilling may generate complaints from coastal residents about offensive smell and noise from the operations. Mud disposal can also pose problems depending on the drainage, soil texture, and the season.
3. Sometimes oil/drilling companies are slow in restoring the top soil or in removing the hardcore.

#### RECOMMENDATIONS

1. If coastal planning authorities are to be able to deal effectively with problems that may arise from onshore hydrocarbon drilling, they must undertake forward planning. This would involve drawing an "oil map" which will show past and present drilling, and also identify possible and probable future drillings. The forward plan should also contain policies to protect sensitive areas.
2. Before approving any drilling, coastal planning authorities should ensure that there will be no form of pollution from the drilling operation. Provisions for the restoration of top soil should also be made. Oil companies should agree to compensate for any damage that may arise from drilling operations.

**SCOTTISH DEVELOPMENT DEPARTMENT, North Sea Oil and Gas: Coastal Planning Guidelines, Edinburgh, 15 pp., (August, 1974).**

The pressures of North Sea oil developments clearly demonstrate the need for national policy guidance on the way in which oil- and gas-related developments should take place, particularly in coastal areas. The government believes that the guidelines contained in this document go as far as is currently practicable towards setting out a national strategy for coastal development related to oil and gas exploitation; the guidelines do not, however, constitute a plan.

The Secretary of State for Scotland will make his decisions on individual applications within the context of these guidelines and of the government's policy for platform sites as put forward in the ministerial statements of 12 August 1974. Planning authorities are similarly expected to relate their development plans and development control judgements to these guidelines, which should be drawn to the attention of prospective developers. The guidelines do not override the provisions of existing development plans, nor do they prejudice the decisions of the local authority or the Secretary of State on individual planning applications. Each case will be processed in accordance with the existing statutory procedure.

The main policy guidelines may be summarized as follows:

1. The preferred development zones listed in Appendix 1 are areas within which sites for oil- and gas-related development seem likely to be appropriate and within which such development should be encouraged.
2. The preferred conservation zones listed in Appendix 2 are areas of particular national scenic, environmental, or ecological importance in which major new oil- and gas-related development would, in general, be inappropriate and could be justified only in exceptional circumstances.
3. The whole of the west coast from Dounreay to Machriharish has been defined as a preferred conservation zone because of the variety and high standard of its scenery and because of its ecological importance.

**SCOTTISH DEVELOPMENT DEPARTMENT, North Sea Oil and Gas Pipeline Landfalls. A Discussion Paper, Edinburgh, 8 pp., (May, 1974).**

It is a licence condition that petroleum (oil and natural gas) found in the UK sector of the continental shelf must be brought ashore to the UK. In most cases, producers operating in the northern basin

of the North Sea are likely to bring their petroleum to land by pipe where it can be loaded into tankers in the relative safety of the shore, or whence it can be piped to some suitable market or refinery. Because of the immense cost of laying an undersea pipeline, the company will be anxious to keep it as short as possible. Generally, bringing the pipeline ashore does not cause much damage to the environment, nor are suitable sites very difficult to find. However, there are certain activities and installations which may necessarily be associated with the pipeline landfalls; the main problems lie in finding suitable sites to accommodate these landfalls.

The purpose of this paper is to identify the areas in which sites suitable for both landing pipelines and the associated development are likely to be required, and to promote discussion of the steps which might be taken to encourage companies to concentrate pipeline landfalls and associated development within these areas.

The paper is arranged in three sections. The first identifies the areas where companies are most likely to wish to bring oil or gas ashore (based on known fields and discoveries); the second outlines the nature and scale of the development associated with landfalls; and the third describes the criteria important in selecting landfall sites.

The criteria for selecting landfall sites within a general area are as follows:

1. Once the general location for landing a pipeline has been selected, the choice of landfall site will depend partly on the physical characteristics of the shore and partly on the companies' production plans.
2. If a mainland location is required for landing gas, the main physical criteria will be:
  - (a) Onshore -
    - i) a flat approach or reasonably gentle transition from marine to land environment;
    - ii) sufficient land for the treatment works;
    - iii) a non-urban area.
  - (b) Offshore
    - i) a gently sloping approach from the sea with sufficient depth of sand or shingle to give not less than 3 metres of cover over the pipeline down to low water mark, and 2 metres of cover out to a 15 metre depth of water;
    - ii) a sea bed not subject to shifting;
    - iii) a sea bed not subject to currents or a strong tidal flows;
    - iv) areas not used for anchorage or mooring;
    - v) an approach free from obstacles.

It may also be necessary to carry out a detailed analysis of the effect of such developments on the local environment.

**SMITH, H.D. et al., "Scotland and Offshore Oil: the Developing Impact", Scottish Geographical Magazine, 92 (2), pp. 75-91, (1976).**

#### ISSUES

1. Two types of environmental issues have arisen from the research and operating experiences in the North Sea:
  - (a) difficulties in assessing the changing economics of exploitation and the long-term behaviour of a reservoir undergoing depletion;
  - (b) hazards posed by and for the environment.
2. Oil-related industry has not been able to change the employment situation in Scotland as well as the inequalities between regions. Many types of oil-related industries have and will continue to have a marked preference for an east coast location.
3. The rate at which the developments have taken place has added to the infrastructural problems in many localities. Housing has been a major problem as the demand increased dramatically. Consequently, land values and house prices in areas near developments followed the inflationary trend.
4. Oil developments have brought strong pressures to bear on local authority committees and departments responsible for planning decisions and the provision of community services.

SQUIRES, S.M., "The Impact of North Sea Oil in Norway and Scotland", *Norsk Geografisk Tidsskrift*, 29 (3), pp. 133-140, (1975).

Major issues have arisen in the context of oil-related development in north-east Scotland and south-west Norway.

#### ISSUES

1. A first issue relates to the planning aspect of offshore development. For planning departments, the problem is whether or not they can cope with such vast scales and rapid rates of growth brought about by the oil industry. Despite a lack of resources, staff, and finance, local authorities must act promptly.
2. The need for infrastructure expansion constitutes a second issue and it has brought strong pressures to bear on both the public and private sectors at local and regional levels.
3. Educational needs have to be considered from two angles: firstly, from the point of view of the need for technical training for jobs in the oil industry itself; and secondly, from the aspect of the increased strain upon primary and secondary schools within the region.
4. Increased demands for housing in a short period of time have placed constraints on the residents of certain parts of Scotland and Norway who must face short supplies and soaring prices. Certain sectors of society will be priced out of the market.
5. Structural changes in regional employment characteristics as a result of the exploitation of North Sea oil are inevitable. The manufacturing industry in Norway will be transformed under the impact of an increasingly dominant oil industry. One potential danger in the development of North Sea oil reserves is the establishment of an industrial monoculture.
6. The local attitudes to development of the North Sea reserves are concerned with conservation, not only in the environmental sense but also in terms of the preservation of the traditional ways of life in the affected communities.
7. The preservation of certain elements in the man-made environment is another major issue in terms of conservation. The traditional character of a settlement is in danger when subjected to rapid and large-scale development. The oil boom inevitably causes stresses and strains in the fragile structure of any community.

STOREY, R.J., "Oil Related Developments in the Highlands and Islands of Scotland - Features of Social Impact and Policy", paper presented at a symposium held in St. John's, Nfld, November 1974, IN *Consequences of Offshore Oil and Gas - Norway, Scotland and Newfoundland*, Institute of Social and Economic Research, Memorial University, St. John's, Nfld, pp. 144-180, (1977).

#### ISSUES

1. After 1971, with regional depopulation halted, unemployment rising less fast than in Scotland as a whole, and traditional industries flourishing in at least one area (Shetland), oil development appeared as rather less of a lifeline to the region than it might have done earlier and was regarded as a mixed blessing. Debate in the Highlands and Islands on the subject of oil costs and benefits clearly reflects the relativity of the issues.
2. Oil development has brought high wages and resulted in acute labour shortage, affecting existing industries, services, and the expansion of infrastructure. The fluctuation in labour demand has created great difficulty for the small local planning staff as well as the scale and rate of development.
3. The influx of construction workers and their families has posed serious housing problems and consequently presumed the provision of community-type facilities (education, recreation, etc.). Similarly, other social implications are felt and evolve around the issue of whether oil development will radically affect the local identity or the quality of life. There have been strong reservations about the desirability of oil development on the grounds that traditional local values and customs will be overwhelmed.

**UNITED KINGDOM, Department of Energy, Development of the Oil and Gas Resources of the United Kingdom, HMSO, London, IV, 59 pp., (June, 1980).**

This report describes the development of the United Kingdom's resources of oil and gas during 1979. It also updates estimates of the UK's oil and gas reserves and forecasts of production.

The different sections of the report involve oil production, gas production, licensing, exploration and development, economic benefits, and investment. The final section deals with offshore safety in a comparison of fatal accidents offshore to 1978 figures.

**UNITED KINGDOM, Department of Energy, Gas Gathering Pipeline Systems in the North Sea, Energy Paper Number 30, HMSO, London, 65 pp., (May, 1978).**

Gas Gathering Pipeline Ltd. (GGP) prepared this report to meet the requirements outlined by the Secretary of State for Energy. GGP was required to look in detail at the possibilities for gas gathering within the UK sector of the Northern North Sea. No account was to be taken of reserves lying in the Norwegian Sector. The economics of gas gathering systems in the Northern North Sea were examined using the latest data available to GGP to project the quantities of gas likely to be available for collection from the three categories of offshore gas resources: gas fields, gas condensate fields, and associated gas and oil fields.

In its studies, GGP set an economic target of collecting gas from individual fields only if a minimum test discount rate of 10% in real terms before tax could be achieved on capital invested. Where gas gathering systems were identified which had a substantially higher rate of return than 10%, consideration was given to including subeconomic links which would then effectively be cross-subsidized by the more profitable links.

GGP had studied the economics mainly on the basis of common ownership, by assuming that all facilities required for gas collection on the platforms, transmission from platform to shore, and processing on shore comprise a single system, with all costs and revenues accruing on a common basis. Possible commercial arrangements provide wide scope for variations (for example, payments for gas collection, transmission charges through existing lines, and carriage of products to which the gathering system may not hold title - particularly NGL - and from which sales revenues might not accrue to the system).

Based on the information it has received and appraised on reserves, marketing, and engineering work, and taking account of the existing gas trunk lines, GGP reached a number of conclusions which consisted of estimates of the amount of gas which could be expected to be recovered with the present technology available, as well as estimates of various gas fields which could be recovered by advances in technology.

Based on these conclusions, GGP made the following recommendations:

1. At this stage, no gas gathering system requiring the construction of a new trunk pipeline to the shore is necessary; maximum use should therefore be made of the existing pipelines. This strategy would give the necessary flexibility in dealing with the very uncertain time-scale of development of oil discoveries.
2. In future, all platforms in the UK North Sea should, if appropriate, have users for gas collection installed at the outset. Their design should also allow for the installation of other equipment necessary for collection and/or onward transmission of gas for delivery, within a controlled specification, to a future high pressure gas gathering system. These requirements should be subject to a waiver in certain special cases (e.g. for very small quantities on inconveniently located gas). Consideration should be given to the funding of such advance investment.

These recommendations are again based on the estimates of recoverable gas deposits in the UK sector with present technology as well as on estimates of gas with advances in technology recovering gas from under the North Sea.

**UNITED STATES CONGRESS, 94th Congress, 2nd Session, Committee Print, North Sea Petroleum Operations in the United Kingdom and Norway, U.S. Government Printing Office, Washington, DC, 190 pp., (1977).**

The purpose of this report is to evaluate the administration of oil and natural gas operations in the United Kingdom and Norway. The study includes a comparative analysis of the governmental and legal structure, the licensing methods and, the sharing process of both the UK and Norway. Production estimates and economic conditions are also assessed. Socioeconomic and environmental impacts of North Sea petroleum operations are briefly documented. The following issues are relevant to the United States:

1. "In addition to the economic factors, including costs and cost inflation, any delay in reaching a sound government oil policy can affect offshore activity."

2. "The extreme weather conditions of the North Sea could prove valuable in evaluating costs, delays and the endurance of men and equipment."
3. "The way North Sea countries deal with security of the offshore rigs is another area where the U.S. can learn."
4. "The change or alteration to the infrastructure of the onshore areas affected by offshore oil and gas activity will have both beneficial and detrimental impacts to the economic, environmental and social structure of the area concerned."

## VII EXPERIENCE OF NORWAY

AGER-HANSEN, H., "The Exploitation of Norwegian Oil and Gas", Energy Policy, 8 (2), pp. 153-164, (1980).

### ISSUES

1. The emergence of the North Sea as one of the most important and productive new petroleum provinces outside the Middle East and the proximity of the area to the major industrial markets in Western Europe are some of the important reasons why the North Sea Petroleum Development has been regarded with great interest by the international oil industry.
2. However, North Sea oil and gas developments have faced formidable climatic, design, technology, and financing challenges.
3. Design of regulation and control of offshore development activities have also presented tremendous challenges. National authorities had to develop policies which will both attract the oil industry to make the necessary commitment in capital, technology and R & D, and at the same time ensure that the resulting impacts will be beneficial to society. Offshore oil and gas exploration and development in Norway, for example, are regulated by three major policies: the concession policy, the taxation policy, and the safety and environmental policy. These policies are administered and continuously reviewed by four ministries: Ministry of oil and energy, Ministry of municipalities and labour, Ministry of environment, and Ministry of finance. The concession policy is administered by the Ministry of oil and energy. The Ministry of municipalities and labour and the Ministry of environment are responsible for the safety and environmental policy, and the Ministry of finance deals with the taxation policy.

### RECOMMENDATIONS

1. Future development on the Norwegian continental shelf should relate to the establishment of a national infrastructure for optimum exploitation of the resources. For example, new field development should take advantage of processing facilities already established. Because emphasis so far has been placed on optimizing the present worth of a given field, there has been a large degree of under-utilization of processing facilities. The author suggests that new fields should take advantage of this under-utilization and thereby help reduce the need for the construction of new processing capacity and the corresponding investments.
2. Since few gas fields can economically justify the investment need for their own pipelines, the possibilities of shared use of new and existing gas transport systems by several fields should be examined as this may make several fields viable. The author argues that a national solution to gas transport will be one of the major challenges to face Norwegian continental shelf development in the future.

GAULT, I., "The Frigg Gas Field: Exploitation of an International Cross-Boundary Petroleum Field", Marine Policy, 3 (4), pp. 302-311, (1979).

### ISSUES

1. The phenomenon of the cross-boundary petroleum field is a new problem in international law. The Frigg gas field, which is the first continental shelf cross-boundary field to be the subject of joint exploitation, will therefore set a precedent for the exploitation of cross-boundary petroleum deposits in the North Sea and other offshore areas.
2. In the mining of hard minerals (coal), transgressions into a neighbour's field can easily be recognized; however, in the exploitation of a fugacious mineral like petroleum, which is under pressure, the detection of such a transgression is difficult as a perforation of the reservoir causes the mineral to migrate. Thus, a well sunk into a cross-boundary field may deny other parties of their fair share. The legal question which arises is whether a party having an interest in the field can unilaterally exploit the resource in whole or in part.
3. Neither the Geneva Convention on the Continental Shelf 1958 nor the Informal Composite Negotiating Text (ICNT) of the Third UN Conference on the Law of the Sea (UNCLOS III) contain provisions referring to cross-boundary mineral deposits. Under customary and conventional international law, a state has exclusive rights to drill and obtain from the seabed and subsoil of the continental shelf adjacent to its coast.

4. Under the provisions of the UK petroleum (production) regulations 1976, and the Petroleum and Submarine Pipelines Act 1975, the Minister of energy is empowered to give directions to licensees in the event of a discovery of a deposit in which more than one UK licensee has rights or where the deposit extends across the continental shelf boundary. Norwegian regulations (1965 and 1972 versions) make no distinction between joint deposits either wholly within the Norwegian continental shelf or across international boundaries. Under Norwegian law, the Minister of energy can intervene when licensees cannot reach agreement themselves on joint exploitation to secure a national operation of maximum production.

#### RECOMMENDATIONS

1. Problems relating to cross-boundary deposits can be resolved by ignoring the man-made boundaries and treating the field as a simple unit - the unitization process. Unitization, first used in Texas in the 1930s, is now recognized as the standard solution to the cross-border deposit problem for both onshore and offshore resources.
2. The International Court of Justice (ICJ) has recommended that where two or more adjacent states consider that application of the international customary law rules of definition leads to an overlapping of areas, joint exploitation may be considered as a possible solution which will preserve the unity of the deposits.
3. When the approximate proportioning of the Frigg field failed, UK and Norway referred the issue to an expert for determination. This resulted in the Frigg Field Expert Agreement of May 1973, under which the expert determined that 60% of the deposit of  $45 \times 10^6 \text{ m}^3$  of gas was on the Norwegian side.
4. Under the Frigg Field Agreement 1976, the inter-company unitization and operating agreement was signed. The two governments undertook to require their licensees to submit plans ensuring the conservation of the Frigg Field Reservoir for productive operations, as well as to ensure that legislation for the protection and welfare of employees is consistently applied to the exploitation of the Frigg Field Reservoir as a single unit.

**NORWAY, Royal Ministry of Defence, Surveillance of Fisheries and Petroleum Activities: The Establishment of a Coastguard Service, Report to the Norwegian Storting No. 81, Oslo, Norway S. (1975-76).**

#### ISSUES

1. The extension of Norwegian jurisdiction over the sea areas off the coast and the development of petroleum activities on the Norwegian continental shelf created new national responsibilities.
2. Because major accidents, hijacking, and other terrorist activities with respect to continental shelf petroleum and fisheries operations were a distinct possibility, there was a need to provide assistance to the police in case of such an event.
3. An emergency preparedness program was needed to deal with large-scale oil slicks and other offshore and shelf accidents.

#### RECOMMENDATIONS

1. In order to provide an effective surveillance, the Storting Committee recommended that a naval fisheries surveillance service should be built within the framework of the Defence organization to form a coastguard service. The coastguard would have the responsibility for fisheries surveillance and gear protection, and for surveillance of activities on the continental shelf.
2. To deal with possible terrorist activities, it was recommended that a special marine commandos unit be formed from the Navy and Paratroopers from the Army.
3. In the event of oil pollution, individual municipality or intermunicipal emergency preparedness is responsible for taking appropriate measures. The Committee recommends that an operations centre be established to coordinate activities. A special accident commission to investigate major accidents on mobile and fixed installations on the continental shelf was also proposed.



**NORWAY, Ministry of Environment, Oil Spill Emergency Preparedness, Provisional Report on Research Programme for Depolluting Equipment, Development Fund, Project Committee for Development of Depolluting Equipment Research Committee, Oslo, Norway, 47 pp., (November, 1977).**

On the basis of Storting Proposition No. 182 (1975-76) concerning additional appropriations on the 1976 budget to improve oil emergency preparedness, a sum of 10 million kroner was allocated by the Storting on June 8th, 1976, for the development of better depolluting equipment. Subsequently, the Ministry of the Environment decided that 8.5 million kroner of this sum should be placed at the disposal of the Development Fund as recommended by the Project Committee for Development of Depolluting Equipment.

From the experience gained through this Project Committee, it soon became clear that a more comprehensive research and development program was required if work to improve depolluting methods was to make further progress. A lengthy research and development program was announced in the government's long-term policy for 1978-81, which was presented in April 1977.

#### RECOMMENDATIONS

The conclusion drawn by the Committee was that it would be desirable to have a 4-year research program having a total budget of 15.6 million kroner, and a system of grants of 1 million kroner (1978 kr). In addition, the Committee would call attention to the need for a development program and for additional investments in testing facilities, the cost had not been estimated. The object of the research program would be to continue towards:

- (a) clarifying the possibilities and limitations of the various methods of response in the case of major oil spills at sea;
- (b) procuring knowledge to promote the development of better response equipment and methods for major oil spills at sea;
- (c) procuring basic data and performing rough analysis to form the basis for decisions on oil contingency aims and strategies.

No definite opinion could be given concerning the results of the program. Probably the greatest benefits in the short-term would be to make present-day booms and skimmers more efficient through improved design and handling systems. Moreover, the program could be expected to provide a better basis than currently available for making decisions concerning the further development of oil emergency preparedness.

**NORWAY, Ministry of Environment, Parliamentary Bill No. 182, Extraordinary Appropriations for Reinforcement of the Oil Pollution Contingency Planning, Government Printing Office, Oslo, Norway, 49 pp., (1975-76).**

In this bill, the government proposed reinforcement measures concerning national oil pollution contingency planning. The measures came into effect in 1977, with the objective to bring the oil pollution contingency arrangements to a satisfactory level by the summer of 1978.

According to existing regulations in Norway, the licensees on the continental shelf have responsibility for maintaining and paying for the necessary oil pollution emergency preparedness. This is in accordance with the "polluter pays" principle. The government will require the licensees to maintain an emergency preparedness which is based on the best available technology. The provision of the necessary equipment will, according to the authorities' preliminary estimates, cost about 50 million Norwegian kroner or more, depending upon the final requirements. At the same time as licensees are required to reinforce their emergency preparedness, the state's contingency planning will have to be further developed. This reinforcement is necessary to deal with oil pollution from shipping accidents. The state's contingency planning is also necessary for protecting the coast in case of a major oil spill on the continental shelf if the licensee does not manage to prevent the oil from approaching the shore. It is therefore proposed that the state procure oil pollution combat equipment for 55 million Norwegian kroner.

To prevent oil spills from occurring as a result of continental shelf activity, it is the government's view that efforts should primarily be aimed at the prevention of accidents. Chapters 2 and 3 contain a detailed description of measures for the prevention of accidents. In spite of these efforts, the possibility of larger oil spills cannot be excluded. The government's proposal for strengthened oil pollution contingency measures will, however, make the combatting of oil spills far more effective than at present. In case of a major blowout on the continental shelf, however, the risks of extensive damages cannot be excluded, although the damages may be substantially improved. The reason for this is that the equipment currently available for combatting oil spills at sea is not sufficiently developed for use under all weather conditions.

By the Royal Decree of December 19th, 1975, it was decided to give the Ministry of Environment the responsibility for prevention of oil pollution from ships, with the Maritime Directorate as a subordinate

body. Pollution from ships was formerly the responsibility of the Ministry of Commerce and Shipping. The administrative coordination of the oil pollution contingency planning implemented by the government during past years has made possible a broader and more coordinated consideration of the needs for protection against oil pollution.

**NORWAY, Ministry of Industry, Operations on the Norwegian Continental Shelf, Report No. 30 to the Norwegian Storting (1973-74), Unofficial Translation from Norwegian, Oslo, Norway.**

**ISSUES**

1. Because of the technological and commercial nature of continental shelf oil and gas activities, it has become necessary to transfer the responsibilities for these activities from the mining office to another agency.
2. Water depth, distance from shore, and difficult meteorological conditions all combine to make the North Sea a very challenging environment to the offshore petroleum industry. Those factors could also contribute to make blowouts, fires, or explosions on platforms a likely possibility.

**RECOMMENDATIONS**

1. The Norwegian Petroleum Directorate was established in 1973 to ensure that the continental shelf operations are carried out in accordance with the laws and regulations. The Directorate was charged with the responsibility for collecting, processing, planning, and interpreting geological, geophysical and technological material from continental shelf operations.
2. To prevent serious accidents from occurring on offshore platforms, the development of safety regulations to control offshore operations was given a high priority from the very beginning.

**NORWAY, Ministry of Industry, Report No. 90 to the Storting. The Development and Landing of Petroleum from the Statfjord Field and a Gas Trunk-Line, Government Printing Office, Oslo, Norway, 46 pp., (1975-76).**

On January 5th, 1976, the Statoil/Mobil Group submitted to the Ministry of Industry an application regarding the development and landing of petroleum from the Statfjord Field in blocks 33/9 and 12.

In part I of this report to the Storting, the Ministry gives an account of the questions which have arisen in connection with the further development of the field and the landing of the existing oil reserves.

In Chapters 2 to 6 of part I of the report, the Ministry has endeavoured to present a summary of the comprehensive material which licensees submitted together with their application. Chapter 2 gives a summary of the locality of the field, wells, geology, reserves, and the weather conditions in the area. Permission for a gradual development of the installations in the Statfjord Field was given in connection with the Storting debate of Proposition No. 114 (1974-75) concerning Statoil's option to participate in the development of a deposit in the Statfjord Field. In Chapter 3, the development status for Phase I is given.

Further field development are described in Chapter 4. Since parts of the Statfjord Field straddle the median line of the British continental shelf, it will be necessary for the licensees to reach agreement about unitization of the petroleum resources. Work relating to these agreements is further described in Chapter 5. Chapter 6 refers to the appraisals of which would be the best transport method for oil and gas from the field.

In chapter 7, the Ministry expressed its opinion on the Statoil/Mobil Group's application. Based on the available information, the Ministry considers the principle that the field development plans outlined by the licensees may be given the necessary sanction. It should thus be possible to develop the field with three combined drilling and production platforms and a maximum of two loading buoys.

From the point of view of an overall appraisal, the Ministry feels that landing in Norway by pipeline would be the solution which benefits Norwegian society as a whole more than any other method. The Statoil/Mobil Group must continue work on the remaining technical issues bearing this in mind. If such a solution, in a context of national, technical, and financial evaluations, should subsequently prove unsuitable, the authorities would then have to consider the alternative of offshore loading as a permanent solution.

In part II of this report, the Ministry gives an account of the work which has been carried out in order to establish the possible alternatives for laying a gas trunk line from fields on the Norwegian continental shelf. A survey is given of the total production of oil and gas from fields on the Norwegian continental shelf.

with and without such a gas trunk line in operation. Further, a description is given of the dissimilar markets for natural gas in western Europe.

The Ministry believes that a trunk line for gas from fields on the Norwegian shelf, south of the 62nd parallel, represents an interesting solution, from the point of view of a sound utilization of resources and hopes for a coordinated transport policy on the Norwegian shelf. The Ministry emphasizes, however, that the project is still in the preparatory state. Before a final decision can be arrived at regarding the realization of the project, a 2-year period of planning and studies will have to be completed, among other things, in order to clarify the extent of basic reserves, market conditions, the structure of ownership, the economy, financial arrangements, etc.

**NORWAY, Ministry of Industry, Report No. 92 to the Norwegian Storting. Landing of Petroleum from the Valhall and Hod Fields, Government Printing Office, Oslo, Norway, 22 pp., (1976-77).**

Chapter 2 of this report gives an account of the Amoco/Noco Group's application to the Ministry of Industry for permission to land petroleum from the Valhall and Hod fields, and a list of licensees together with a summary of state participation.

Chapter 3 gives a survey of the location of fields, drilling, geology, and reserves. Chapter 4 describes the licensees' plans for developing the fields. Chapter 5 carries a summary of the alternative landing and transportation methods that have been considered. Chapter 6 gives an account of agreements concerning allocation of the reserves of the fields, the transportation and processing of gas and oil, as well as sale of natural gas. Chapter 7 contains comments made by the Ministry of Industry in connection with the applications for landing as well as the Ministry's recommendation.

After a total evaluation, the Ministry recommended that permission for landing of petroleum from Valhall and Hod fields to Teeside (Great Britain) and Emden (West Germany) be granted in accordance with certain conditions, one of the conditions being that option agreements between the licensees and the government be entered into regarding delivery of NGL to Norway.

**NORWAY, Ministry of Industry and Crafts, Petroleum Exploration North of 62°N, Report No. 91 to the Norwegian Storting (1975-76), Unofficial Translation, Oslo, Norway.**

#### ISSUES

1. A detailed knowledge of wave heights, currents, winds, and temperatures, is an essential prerequisite to any effective formulation and evaluation of safety regulations for drilling operations north of 62°N. Petroleum exploration activities befouling the sea should also be regulated.
2. The size of the supply base and the goods and services it is designed to offer depend partly on the phase offshore oil and gas development has reached. For example, a drilling platform which requires the services of two supply ships, one emergency launch, helicopters, and tugs needs a service base of between 5 000 to 15 000 square metres.
3. The offshore oil and gas development area north of 62°N is also one of the richest fishing areas in the Norwegian continental shelf. There is, therefore, a potential conflict between the oil and gas industry and the fishing industry.

#### RECOMMENDATIONS

1. The Ministry of Industry and Crafts was charged with the responsibility for coordinating the gathering of physical environmental data necessary for the formulation of regulations. To prevent befouling of the sea by petroleum activities, the regulations required that equipment, barrels, etc., be marked. The collection of waste from offshore platforms and the transportation of such wastes were also governed by regulations.
2. In order to ensure that service bases are located as close to offshore operations as possible, there must be closer cooperation between all the parties involved. The process of selection of supply bases must also be flexible to allow for decentralization in order to respond to changing phases of offshore operation.
3. A centrally administered system to compensate for oil- and gas-related damage to fishing gear and nets is also required.

**NORWAY, Ministry of Industry and Crafts, Report No. 51 to the Norwegian Storting. Landing of Petroleum from the Ekofisk Area, Government Printing Office, Oslo, Norway, 68 pp., (1972-73).**

In this report to the Norwegian Storting, the Ministry gives an account of the landing of petroleum from the Ekofisk area and of the government's standpoint as regards the Philips Group's application. Background information for this report can be found in Chapter I, where the development and exploitation of the reserves in the Ekofisk area are viewed in a broader context. In 1970, the Ministry appointed the Ekofisk Committee to study the possibilities of landing petroleum in Norway. Chapter II reports on the Committee's recommendation, and on certain circumstances that alter the assumptions on which the Committee relied.

In its recommendation, the Committee gave an account of the Ekofisk Field, the possibilities of petrochemical industry, offshore loading, and pollution hazards. In addition, it gave a broad description of the various technological and economic aspects relating to the laying of pipelines from the Ekofisk Field. In its conclusion, the Committee stated that the landing of natural gas by pipeline from the Ekofisk Field to Norway would not be an appropriate alternative because the market which exists, or which may be established in Norway, is not large enough. The production of LNG offshore and the loading thereof into ships would be a technologically possible alternative provided certain development work could be carried out; however, in view of the field's location relative to the potential markets in the UK and on the Continent, all the Committee members agreed that a pipeline to one of these markets would be the alternative providing the highest earnings for Norway. According to the results of the Committee's studies, it was presumed to be technologically possible to lay a pipeline with the necessary dimensions both to the UK and to Norway. Both these alternatives involved considerable technical and financial risk; this risk was, however, decidedly greater in the event of a line to Norway, which would pass depths far greater than have ever been tested in practice with pipeline of these dimensions.

Chapters IV through VIII deal with the Philips Group's application with respect to the technical issues involved in laying pipeline across the Norwegian Trench. Chapters IX through XI give an account of the Ministry's remarks and the government's standpoint to the Philips Group's application. Following an overall assessment of the social and political consequences, the government had decided to recommend that the Philips Group's application be granted. This decision was based on the licences that had previously been granted under the then applicable rules, and technological and economic problems of laying pipelines across the Norwegian Trench. A condition for this recommendation was that the State Oil Company should participate up to 50% in the pipeline companies on certain specified terms, and that sufficient quantities of NGL for the production of 226 750 tonnes of ethylene be returned free of freight charges to Norway or made available to the State at the landing point, with a view to the establishment of a new Norwegian petrochemical industry.

**NORWAY, Ministry of Petroleum and Energy, Report No. 67 to the Norwegian Storting. On the Exercising of the State's Option for the Landing of Gas from the Frigg Area to Karmoy, Government Printing Office, Oslo, Norway, 22 pp., (1978-79).**

Production licences Nos 024 and 026 for petroleum were awarded by royal decree to A/S Petronord on May 23, 1969. The Frigg Field was discovered in May 1971 and was declared commercial in May 1972. It was then evident that the field extended into the British continental shelf. In October 1973, the Petronord Group applied for permission to lay a pipeline for the landing of gas from Frigg to St. Fergus in Scotland. The application was dealt with in Parliamentary Report No. 77 for 1973-74.

In a royal decree of June 21, 1974, the Ministry of Industry gave approval for the main portion of the gas from the Norwegian sector of the Frigg area to be landed at St. Fergus, under certain conditions. These conditions included:

1. The state retained the option of delivery of up to 34.25 billion m<sup>3</sup> natural gas to Karmoy.
2. The pipeline project was to contribute to the development of techniques and technology for laying a pipeline so that landing in Norway would be a possibility.
3. The project was to give Norwegian institutions and companies the possibility of acquiring technical know-how with regard to pipelaying in particular and offshore activities in general.

# VIII NORTH AMERICAN EXPERIENCE

**CANADA, Department of Energy, Mines and Resources, Offshore Exploration, 8th Issue, Ottawa, Ont. ix, 105 pp., (April, 1979).**

"Offshore Exploration" provides a liaison between the oil and mining industries and the various federal agencies concerned with Canada's interest offshore. Its purposes are to introduce to operating companies the responsibilities and requirements of federal agencies concerned with the offshore, to note some of the services available through agencies, and to list the persons who may be contacted for assistance.

**CANADA, Department of Industry, Trade and Commerce, Ocean Industries Division, Canada's Offshore Petroleum and Oceanology Capability, Ottawa, Ont., 142 pp., (1974).**

This directory introduces some of Canada's foremost offshore companies to potential customers and to distributors seeking successful companies with which to do business. The services and products described represent only a fraction of Canada's capacity in the entire spectrum of marine activity.

**CANADA, Department of Industry, Trade and Commerce, Marine Canada: a Directory of Canadian Ship Builders, Marine Products and Services, Ottawa, Ont., 185 pp., (1976).**

This directory describes Canadian shipbuilders, consultants, manufacturers of marine products, and service companies now selling in the international marine market. It provides designers, shipyards, and shipowners with a ready reference to Canadian sources of ships, marine products, and services.

**CANADA, Department of Regional Economic Expansion, The Impact on the Regional Economy of Eastern Canada Resulting from the Potential Development of Offshore Oil and Gas, EIU Canada Ltd., Toronto, Ont., 105 pp., (1972).**

This report examines the potential impact of offshore oil and gas development in the Atlantic Provinces and the anticipated economic impact on the region. The purpose of the study is to provide insight to the following issues:

- (a) threshold reserves necessary for development;
- (b) location of markets for products;
- (c) number of jobs created;
- (d) spatial distribution of jobs;
- (e) distributions of expenditures and benefits to the region;
- (f) possibilities of industrial opportunities.

**CANADA, Environment Canada, Fisheries and Marine Service, Canada's Ocean and Aquatic Science Programs, 23 pp., (1975?).**

The first part of the document examines the role of the Fisheries and Marine Service of Environment Canada and the function of its various branches. The activities and domain of interest of the Atlantic Oceanographic Laboratory and of the Institute of Ocean Sciences (B.C.) are also detailed. The second part of the report describes briefly the specific programs directed toward the management of fisheries carried on in all regions of the country.

**CANADIAN COUNCIL OF RESOURCES AND ENVIRONMENT MINISTERS, Shore Management Symposium October 4 and 5, 1978, Victoria, British Columbia, Proceedings, Toronto, Ont., viii, 465 pp., (1979).**

The various workshops of the symposium identified shore management issues on the basis of certain topic areas. These issue statements reflect the insight of the various delegates as to concerns from the perspective of their own region and/or jurisdiction. Findings and recommended guidelines accompany the issues raised in each topic area. These consist of the following (the number of theme issues discussed in each area of interest are in parentheses):

- (a) public access (3);

- (b) hazard areas (5);
- (c) surface use conflicts (3);
- (d) water quality (8);
- (e) fish habitat protection and management (8);
- (f) development siting (8);
- (g) protecting sensitive, unique and significant areas (6);
- (h) planning, coordination and evaluation (10);
- (i) data needs and research requirements (5);
- (j) public information and education (5);
- (k) administrative cooperation and implementation (9).

This volume represents the most complete statement to date of coastal zone management issues in Canada. The format of the volume is arranged around issue statements and recommendations.

**CENTER FOR OCEAN MANAGEMENT STUDIES, University of Rhode Island, Comparative Marine Policy: Perspectives from Europe, Scandinavia, Canada and the United States, Praeger Publishers, New York, NY, (1981).**

## ISSUES

1. Economic, social, and political links across the Ocean have helped to bring together people and nations as one functional entity. This interdependence and closeness has further been reinforced by commerce, communication, culture, and even pollution, which respect no boundaries. Unfortunately, nations continue to formulate domestic marine policies as though they could be implemented in isolation. This "tunnel vision" may be the result of national self-interest or lack of imagination.
2. The UK offshore oil and gas development has now reached a stage where it has to ensure continuous exploration when the success rates are falling; maintain a stable level of offshore activity and thereby prevent sharp fluctuations in the demand for production platforms, equipment and labour; ensure a fair balance between financial benefits between the government and the private oil companies; and at the same time resolve the conflict between offshore oil and fishing interests.
3. Problems confronting Canadian marine policy makers are caused by cultural, institutional, geographic and economic factors. The proposal to transport Arctic oil through the Northwest Passage presents serious environmental problems. A major oil spill could seriously affect the lives of the Native People in northern Canada who survive by hunting and fishing. The profitable herring fishery and the salmon fishery on the west coast of Canada could also be threatened by any major tanker spills from the Valdez-Cherry Point oil transportation system.

## RECOMMENDATIONS

1. Because of the interrelationship and the free flow of ideas, culture, commerce and pollutants, irrespective of geographical and political boundaries, there is a need for a global ocean policy that will provide common sets of principles and guidelines to govern individual and national marine activities. Such principles and guidelines must protect the vitality of the oceans, prevent over-exploitation of marine resources, and ensure the peaceful uses of the sea.
2. In moving from a period of "hectic youth to a more stable middle age", it appears that the UK's offshore oil and gas development policies will have to be reviewed and amended to deal with the new issues. The conflict between the oil and fishing industries has not been resolved, partly because of lack of cooperation between government officials and the oil industry and partly because some of the offshore legislation contradicts the principles of free access and public rights.
3. The basic Canadian marine environmental protection policy is shared by all federal departments and provincial governments. The protection policy involves health, fisheries, protection, tourism, recreation, and transportation factors; therefore, the agencies of health, fisheries, tourism, recreation, and transportation at both the federal and provincial levels are involved. This policy is implemented by identifying, for each of the sensitive areas under Canadian jurisdiction, the basic requirements for marine environmental protection. These requirements are then translated into Canadian law which can be administered directly by the federal government or delegated to the provincial governments.
4. This multiple approach to marine environmental protection by Canada, even though involving duplication, provides checks-and-balances that ensure effective protection of the environment.

**THE COMPTROLLER GENERAL OF THE UNITED STATES, Report to the Congress: Impact of Regulations After Federal Leasing on Outer Continental Shelf Oil and Gas Development, General Accounting Office, Washington, DC, 63 pp., (February 27, 1981).**

**ISSUES**

1. United States Geological Survey (USGS) must approve industry's plans for outer continental shelf (OCS) exploration and development activities. The time frames required for USGS approvals have significantly increased since 1978. Most serious delays exist where time frames for completing agency action are not legislatively mandated.
2. The involvement of state and local regulatory agencies in OCS activities increases as OCS activities move from exploration to development and production stages. However, increased state and local involvement does not have to delay OCS operations.
3. Environmental laws pose the greatest obstacles to timely OCS development.
4. Industry has a credible record and has been "diligent" in its OCS activities.

**RECOMMENDATIONS**

1. Because intergovernmental and interagency leadership is necessary for OCS developments, Congress should enact legislation to establish a standard reasonable time within which all federal agencies should complete approvals and issue permits.
2. A Steering Committee should be established to bring public and private sector interests together to ensure a balance between oil and gas development and environmental protection and to streamline the process.
3. A Steering Committee should be established to encourage and assist coastal states in developing legislation and administrative procedures.
4. The quality and timing of environmental reviews should be improved. The issuing of permits should also be accelerated.
5. The effectiveness and real need for the various regulatory requirements imposed on industry activities should be monitored, enforced, and evaluated.

**KINGSBURY, J.M., Oil and Water - The New Hampshire Story, Shoals Marine Laboratory, Cornell University, Ithaca, NY, 102 pp., (1975).**

An example of a conflict between public and private business is the controversy which took place in Durham, New Hampshire. In 1973, the Olympic Refining Company proposed to construct, in Durham, an oil refinery with a design capacity of  $4 \times 10^6$  barrels a day and a capability of expansion to  $6 \times 10^6$  barrels a day. The facility would have occupied 1 214 ha in Durham, cost about \$600 million to construct, and been the largest start-from-scratch refinery built in the United States. The proponents of the proposal emphasized that the development would create about 2 500 jobs during construction and employ about 1 000 people when the refinery commenced operation. Opponents of the proposal questioned the economic, environmental, and social impacts of the development.

Since Durham had a zoning by-law which did not permit large-scale industrial development such as a refinery, Olympic's first step was to attempt to have Durham amend its zoning by-law. However, the process was abruptly halted in March 1974. Public sentiment had become so unfavourable that Olympic withdrew its refinery proposal without ever formally requesting the rezoning. The state legislature had rejected legislation which would have given the state ultimate site review authority and enacted in its place legislation which affirmed home rule by making local government approval necessary.

The Durham controversy is an illustrative case in many respects. The full-scale details of the refinery-offshore terminal proposal never did come out, and no governmental decision was rendered. More significant are considerations of the land use decision-making process itself which, as exemplified in the Durham controversy, provide lessons for the principals: the developer, the public, and government at the local, regional, and state levels.

KOPPELMAN, L.E. and S.F. ROBBINS, "The Long Island Response to the Risks of Outer Continental Shelf Oil Production", Coastal Zone Management Journal, 7 (2-3-4), pp. 163-183, (1980).

#### ISSUES

1. An agency or department charged with a responsibility to protect offshore resources may have difficulty convincing the public that there is no conflict of interest in trying to protect and exploit offshore resources at the same time.
2. By resorting to legal battles, supported by technical studies, local litigants can secure increased environmental safeguards, obtain extensive media coverage, as well as shape public opinion regarding the risks of outer continental shelf oil and gas production.

MANNERS, I.R., The Coastal Energy Impact Program in Texas, University of Texas at Austin, Bureau of Business Research, Austin, TX, xi, 70 pp., (1980).

Offshore oil exploration and production are expanding at a rapid rate as the changing global energy situation encourages a geographical spread of activities to areas far removed from the traditional centres of production and into much deeper waters, where both environmental conditions and the logistics of supply and transportation pose enormous challenges. "Accelerated exploration of the outer continental shelf frontier has been delayed by controversy over the nature, scope, and severity of the impacts that would be associated with offshore oil development. The controversy is multifaceted, it arises from the difficulty of predicting the social and environmental impacts of new exploration and production technologies, it is complicated by the uneven distribution of both the costs and the benefits of energy development, it is inflamed by such high-stress incidents as oil spills and blowouts, and it is obscured by inevitable disagreements over the relative weighting of social, ecological, and economic variables."

In an attempt to resolve these issues and expedite offshore development, Congress enacted the Coastal Zone Management Act and the Outer Continental Shelf Lands Act. In broad terms, the intent of this legislation was to strike a balance between national and local development and conservation interests.

A central question is whether this federal legislation provides a viable framework for identifying and mitigating the social and environmental "costs" of offshore oil activity and thereby avoiding the sort of adversary relationships between planners, developers, regulators, and affected communities that have delayed exploration of the Atlantic outer continental shelf areas.

The research described in this book has been directed towards an evaluation of the planning strategies presently being developed and implemented by coastal communities in those states currently involved in offshore production. Careful identification of the impacts of energy-related facilities, combined with a systematic comparison of the costs and benefits of locating such facilities in coastal areas, vis-a-vis alternative uses of the resources of the coastal zone, appears to be a useful way of resolving siting conflicts, especially if accompanied by a program of compensation for adversely affected communities and interests. Against this background, the book covers certain objectives which are:

- "the extent to which current planning strategies, evolving from federal pressures and local initiatives, have enhanced impact assessment and mitigation procedures in the coastal zone;
- the manner in which local communities have used those funds available under the federal impact assistance program; and
- the effectiveness of such initiatives in diminishing community apprehensions over the social and environmental costs of offshore oil development."

The study is restricted to the Texas Gulf Coast, where the issue of coastal planning initiatives is the subject of some controversy; the questions were approached through the perception and actions of those most directly involved in offshore development and onshore planning, namely planners and affected communities.

NIERING, F.E., "Canada Oil and Gas Potential of the Arctic", Petroleum Economist, XLVII (8), pp. 339-341, (1980).

#### ISSUES

1. Natural gas reserves in the Arctic are estimated at about  $623-680 \times 10^9 \text{ m}^3$ . Beaufort Sea drilling, which has yet to contribute to the reserve estimates, could raise the total estimated reserves.



2. Based on the results from Imperial's drilling projects, it is estimated that the Beaufort Sea reserves could be between  $30-40 \times 10^9$  barrels of oil, compared with Canada's end-1979 proven reserves of  $6.8 \times 10^9$  barrels. Drilling results thus indicate the Canadian Arctic's potential importance in contributing to the national goal of energy self-sufficiency.
3. There is the need for research into Arctic transportation and production systems to facilitate year-round operation. At present, the drilling season which ends in September is restricted to the summer months in the Beaufort Sea, when the ice recedes to allow the drill ships to operate. Unlike the Beaufort Sea, offshore drilling in the High Arctic can be carried out throughout the year because the ice never fully melts. Year-round operations is also made possible by mounting conventional rigs on floating ice islands, built by flooding and freezing in layers.
4. Despite encouraging drilling results and the Arctic region's long-term potential, drilling has fallen off sharply in recent years because of a number of reasons: expiration of the super depletion allowance which allowed up to a \$5 million write-off on a single well, and diversion of drilling money away from the Arctic due to provincial and federal incentives to drills in conventional producing regions. Thus, the extent to which the Arctic region can contribute to Canada's long-term energy supply will depend on how problems relating to finance, technology and the environment are solved.

#### RECOMMENDATIONS

1. Transporting Arctic oil and gas will depend on sustaining the interest of sponsors and the extent of the reserves. Despite declining drilling activities in recent years, two groups are still pushing ahead with their plans to transport Arctic gas.
2. The Arctic Pilot Project group transportation system involves using tankers to transport gas liquefied on a barge-mounted plant on the south coast of Melville Island at a daily rate of  $6.37 \times 10^6$  m<sup>3</sup>. The estimated cost of this project is \$2.2 billion. The APP group have concluded the first sale of Arctic natural gas to an American group.
3. The second transportation system, which is believed to be the best means of getting Arctic gas quickly to the market, is the Polar Gas Project. This project envisages the construction of a Y-shaped pipeline that would transport gas from the High Arctic and the Mackenzie Delta at an estimated cost between \$12-\$17.7 billion.

**NOVA SCOTIA, Department of Mines and Energy, Offshore Oil and Gas: A Chance for Nova Scotians, Halifax, Nova Scotia, (July, 1980).**

#### ISSUES

1. Offshore oil and gas could provide Nova Scotia with the much needed financial resources to help overcome the chronic economic problems.
2. Despite the potential financial benefits, offshore oil and gas development, if mismanaged, could generate adverse economic (inflationary), environmental (oil spills), and social impacts.

#### RECOMMENDATIONS

1. The government of Nova Scotia plans to obtain the needed financial resources from direct revenues: bonuses from license sales, royalties, and income tax. In addition, the government has reserved up to 25% working participation in all offshore oil and gas developments.
2. The social and environmental impacts of offshore oil and gas development will be mitigated by regulating the rate and nature of development to suit local community circumstances. To improve quality of management, regulators and decision-makers will be encouraged to work closely with local communities.

SCARLETT, M.J. (with contributions by C.E. Banfield and G.A. Royce, Memorial University of Newfoundland), "Some Aspects of the Newfoundland Setting for Developments of Offshore Oil/Gas Resources", paper presented at a symposium held in St. John's, Nfld, November 1974, IN Consequences of Offshore Oil and Gas - Norway, Scotland and Newfoundland, Institute of Social and Economic Research, Memorial University, St. John's, Nfld, pp. 218-264 (1977).

#### ISSUES

1. For several years there has been concern over the legal rights to offshore oil and gas resources. The validity of the argument that such resources are the exclusive property of the federal government is questioned by all eastern Canadian provinces. The need to resolve the legal problems is urgent.
2. Perception of future events by Newfoundlanders constitutes an important issue at this stage. There is increasing concern that rapid growth will threaten traditional life styles and values. This possibility demands intelligent planning in order to minimize the disruption and maximize the benefits to the people of the province from OCS exploitation.
3. A number of questions are posed at this stage and most of them remain unanswered. A great amount of work has to be done. How will an influx of oil money affect urban growth and induce social and economic change?

#### RECOMMENDATIONS

1. Careful studies are needed of Newfoundland society and environments, primarily in terms of spatial organization, especially geographical, but structured in light of Norwegian and Scottish experience. Far reaching planning is essential to provincial authorities as well as to local governments.

**STATE OF OREGON, Department of Energy, Final Report: Outer Continental Shelf Oil and Gas Development Task Force, Oregon Outer Continental Shelf Oil and Gas Development Task Force, Salem, OR, xiii, 109 pp., (January, 1979).**

Offshore oil and gas development offers potential benefits to coastal communities and to the state as a whole. However, without advance planning or adequate attention to environmental protection, these benefits could be lessened by a variety of social, economic, and environmental problems. Existing and proposed offshore oil and gas development activities likely to affect Oregon include outer continental shelf leasing on the west coast, and the proposed construction of oil and gas processing plants and terminals.

Based on these proposed offshore oil and gas development activities, a series of recommendations were given in this report and are summarized below:

##### (a) Agency Coordination and Responsibility:

- i) The Department of Land Conservation and Development should be designated as the coordinating agency for OCS-related concerns.
- ii) The OCS Task Force should be reactivated when OCS leasing is scheduled off the Oregon coast. The main function of the Task Force should be to facilitate information sharing among the participating agencies and to serve as a forum for discussing policy alternatives.
- iii) Major OCS-related tasks that need to be undertaken and coordinated with other state agencies include: OCS plan review, environmental studies, contacts with industry, participation on national and regional OCS advisory boards, planning and financial assistance to local governments, and information sharing and education.

##### (b) Onshore Facility Siting:

- i) Legislation to broaden the scope of the Energy Facility Siting Council should be promoted.
- ii) The Land Conservation and Development Commission should consider designating certain energy-related industrial facilities, such as platform fabrication yards and pipe coating yards, as activities of statewide significance.
- iii) The state should consider expanding its site suitability studies to include the identification of appropriate sites for oil and gas facilities.
- iv) Oil- and gas-related onshore facilities should be consolidated unless consolidation produces greater adverse environmental, safety, or social consequences.
- v) In the selection and approval of sites for oil- and gas-related facilities, sites should be carefully reviewed for needed separation from residential, commercial, and recreational land uses.

- vi) State agencies, local governments, and ports should encourage the concurrent use, reuse, conversion, and removal of OCS-related facilities.
- vii) Comprehensive planning and port planning should be more closely coordinated.

(c) Transportation of Oil and Gas:

- i) The state should investigate existing and potential navigational safety problems at Oregon ports along the coast.
- ii) Before approving new port facilities for petroleum products and liquefied natural gas, cities and port authorities should carefully evaluate their effect on current and future vessel traffic.
- iii) The State of Oregon should consider adopting pilotage or tug requirements for tankers in hazardous areas.

(d) Air and Water Quality:

- i) Oregon's oil spill response program should be closely coordinated with similar programs in other nearby states.
- ii) The State should encourage the establishment of more stringent safety requirements for oil terminals.
- iii) The State should encourage the Regional Response Team to periodically conduct mock oil spill drills on the Oregon coast to increase the capability of state and federal agencies to respond to actual spills if they occur.
- iv) Further investigation should be undertaken of the state's authority to regulate oil tanker air pollutant emissions.

**UNITED STATES, Department of the Interior, United States Geological Survey, Outer Continental Shelf Oil and Gas Information Program, Directory to Federal, State and Local OCS-Related Activities and Contracts, The Mite Corporation, Washington, DC, x, 4-12 pp., (November, 1979).**

This directory identifies specific federal, state, and local agencies involved with oil and gas activities on the outer continental shelf (OCS). Current agency responsibilities and the mechanisms used for interacting with OCS activities are outlined in three groupings: (a) an overview of major federal activities (Chapter 2) and the mechanisms used for controlling, regulating, and monitoring OCS activities; (b) a review of major state government programs (Chapter 3) pertaining to the OCS, both the activities for which the states have direct responsibility; and (c) a description of county and municipal participation (Chapter 4) in local and substate programs which can affect the OCS process. Appendix A is a bibliography and Appendix B is a one additional telephone directory of agency contacts arranged alphabetically by state and region. The directory progresses from federal to local information. The reader can then identify which level of interaction is of interest and obtain the appropriate government contact from the listings in Appendix B.

**UNITED STATES, Department of the Interior, Bureau of Land Management, Outer Continental Shelf, Joint Federal/State Beaufort Sea; OCS Leasing Systems, Sale No. BF (Part V) and (Part VI), Federal Registrar, Washington, DC, (November 7, 1979).**

This is the final notice of the proposed joint Federal/State Beaufort Sea lease sale in the offshore waters of the Beaufort Sea off northern Alaska. The principles and conditions under which the United States and the State of Alaska will jointly conduct the proposed sale are specified in this document. This notice applies to those tracts (leasing units) under federal jurisdiction; those tracts whose jurisdictional status is in dispute between Alaska and the United States; and those tracts under State jurisdiction. Also contained within this document is the method of bidding as well as lease terms and federal and state stipulations which holders of leasing units must abide by.

**UNITED STATES, House of Representatives, Subcommittee on Advanced Energy Technologies and Energy Conservation Research, Development and Demonstration of the Committee on Science and Technologies, 95th Congress, Energy from the Oceans, U.S. Government Printing Office, Washington, DC, XII, 433 pp., (1978).**

In response to the prospect of increasing shortages of energy, there is renewed interest in alternate energy sources, especially those which are renewable. This interest has extended to the ocean whose renewable energy resources consist primarily of those derived from solar radiation, gravity, and chemical composition. Sources of renewable energy unique to the ocean include thermal differences, waves, currents, tides, winds, and salinity differences. Renewable energy can also be derived from plants grown of energy from the ocean; their main disadvantage is their general dispersion, which precludes their efficient use except in locations of special concentration. Specifically, these renewable energy resources are:

- (a) Ocean Thermal Energy Conversion - temperature differences between warm surface water and cold, deep ocean water represent a potential source of energy;
- (b) Energy from Ocean Waves - where waves are sufficiently large and can be anticipated regularly, as in the trade wind zone or at the eastern shores of oceans where the swell arrives continuously from distant storms, significant energy can probably be extracted from the wind waves;
- (c) Energy from Ocean Currents - ocean currents result from the interaction of a number of geophysical phenomena including the rotation of the earth, the winds, the distributions of salinity and temperature, tidal effects, and the shapes of the ocean basins. The total power of ocean currents has been estimated to be about  $5 \times 10^6$  megawatts. However, not all this power is available; energy extraction is practical only in a few areas, usually located near the periphery of the ocean basins, where the currents are concentrated into ribbons of high velocity flow and high volume transport;
- (d) Energy from Ocean Tides - tides ebb and flood in response, primarily, to the gravitational attraction of the moon and, to a lesser degree, of the sun;
- (e) Energy from Oceanic Wind - the amount of power that can be derived from the wind is proportional to the cube of its speed; thus, the payoff in wind energy conversion installations is in locating them on sites with high wind speed;
- (f) Salinity Gradient Energy Conversion Processes - in principle, it is possible to derive energy from any process in which two or more liquids of different chemical composition are mixed; energy producing devices have been made that depend upon mixing two systems of water of different salt concentration;
- (g) Oceanic Bioconversion - most of the solar energy reaching the earth is received by the oceans, which comprise approximately 71% of the earth's surface; thus, the oceans offer a large potential for the collection and utilization of solar energy;
- (h) Deep Ocean Oil and Gas - the complexities of offshore hydrocarbon extraction appeared prohibitive in the past, but the development of marine geophysical prospecting technology and various types of offshore drilling rigs and production platforms suited to differing depths and conditions has now made hydrocarbon exploration and production in the shallow, and even in the moderately deep, offshore waters of the continental shelves entirely feasible;
- (i) Offshore Geothermal Energy - geothermal energy is the natural heat of the earth which increases with the depth due to the radioactivity present in small amounts in all rocks;
- (j) Offshore Hard Mineral Energy Resources - coal and other minerals have been mixed beneath the sea floor for many centuries; today, there are over 100 underground mines operating under the ocean bottom.