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FOR

TECHNICAL REVIEW

COASTAL POLICY STUDY :

"WHERE SHOULD HEAVY INDUSTRY BE SITED IN COASTAL MAINE?"

Prepared by: Maine Department of Conservation and
Maine Office of Energy Resources

for the

GOVERNOR'S ADVISORY COMMITTEE ON COASTAL DEVELOPMENT AND CONSERVATION

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WHERE SHOULD HEAVY INDUSTRY BE SITED IN COASTAL MAINE?

A Report to the Governor's Advisory Committee
on Coastal Conservation and Development

Prepared by
the Maine Department of Conservation

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I. STATEMENT OF THE ISSUE

Cold, deep ocean water.

Protected harbors.

Fast-flowing, abundant nearby fresh water.

For three centuries, these features have attracted various industries to the Maine coast. These industries - ice-cutting, ship-building, fish processing and others - usually depended on local natural resources, employed relatively large numbers of local residents, and served, along with fishing, commerce, recreation, and agriculture, as bases of an economy that became a way of life.

In the mid and late sixties the same features which had maintained and contributed to the traditional lifestyles began to attract new industries that were far from traditional. Headlines were full of proposals to build oil terminals, oil refineries, aluminum-smelting plants, nuclear power plants, and other energy generating facilities on the coast (see Appendix A). Coastal town halls and state legislative chambers were full of reaction to the proposals.

In the early seventies, two major pieces of environmental protection legislation, the Coastal Conveyance of Petroleum Act and the Site Location of Development Act, were enacted in response to the prospect of this new type of industry coming to Maine.

In 1973, a third piece of legislation directed very specifically at these industries was presented by Governor Kenneth Curtis. The proposed legislation was the product and final recommendation of the Governor's Task Force on Energy, Heavy Industry, and the Maine Coast. It called for restricting heavy industry*

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*The Task Force never clearly defined heavy industry except by example. For the definition used in this report, see Section III A, Potential Heavy Industry on the Maine Coast in the Next 25 Years.

to two locations on the coast, Portland Harbor and Machias Bay, and explicitly rejected the alternatives of (1) prohibiting heavy industry on the coast and (2) dealing with heavy industry on a case-by-case basis. The 106th Legislature, in turn, rejected the proposals of the Task Force.

Heavy industrial proposals kept coming, however: an oil terminal and refinery in Eastport (Pittston Oil Company), an oil terminal in Portland and refinery in Sanford (New England Energy Corporation), an oil-fired electric generation plant on Cousins Island (Central Maine Power Company), and a nuclear power plant and coal-fired generation plant on Sears Island (Central Maine Power Company).

As these proposals have surfaced and been discussed before state and federal permitting agencies, interest groups have presented different and often conflicting views about locating heavy industry on the Maine coast, and about the State's role in the process. Among the interest groups are: environmentalists; developers; those who make their living from coastal resources used in a traditional manner; those state and local officials who must make decisions about where major public investments, such as roads and utilities, should be located or improved; and researchers who collect scientific information about natural resources on the coast. A brief summary of the viewpoints of each of these groups might look like this:

Environmentalists want nondegradation.

One or more established or ad hoc "environmentalist" groups has opposed every coastal heavy industry siting proposal. These groups have been concerned that the Maine coastline, and coastal resources dependent for their existence on clean air and clean water, will be jeopardized by heavy industrial development. They have sought to prevent the degradation of coastal ecosystems which are valuable both for their beauty and their productivity. They feel that the

state's role should be, in the words of the Coastal Conveyance of Petroleum Law (12 MRSA 541) to maintain "the coastal waters, estuaries, tidal flats, beaches and public lands adjoining the seacoast in as close to a pristine condition as possible. . ."

Developers want ease.

Those who make the heavy industrial siting proposals, and proponents of heavy industrial development along the coast, are not undismayed by the opposition they have met. They feel that location of heavy industry on the coast is a logical and economically healthy prospect. They think the state's role should be, in the words of the statutes establishing the State Development Office (5 MRSA 7002): "to promote and attract new industry to the State," including its coastal communities. The Maine coast satisfies the physical requirements of the proposed heavy industries; local tax bases and economies will benefit from the development; it should be much easier than it is to place heavy industry on the coast.

Traditional users want no impacts.

Those people who make their living primarily from fishing or from serving tourists are wary of any activity which may lessen the abundance of either resource. Heavy industry is such an activity, particularly oil-related heavy industry.

Traditional users feel that, again in the words of the Coastal Conveyance of Petroleum Law (12 MRSA 541): "the highest and best uses of the seacoast of the State are as source of public and private recreation and solace from the pressures of an industrialized society, and as a source of public use and private commerce in fishing, lobstering, and gathering other marine life used and useful in food production and other commercial activities."

This group is, in general, jealous of local autonomy. If the state is to have any

role, it should be to minimize the impacts of any activity which might interfere with traditional uses of the coast.

Public investment decision-makers want predictability and economy.

Roads, sewers, and water supplies cannot be located everywhere. It is much less expensive in terms of public investment to locate heavy industry where the necessary infrastructure already exists or can be anticipated.

The actual construction or operation of heavy industries can bring about an influx of population which requires additional public investment. If provision of necessary services can be planned in advance, their delivery will be more economical and effective.

Public investment decision-makers want predictability and economy in heavy industrial siting. To them, the State's best role would be to guarantee that goal.

Researchers and planners want missing information.

Great quantities of Maine coastal resource data have been collected and analyzed. However, there are still many missing pieces, especially those pieces needed to make an informed selection of the specific sites where heavy industry can be located most suitably and with the least environmental impact. Public agencies, private investors, and others who gather and work with the data would like to see the environmental information base for the coast made more complete. From this perspective, the state's role in heavy industrial siting should be to provide leadership and funding for the collection of natural resource data which will be used (1) to determine which particular pieces of land can accommodate heavy industry with least impact and (2) to provide a baseline for effective monitoring of future impacts.

The differing perspectives summarized above help explain why the State of Maine has not adopted a comprehensive policy for heavy industrial siting along our coast. The lack of such a policy does not in this case mean that no need for a policy is perceived.

During the 1977 Legislative Session, Representatives Sherry Huber of Falmouth, Nancy Masterton of Cape Elizabeth, Richard Spencer of Standish, and Barbara Trafton of Auburn sponsored a resolve (L. D. 1664 - Appendix B) which was intended to find answers to several major coastal land use policy questions, among them the state's role in heavy industrial siting. The resolve instructed various state agencies to make recommendations and to draft implementing legislation for the six issues of port development, tourism, heavy industrial siting, fisheries, cumulative impacts of minor developments, and resource information transfer. The resolve took the form of emergency legislation because the sponsors considered it "in the public's best interest to have recommendations on the major unresolved coastal issues prepared for legislative consideration as soon as possible."

Governor Longley also appreciated the urgent need to address the questions set forth in the resolve, but felt it more appropriate that the policy studies be directed by his Advisory Committee on Coastal Development and Conservation (CCDC) which he had previously established in February of 1976 to provide him and the State's executive agencies with guidance on coastal policy matters.

The Legislature agreed, the resolve was dropped, and the Governor directed his committee to report on the six issues to the 1978 Legislative Session. The Department of Conservation was assigned to answer the question "Where should heavy industry be sited in coastal Maine?"

This task is perhaps the most explicit of the six. The Department was not directed to recommend whether heavy industry should locate on the coast, or how many heavy industries should locate, or which heavy industries; but, to answer the narrower question of where.

It is not an easy question. In determining how to undertake the task, the staff attempted to find a policy approach which will come the closest to meeting the conflicting wants of all five interest groups identified above and will be consistent with the policy goals of the CCDC.

After reading the literature on the subject and looking at what other states have done (Appendix C), the project team examined five options for a state policy regarding the location of heavy industry on the coast:

1. Provide technical assistance to coastal municipalities to specify local heavy industrial zones.

This option might satisfy developers. It could give them a variety of locally zoned heavy industrial sites to choose from, and assure a welcome by the municipalities which designate those sites.

The other interests will not be happy.

The impacts of heavy industrial siting go inevitably beyond municipal boundaries. The livelihoods of traditional users in neighboring towns will be adversely affected by zoning decisions in which they have no say.

Technical assistance from the state will help a municipality to designate, if it wishes, heavy industrial zones which will cause the least possible environmental degradation in the municipality. There is no guarantee, however, that the selected areas will be those with the least environmental degradation for the coast as a whole.

There are likely to be so may sites designated all along the coast that public investment decision-makers will not be certain as to where heavy industry will actually locate. If public investments are made for each site or for very many sites, no economies will result.

Determination of the best local heavy industrial sites will not provide as much of an opportunity to collect missing data, because such efforts will of necessity be small-scale and individual in nature.

2. Add specific standards for heavy industry siting to the Site Location of Development Law.

If the additional standards specify certain environmental impacts to be prohibited, environmentalists and traditional users might both be pleased with this option. It can assure those in the fishing and tourist industries that no impacts on fisheries or aesthetics will be allowed. It can likewise provide environmentalists with a powerful weapon to defeat any application for an industry which might degrade the environment in any of the ways specified by the new criteria.

Developers, however, will not be happy with the additional requirements, particularly if the standards are demanding enough to satisfy environmentalists and traditional users.

Public investment decision-makers will not gain any degree of predictability.

Little help will be provided in gathering missing research information other than on an ad hoc basis.

3. Work with heavy industries which wish to locate on the coast to determine the best site among a number of alternatives.

In Massachusetts, the Energy Facilities Siting Council requires applicants to

present several alternative locations for each energy facility. New York goes further by requiring three alternative sites, each with a complete environmental analysis, from proposers of major electric generation facilities.

Adoption of a similar policy for heavy industrial siting on the Maine coast might make siting easier for developers. They will not be forced to put all their eggs in one basket. On the other hand, if the New York requirement were added, application preparation costs might soar.

Environmentalists and traditional users might be happier to deal with a selection among several sites than to attempt to gain acceptance of their views on one particular site. Again, however, as in option #1, there is no guarantee that among the alternatives presented will be that site which will be most satisfactory to either interest group.

Public investment decision-makers will not be afforded predictability or economy.

Researchers may gain employment providing additional research data on potential sites; however, there may not be enough time available in preparation of development proposals to gather important missing data.

4. Designate specific sites for specific industries in advance of individual heavy industry proposals.

In Maryland, the Power Plant Siting Program (PPSP) identifies those sites where electric power can be generated at reasonable cost with minimal environmental degradation. The Secretary of Natural Resources has authority to acquire the sites, by eminent domain if necessary, for future lease or sale to electric utilities.

A similar process applied to coastal heavy industrial siting offers a researchers'

and planners' bonanza: the state funds the collection of missing data in order to determine which sites are most suitable both in terms of plant operating economics and environmental impacts.

Environmentalists and traditional users will probably be happy with the general approach, as should the developers to whom the State will offer pre-approved plant locations. In Maryland, while opposition to specific sites continues, PPSP is highly regarded by both utilities and concerned citizens (U. S. Nuclear Regulatory Commission 1977).

Public investment decisions can be made with the benefit of predictability in heavy industry location, and economies in infrastructure can be effected in the site preselection process.

The option comes very close to satisfying the wants of all the interest groups. It does, however, have two major drawbacks: cost and possible inconsistency with the Maine Constitution.

The Maryland program is funded by a tax that will raise $7.1 million in fiscal 1977. The cost of establishing and maintaining a similar state government capacity in Maine to preselect sites for coastal heavy industry will probably be comparable to Maryland's. Looking for the best particular pieces of land for particular uses is an expensive proposition.

In addition, acquiring land for these purposes by eminent domain authority appears to be unconstitutional under Article I, Section 21 of the Maine Constitution. A discussion of this problem is provided in Appendix D.

5. Designate limited areas of the coast where heavy industry may locate.

This option prohibits heavy industrial development along most of the coast, but allows location of heavy industries in a few areas that can suitably accommodate

clusters of heavy industries.

Environmentalists should be pleased. Almost all of the coast will be protected, as securely as is possible in an uncertain world, from major forms of environmental degradation.

Heavy industrial firms seeking to locate on the Maine coast will be able to base their future development planning on a much clearer state siting policy. Heavy industry and its proponents will probably be glad to trade the unknown odds of locating anywhere along the coast for the certain opportunity to locate somewhere along the coast.

Public investment decisions which relate to heavy industry location can be planned and executed with the benefit of predictability. Also, because industries will be clustered in a few places, economies in infrastructure can be realized.

Although coastal researchers will not be guaranteed state funding under a clustering policy, they will be able to greatly accelerate gathering of data important to particular industry siting decisions because the list of places for which such data is useful will be greatly abridged. Research necessary to fill information gaps on such topics as ocean currents and archeological sites will be efficiently concentrated in the designated areas.

Another benefit of a clustering policy is that it maintains continuity in the traditional economic activities and bases of daily life on the coast. Those in the fishing and tourist industries should be pleased to have the specter of random and unexpected industrial development vanish.

All five interest groups may be satisfied with the clustering option; however, it is almost certain that some members of each group will oppose exclusion or in-

clusion of heavy industry within any given coastal area. Dealing with this problem on a one-time comprehensive basis, as with a clustering policy, appears preferable to dealing with it on a case-by-case basis, as with option 4. In Maryland, for example, citizen groups were formed to oppose each of the five sites identified by the PPSP. Mainly because of public opposition, none of the sites has been acquired.

We recommend that the state designate particular areas of the coast for the location of heavy industry, and prohibit the location of new heavy industry along the remainder of the coast.

The Committee on Coastal Conservation and Development adopted six major policy goals for Maine's Coastal Program at its meeting of June 15, 1977. These are:

1. Economic expansion in an orderly fashion compatible with traditional activities.
2. A clustering of development so that the character of coastal communities will be maintained.
3. An increase in social well-being, especially in such aspects as community stability, the availability and quality of basic services, the general standard of living and in opportunity for coastal access.
4. Maintenance of environmental quality, including the maintainance of open space and agricultural and forest land.
5. Protection of those aspects of the coast that make it a unique resource, particularly its aesthetic values.
6. The management of the renewable resources of the coast on an optimum sustained yield basis.

The policy recommendation made above parallels the CCDC's goal #2 and comes closer than any other policy option discussed here to accomplishing the Committee's other five goals.

II. BACKGROUND: METHODOLOGY

OVERVIEW

The purposes of this report are (1) to designate areas of the coast where heavy industry can most suitably be clustered and (2) to provide recommendations which implement a clustering policy and deal with the special problems inherent in such a policy.

Part I provides a general discussion of the issue and of related policy goals. This part explains the methodology used to determine which areas of the coast should be designated for heavy industrial development. Part III applies this methodology. Part IV discusses some problems inherent in a clustering policy and alternative solutions. Part V summarizes the recommendations of the project team and presents draft legislation which implements these recommendations.

METHODOLOGY

The methodology employed in this report is based in part on that used by the Resource Planning Associates in its Alternative Siting Study, Northeast Coast Liquefied Natural Gas Conversion Facility. A description of this study is given in Appendix E.

A basic premise of the methodology used here is that it is not efficient to analyze an entire coastline for the presence of heavy industry sites when it is clear that only portions of that coastline are suitable and that only certain types of heavy industry may reasonably be expected to seek to locate in coastal Maine during the remainder of this century. The examination of the entire coast for every siting consideration for every heavy industry would be an enormous undertaking far beyond the capability of this project. In the time allowed the project team focused on (1) the heavy industries most likely to seek to locate in coastal Maine, (2) the industry siting factors most instrumental in determining the suitability of a site, and (3) the areas of the coast where these factors appear best to be met.

Another significant consideration in the design of this methodology is that the policy goal of clustering coastal industries is introduced early in the methodology, rather than superimposed at its end.

This part of the report presents a summary outline of the methodology, followed by a description of the elements of the methodology.

Summary of the Methodology

A. Identification of the heavy industries which may be expected to seek to locate on the Maine coast in the next 25 years.

B. A comprehensive listing of the factors which affect an assessment of the overall suitability of potential coastal industrial sites.

C. Identification of the primary siting factors for each of the industries identified in Section A.

D. Identification of the industries which have the most demanding primary siting factors.

E. Screening the coast to determine areas which are capable of meeting the requirements of the most constraining industries.

F. An evaluation of the remaining areas for the presence or absence of all other siting factors identified in Section B.

G. An evaluation of the remaining areas for their suitability for location of the industries which have less constraining siting factors.

Description of the Methodology

A. The first step in this methodology is the determination of the types of heavy industry which may reasonably be expected to locate on the Maine coast during the next 25 years. Each type of heavy industry has its own special set of requirements. For some industries, Maine's location and physical and cultural characteristics are attractive; for other industries, they are less desirable. This initial step utilizes information regarding national and international trends, availability of raw materials, past heavy industry proposals in Maine, and the state's general physical characteristics. The product of this step is a list representing industries with the highest probability of seeking to locate in Maine.

B. The second step calls for a comprehensive listing and, where appropriate, a definition of the considerations involved in determining the suitability of locations for heavy industry. The list includes criteria for both specific site selection and general area evaluation. This step does not attempt to treat fully each consideration. However, it does attempt to convey the spectrum of concerns involved in major facility siting. The list includes physical, biological, social, cultural, and economic factors. Some are factors required by the nature of the industry, e.g., large amounts of fresh water for construction of concrete OCS platforms. Some are standards imposed by federal, state, or local governments, e.g., air quality emission standards. Some are public safety concerns. Others relate to recognized and expressed public policy concerns, e.g., the integrity of valuable recreational or fishing resources.

C. The third step links the first two products of this process. For each heavy industry identified in Step A, the primary siting factors are specified. Primary siting factors are location needs which are of particular importance for each industry. These factors are of such importance that they may be considered basic requirements. These factors may be mandated by law, economics, current policy, public interest, or the basic physical needs of the facility. The identification of some factors as "primary" in no way implies that the other considerations are not significant. Rather, by highlighting the most critical requirements of each facility, this step serves to define the general type of area which is most suitable for each industry.

These major requirements vary greatly among different types of industries. A primary siting factor for a liquefied natural gas terminal and regasification plant, for example, is a channel at least 450 feet wide and 44

feet deep. Areas with channels which fail to meet these requirements may virtually be precluded from further consideration. Although it is recognized that technological advances may increase the theoretical flexibility of some of these requirements, this report assumes that there are economic constraints upon industry which will limit the application of this technology.

D. At this step, the policy goal of clustering coastal heavy industrial development is introduced. Suitability of a coastal area for location of two or more facilities is determined in large part by the capability of the area to satisfy the siting requirements of the facility with the most demanding requirements. This step identifies the industries which have the most restrictive primary siting requirements and are therefore the most constrained in terms of where they can physically locate.

E. The fifth step in this process calls for a first screening of the Maine coast to determine what areas, if any, can meet the primary siting factors of the most constraining industries identified in Step D. The coast is divided into thirteen geographic areas which are then examined for their ability to meet these requirements. The product of this step is a list of the municipalities which meet the primary siting factors of each of the most constraining industries. This step serves to (1) eliminate the broad sections of the coast which can not offer the required critical factors and (2) focus subsequent analysis on those areas which do meet the basic requirements for the most constraining industries.

The materials and conclusions in this section were derived in large part from the work of others, particularly the Resource Planning Associates

report, Alternative Site Study, Northeast Coast Liquefied Natural Gas Conversion Facility and the New England River Basins Commission's report, Analysis of Potential Deepwater Oil Terminals in Maine.

F. This step is a second screening of the areas remaining after application of the preceding step. The coastal areas which satisfy the major siting factors of the most constraining industries are further examined for the other non-primary siting factors identified in Step B. The project team relied mainly on governmental and outside agencies to describe and to assess the importance of these factors for the areas designated in Step E. This step is not an environmental impact assessment but rather an attempt to discern (1) potential impacts of heavy industry which are clearly unacceptable or (2) local, state, or federal requirements which might rule out areas. The product of this step is a list of municipalities which meet the primary siting factors for the most constraining industries and for which the location of heavy industry does not appear to present any clearly unacceptable impacts on any of the factors listed in Step B.

G. The final step in this methodology is the re-examination of the areas remaining after application of Step F to evaluate their suitability for accommodating the remaining, less constraining heavy industries. The designated areas are evaluated for their ability to meet the primary siting factors identified in Step C of these industries. The product of this step is a listing of municipalities designated as heavy industrial development areas.

Two points should be kept in mind in reading this report:

1. That for the data and, in many cases, the conclusions regarding the suitability of areas of the coast the project team depended very heavily on the work of others. For the most part, these were major studies produced by consultants with large staffs, large budgets, and considerable technical expertise.

2. That the project team was looking for sites that affirmatively met the requirements of the potential heavy industries. There are no sites in Maine which are ideal for any of these industries. However, there are never any absolutes in this type of undertaking. The intent of this study was to determine sites which are more suitable for industrial development, not those which meet the barest minimum requirements. Therefore, in most cases where a site's ability to meet the requirements of an industry is dubious or doubtful that site is eliminated from consideration.

III. ANALYSIS

A. POTENTIAL HEAVY INDUSTRY ON THE MAINE COAST IN THE NEXT 25 YEARS

Maine is the potential location for a number of different types of heavy industry in the remaining years of this century. The types of heavy industry which may locate in Maine are primarily energy conversion or energy storage facilities, particularly those which require the clean air, cold water, and relatively undeveloped land abundant in the State.

Heavy industry means a development characteristically employing equipment such as, but not limited to, smoke stacks, tanks, distillation or reaction columns, chemical processing equipment, scrubbing towers, pickling equipment, and waste treatment lagoons; which industry, although conceivably operable without polluting or otherwise causing a significant adverse environmental impact on the coastal area (by, but not limited to, the likelihood of generation of glare, heat, noise, vibration, radiation, electromagnetic interference and obnoxious odors) has the potential to pollute or otherwise cause a significant adverse environmental impact. Examples of heavy industry are oil refineries; steel manufacturing plants; pulp or paper mills; chemical plants such as petro-chemical complexes. Examples of development which is not heavy industry are textile mills; shoe factories; fish processing plants; and garment factories.

The project team did not define tidal power generation as a heavy industry in this study for two reasons: (1) there is clearly only one place on the Maine coast, Passamaquoddy Bay, where tide levels are adequate to make this form of power generation feasible. The question of where to site tidal power generation in Maine can be readily answered without benefit of the kind of analysis provided in this study; (2) the dams required for holding the tides interfere with passage of oceangoing vessels necessary for the operation of several other heavy industries. Engineering requirements needed to overcome this interference serve to make clustering other industries at the same location as tidal power

generation a more costly alternative to location elsewhere.

The list on the following page presents the heavy industries which may seek to locate in coastal Maine in the next twenty-five years. The selection of industries is based on very general physical requirements, economic cost factors, and recent historical trends. The list is followed by a summary of the reasons for selection of each industry. The last two parts of this section explain why certain other heavy industries have a low probability of locating on the Maine coast and of locating in Maine, respectively.

Heavy Industries Which May Seek to Locate on the Maine Coast in the Next 25 Years

Liquefied Natural Gas (LNG) Terminal and Regasification Facility

Oil Terminal

Oil Refinery

Nuclear Power Plant

Coal-Fired Electric Power Plant

Coal Storage and Handling Yard

Construction Yard for Outer Continental Shelf (OCS) Platforms

Heavy Industries Which May Seek to Locate on the Maine Coast in the Next 25 Years

Liquefied Natural Gas

Natural gas represents 34% of total energy consumption in the United States. Since 1970, domestic discoveries of natural gas have decreased despite more intensive drilling efforts. To increase available supplies of natural gas, efforts have been made to develop facilities to import liquefied natural gas (LNG) from other nations. LNG imports require three types of facilities: a terminal, a regasification plant to change liquid natural gas to its gaseous state, and a pipeline to carry the gas to market.

Because of extremely high cost and safety problems, LNG is not a reliable long-term substitute for domestic natural gas. It can, however, be an important supply option until additional gas supplies may become available. President Carter's energy policy calls for review of each application for importation of LNG in lieu of a fixed import limit. The assessment is to take into account the political stability of the selling country, the degree of American dependence such a sale would create, the safety conditions associated with any specific installation, and all costs involved (Executive Department, Office of the President 1977).

In 1976, The Tennessee Atlantic Pipeline Company (Tenneco) announced plans to locate a liquefied natural gas regasification plant in St. John, New Brunswick. If approved, the LNG will be regasified and put into a pipeline traversing the State of Maine. It is not anticipated that any additional liquefied natural gas facility plans will be announced before 1985, considering the Tenneco proposal as well as uncertainty regarding future federal importation policy. Between 1985 and 2000, LNG regasification in Maine is a possibility. In spite

of industrial conversion to coal and conservation efforts, rising demand and decreasing domestic gas supplies are expected to create a need for more LNG imports.

Petroleum

In recent years, a major energy policy objective has been the development of a national refining capacity which is sufficient to provide a secure domestic supply of petroleum products. The primary motivation for adding refining capacity is the country's increasing demand for petroleum despite conservation efforts and other measures designed to reduce consumption. In 1985 petroleum products will supply nearly 42% of this country's energy needs. The increased overall demand for energy will result in a 1980 requirement for nearly 2,000,000 additional barrels per day (BPD) of petroleum products. By 1985 this figure will be 4,500,000 BPD.

If these demands are to be met, the United States will need to increase refinery capacity by 4,440,000 BPD before 1985. Because the East Coast, particularly New England, demands large amounts of petroleum products but offers insufficient local refining capacity to meet its requirements, the construction of several new refineries in New England between now and 1985 is a reasonable expectation.

Two types of petroleum-related heavy industries are possible in Maine during the next 25 years: crude oil terminals and oil refineries. Several factors strongly suggest that oil refining may occur in Maine. (1) The Pittston oil refinery application may finally be resolved in Pittston's favor. (2) The federal government has made strong indications that the New England states should supply more of their own refining capacity. (3) Maine has deep water anchorage to make supertanker traffic feasible. (4) The demand

for petroleum products, barring extremely effective conservation measures, will increase in Maine and New England. It is expected that any oil refinery will be served by its own marine terminal. Current economies of scale in transportation of crude oil make a 250,000 barrel per day refining capacity the most likely size for a refinery operating on imported oil. Recent proposals in Maine, Virginia, and Louisiana support this figure.

Nuclear Power Plant

President Carter's National Energy Plan recommends that the United States rely on nuclear power for base load electric generation until such time as there is sufficient capacity for coal-fired generation. The New England Power Pool has chosen nuclear electric generation as the preferred method of base load generation.

Present projections call for the construction of an additional 160 nuclear power plants between now and 1985. All of the planned nuclear plant sites have already been chosen. Between 1985 and 2000, new sites will have to be chosen for at least 100 more light water reactors. Maine's cold water, relatively low population densities, and stable bedrock geology make it a good candidate for the future location of several nuclear power plants. Tentative plans now exist for a nuclear power plant to be built in Richmond, Maine to begin operations in 1992. Options on the land have already been purchased. The plant will supply approximately 1,000 MW power.

Coal-Fired Electric Generation

In 1976 the Central Maine Power Company announced plans to construct a 600 MW coal-fired power plant on Sears Island. A coal receiving and handling facility is also planned. Plans call for this plant to come on line by approximately 1985.

National energy policy presently views coal as the major energy resource upon which the country must depend. With petroleum decreasing in supply and increasing in cost, additional coal-fired electric generation facilities are anticipated in the next 25 years. For this report, only coal-fired power plants with a base load or intermediate capacity of 200 MW or greater are considered heavy industry.

Coal Storage and Handling

The use of coal for both electric generation and other industrial uses is expected to increase. Since barge or ship transport of coal is less expensive per ton/mile than rail transport, there is a possibility that rising coal use will require at least one major marine coal handling terminal and storage facility. Competitively priced rail-borne coal is expected to capture large segments of the energy market in the near future; a major coastal handling facility is not expected to be necessary before 1985.

The largest industries in Maine each consume approximately 1.25 million barrels of oil per year, equivalent to an average 1,000 tons per day of coal. For the purposes of this report, coal storage and handling is considered a heavy industry if the average daily throughput of the facility is 1,000 tons per day of

coal or greater. The size of facility necessary to meet these conditions is one which requires both a location at docking facilities and proximity to rail transportation.

Construction of Outer Continental Shelf Platforms

Exploration for petroleum on Georges Bank creates the possibility that an oil platform construction yard may locate in Maine. The likelihood of a commercially large find of oil or natural gas is unknown. A very large commercial find would have to occur to warrant construction of a platform yeard.

Two types of platform construction are common, steel and concrete. As an alternative to construction of steel drilling platforms, concrete platforms have played a major part in the development of the North Sea oil fields. Since Georges Bank weather conditions are as bad or worse than the North Sea, there is some expectation that a very large discovery of oil will result in the use of concrete drilling platforms. Virtually all of the potential eastern seaboard sites for concrete platform construction are in Maine.

Heavy Industries Not Likely to Locate on the Maine Coast

Pulp and Paper

The St. Regis facility in Bucksport is the only pulp and paper mill located in a coastal town. St. Regis recently completed a plant expansion that will increase capacity by nearly 20%. Between 1978 and 2000 there may be one new integrated pulp and paper mill or one new paper mill alone. There are very compelling reasons for these mills to locate inland: the cost of transporting wood pulp, relatively lower land prices, and easier access to fresh water supplies. Therefore, pulp and paper is not considered in this report to be a potential coastal heavy industry.

Wood-Fired Electric Generation

The Maine Executive Department is attempting to obtain federal funds for construction of a demonstration 50-100 MW wood-fired electric power plant. Although wood-fired electric generation may occur in Maine before the end of the century, there is no particular advantage or need for a coastal location. Such a facility will be most likely to locate next to large sources of wood waste such as a pulp mill or saw mill. The same factors which tend to discourage coastal location of new pulp and paper mills also discourage coastal siting of a wood-fired electric generation facility. Therefore, this report does not give further consideration to coastal location of a wood-fired electric generation facility.

Other Heavy Industries Not Likely to Locate in Maine

It is not very probable that automobile assembly, aluminum smelting, steel making, petrochemical plants, or shipyards will locate in Maine during the time frame considered.

In 1974, rumors and speculation surfaced that a Volkswagen automobile assembly plant might locate in the Portland area. Volkswagen chose to locate in Pennsylvania. Considering the present market for automobiles, the lack of new capital investment in assembly plants now prevalent in the industry, and the uncertainty regarding the long term availability of gasoline, development of an automobile assembly plant in Maine is not likely.

In 1969, construction of an aluminum smelting plant in Trenton was announced. Any further consideration of aluminum smelting for Maine will be determined by the availability of bauxite from exporting nations. Bauxite exporters are both nationalizing smelters and actively talking about forming a cartel; therefore, the chances of primary aluminum smelting in Maine are small. Furthermore, Maine does not have available the large surplus quantities of low priced electricity required by aluminum smelting industries.

There has never been any planning for a steel mill in Maine. Considering the costs of transporting the raw material for making steel, no mill is expected to seek to locate in Maine. Similarly, rolling mills are not expected unless an unanticipated massive find of petroleum on Georges Bank creates a need for large scale steel drilling platform construction in Maine.

Petrochemical plants require the by-products from approximately one million barrels per day of refining capacity in order to be most profitable. If oil refining comes to Maine, this refining capacity is not expected. It is easier to expand existing refining capacity in other parts of the United States than it is

to build a million barrel per day capacity from scratch.

Large shipbuilding yards are not expected for a number of reasons. (1) There is already an excess shipbuilding capacity in the United States and many shipyards are struggling to survive. (2) The U. S. Merchant Marine is, at best, stablized at a low level. (3) Shipbuilding is not expected to grow extraordinarily in the next few decades.

B. SITING FACTORS FOR HEAVY INDUSTRY ON THE MAINE COAST

The siting factors listed in this section* were used in two phases of this study. The most important or primary factors for heavy industries likely to locate on the coast were drawn from the list. The entire list was used as a guide for investigating and soliciting comment on impacts or constraints which disfavor location of heavy industry in the areas which were not eliminated by a consideration of the primary factors. Factors which appear here were selected because they were mandated by federal or state law, presented physical or economic constraints or opportunities, reflected the policies of governmental agencies, or appeared best to represent the views of the general public.

Use of other studies greatly facilitated preparation of the siting factor list. The California Energy Resources Conservation and Development Commission published earlier this year a list of screening factors for power plant siting. Their report, although limited to power plants and unique in many ways to California, provided an initial framework for identifying similar factors specific to the Maine coast. California's screening factors were based on a series of workshops, mail-in responses to draft lists of state screening factors, and assistance from consultants. Workshop participants consisted primarily of representatives from utilities, architectural engineering firms and public agency representatives.

The factors for Maine were drafted mostly from previously published sources because of the limited amount of time. However, several state agencies were consulted before the initial draft was written, including the Bureau of Air

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*See Appendix F for a description and explanation of each factor.

Quality Control, Bureau of Geology, Department of Transportation, Department of Marine Resources, and Department of Inland Fisheries and Wildlife. The major sources of published material outside of the California report were the Maine State Planning Office, Canadian Department of Fisheries and the Environment, and the U. S. Nuclear Regulatory Commission.

The first draft of the list was sent out for review by 20 state agencies, as well as several federal agencies, university personnel, and research groups. (See Appendix H). Reviewers were selected on the basis of expertise with the different factors. Some state agencies had no comment on the criteria. Nearly all comments and suggestions received have been incorporated into the revised criteria, although in some cases conflicting comments made it impossible to represent all viewpoints.

Summary Listing of Siting Factors for Heavy Industry on the Maine Coast

I. Physical/Biological Screening Factors

A. Air Quality

1. Air Quality Control Regions
2. Ambient Air Quality Standards
3. Emission Standards
4. Prevention of Significant Deterioration
5. Non-Attainment Areas

B. Physical Oceanography and Climatology

1. Fog
2. Ice
3. Winds
4. Waves
5. Tides
6. Currents
7. Bathymetry
8. Fjords and Other Stratified Embayments

C. Hydrology/Water Resources

1. Aquifer Recharge Areas
2. Flood-prone Areas
3. Saltwater Intrusion
4. High Quality Groundwater Basins
5. Areas of Available Freshwater
6. Ocean Water Availability
7. Hydroelectric Resource Areas
8. Water Quality Classification

D. Geology/Seismology

1. Areas of Geologic Significance
2. Landslide Areas
3. Areas of High Liquifaction Potential
4. Subsidence Areas
5. Capable Faults
6. Active Quaternary Faults
7. Prequaternany Faults
8. Seismicity Areas
9. Slope
10. Soil Suitability
11. Mineral Resource Areas

E. Biological Resources

1. Coastal Wetlands
2. Estuaries and Estuarine Zones
3. Migratory Fish Nursery and Feeding Areas
4. Concentrated Fisheries
5. Commercial Fishing Areas
6. Historical Herring Weir Sites
7. Irish Moss and Other Seaweed Sites
8. Existing and Potential Aquaculture Sites
9. Valuable Recreational Fisheries
10. Wetlands Important for Fish and Wildlife
11. Tidal Flats
12. Bird Nesting Areas
13. Seal Haulout Areas
14. Coastal Areas used by Cetaceans
15. Deer Wintering Areas

16. Rare and Threatened Fish and Wildlife

17. Rare, Threatened and Endangered Vegetation

18. Areas Designated Critical by the Maine State Planning Office

19. Isolated Areas

20. Wildlife Refuges

21. State Wildlife Management Areas and Sanctuaries

22. Commercial Forest Land

F. Land Area Requirements

II. Social/Cultural Screening Factors

A. Visual/Aesthetic

1. Coastal Scenic Areas

2. Recreational Boating Areas

3. Wild and Scenic Rivers

4. Specially Designated Waterways

5. Prime Recreation Areas

6. Scenic Highways

B. Land Use

1. Conservation Restrictions

2. Prime Farmland

3. Unique Farmland

4. Active Military Bases and Surplus Federal Property

5. Parks (Federal, State, City)

6. State and National Forests

7. Unorganized Territory

8. Local and Regional Government Plans and Policies

9. Urban Areas

C. Cultural Resources

1. Historical, Archeological, and Cultural Areas

2. Indian Lands

D. Public Safety

1. Population Density

2. Marine Traffic

E. Economic Resources

1. Transportation (Highways and Railroads)

2. Airports

3. Navigable Waterways

4. Availability of Infrastructure

5. Existing Energy Facilities

F. Human Resources

1. Construction Phase

2. Operation Phase

C. PRIMARY SITING FACTORS FOR POTENTIAL HEAVY INDUSTRIES

The preceding section presents a comprehensive list of the physical, sociological, and cultural factors which should be considered in any decision to locate heavy industry on the Maine coast. This section presents the specific siting factors which are of particular importance for each of the industries identified in Section A. These factors are primary; they are of such importance that they may be considered basic requirements. As mentioned in Section B, these factors may be mandated by law, economics, current policy, public interest, or the basic physical needs of the facility. The selection of some factors as "primary" in no way implies that the other considerations listed in Section B are not significant. Rather, by highlighting the most critical and unalterable requirements of each facility, this section serves to define the general type of area which is most suitable for each industry.

Most of the information in this section was taken from other reports. Additional information on the siting factors for these facilities and the citations for all sources used in developing this section are given in Appendix G.

The materials for LNG were based heavily on the Resource Planning Associates' Alternative Site Study, Northeast Coast Liquefied Natural Gas Conversion Facility and the Federal Power Commission's Environmental Impact Statement for the TAPCO project.

The information on oil terminals and refineries was drawn primarily from the following reports: two New England River Basins Commission reports, Onshore Facilities Related to Offshore Oil and Gas Development, and

Analysis of Potential Deepwater Oil Terminals in Maine; two Arthur D. Little Inc. reports, Effects on New England of Petroleum-Related Industrial Development, and Potential Onshore Effects of Deepwater Oil Terminal Related Industrial Development; and the U. S. Environmental Protection Agency's Draft Environmental Impact Statement for Pittston.

Information on siting factors for nuclear power plants was taken from the New England Regional Commission's Power Siting Guidelines for New England, the U. S. Nuclear Regulatory Commission's guide, General Site Suitability Criteria for Nuclear Power Stations, and several reports of the U. S. Atomic Energy Commission.

The major sources of information for coal-fired electric generation and coal storage and handling are the New England Regional Commission's Power Facility Siting Guidelines in New England; Power From Coal, a special report by James J. O'Connor, et. al.; and Evaluation of Power Facilities: A Reviewer's Handbook, by Peter M. Meier, et. al.

The information for platform construction facilities was taken from the New England River Basins Commission's factbook Onshore Facilities Related to Offshore Oil and Gas Development.

* Liquefied Natural Gas

Public Safety. The population density for approximately two miles to either side of the LNG tanker route should be low. In addition, population density in proximity to the regasification facility should be low.

There are no federal standards for population density in proximity to a regasification facility. The State of California requires that no residential or other uses occur within a 1 mile radius of the facility unless in conjunction with the regasification facility. In addition, California requires that population density within a 6 mile radius of the facility not exceed an average of 60 people per square mile. Resource Planning Associates, in their report for the Federal Power Commission on potential LNG sites, uses the criterion of low population density within a radius of 4 miles of the facility.

This report uses a minimum standard of less than 60 people per square mile over a 4 mile radius. In three instances a large population exists just beyond the 4 mile radius. The project team felt this posed an unacceptable risk to the public and eliminated the sites on that basis. We recommend that, prior to any LNG site selection, the State of Maine conduct public hearings and establish public safety standards for LNG facilities.

Oceanographic and Navigational Characteristics. LNG tankers are huge: 950 - 1,000 feet long and 135 - 150 feet wide. Safe passage of these vessels requires a channel at least 465 feet wide and 44 feet deep. Greater depths are required in areas of high tidal fluctuation. The channel should be relatively straight and wide to avoid excessive maneuvering. Weather conditions should be such as to have a minimum negative impact upon operations. Areas with winter icing conditions, currents in excess of 5 knots, and excessive periods of fog should be avoided. The harbor must be sheltered from winter storms. LNG

tankers require an unobstructed turning basin of 2,000 foot diameter.

Land Suitability. A combined LNG terminal and regasification plant requires between 300 and 1,000 acres of land. Slope of the site should not exceed 8%. The facility should be built on soils of good load-bearing characteristics and in an area of relatively stable bedrock geology with low seismicity. The terminal facility requires at least 600 feet of shore frontage. Although the terminal and regasification facility need not be adjacent to each other, they must be less than 2.5 miles apart. LNG facilities must not be incompatible with existing land use.

* Oil Terminal

Oceanographic and Navigational Characteristics. Because large tankers are difficult to maneuver, mean low water depths in the approach channel should be at least 75 feet. Turning and maneuvering areas require depths of 70 feet, and berth areas require depths of 68 feet. Channel use, other than for oil transport, should not be heavy, with good navigation aids in place or available. Ideally, channel configuration should be as straight as possible. The channel should be at least 560 feet wide, and the turning basin should be 2500 feet in diameter. A current greater than 2.5 knots in the channel is the initial danger point. A current greater than 5 knots is dangerous. Tidal fluctuations and channel configuration have a significant effect on current patterns and intensities.

Land Suitability. A marine terminal with the average industry storage capacity requires about 150 acres of land. The tanks require fairly flat land with good load-bearing characteristics. The land can not be in a flood plain. At least 600 feet of ocean frontage are necessary. Oil terminals must not be incompatible with existing land use. The project team makes the assumption that oil terminals are incompatible with heavy recreational use of an area.

* Oil Refinery

Land Suitability. At least 250 acres of land with a slope of 8% or less are required. The facility must be built on soils with good load-bearing characteristics and in an area of relatively stable bedrock geology.

Transportation. The oil refinery requires access to a source of crude oil from a marine terminal. Access is invariably through a pipeline from the terminal storage tanks. The facility also requires access to road and rail transportation.

* Nuclear Power Plant

Public Safety. The Nuclear Regulatory Commission requires a 2,000 foot radius exclusion area around the facility. The exclusion area is the zone within which there may be no unauthorized personnel or property.

Population in proximity to the facility should be low. The low population zone is the area immediately surrounding the exclusion area in which the total number of residents must be small enough to insure with a reasonable probability that appropriate protective measures can be taken in the event of a nuclear accident. There are variable recommendations for the low population zone and no specific standard has been set by the Nuclear Regulatory Commission. An NRC guideline is that the population density around the facility should not exceed 500 people per square mile averaged over the area falling within a 30 mile radius of the plant.

Land Suitability. The structure requires a site of at least 25 acres. Existing nuclear power plant sites range between 200 and 800 acres to allow for exclusion areas. The Nuclear Regulatory Commission requires that the site have a very stable, earthquake-free, bedrock surface within which there has been no observed movement along any faults during the last 35,000 years. Sites within about 5 miles of a capable fault longer than 1,000 feet are generally unsuitable for a nuclear power plant.

Hydrology/Water Resources. Between 300,000 and 450,000 gallons per minute of cold water are required for cooling. About 1,000 gallons per minute of fresh water are required for other uses. The water body receiving the used cooling water must be able to accept the warmer water without rising significantly in temperature.

* Coal-Fired Electric Generation

Land Suitability. This facility requires approximately 400 acres of land, most of which is used for storage of coal and disposal of solid waste. The storage pile must be located on level ground which has had all vegetation removed. The soil must be well drained and have good load-bearing characteristics. Bedrock should be stable and have low seismiscity.

Hydrology/Water Resources. A coal-fired power plant requires approximately 300,000 gallons per minute of cooling water. The cooling water need not be fresh water. Less than 2,000 gallons per minute of fresh water is required for other uses.

Transportation. Economic land transportation of coal to a generation plant requires access to railways for movement of coal trains and removal of waste.

Economic waterborne transportation of coal to a plant requires direct access to the handling facilities. The access channel should have a depth of about 30 feet.

* Coal Storage and Handling

Transportation. Coal is transported by ship, barge, trains, and truck. A coastal location for coal handling facilities requires water access for barges and ships to unload coal and rail and road access to load the coal for market. This combination of existing or potential access to both water and land based transport is the most important element in determining the location of a coal storage and handling facility.

Land Suitability. Coal storage and handling facilities can vary considerably in size depending upon the volume of coal being handled, the amount of coal stored as inventory, and the amount of land available. The storage site must have little or no slope. The soil should have good load-bearing characteristics.

Sufficient area for the construction of a docking facility and rail head is also necessary. However, any type of dry bulk cargo docking facilities can be used for coal so that acreage demands for separate coal docks are minimal where dock facilities already exist.

* Construction of Steel OCS Platforms

Oceanographic and Navigational Characteristics. The channel mu least 300 feet wide and have vertical clearance of at least 300 The channel to open water must be short, straight, and relatively traffic. Water depths of at least 3 feet close to shore are nec

Hydrology/Water Resources. If prefab parts are brought to the s for assembly, about 100,000 gallons per day of water are necessary. there is steel rolling activity, substantially larger amounts of wat are required.

Land Suitability. Platform construction yards vary considerably in si from a low of 50 acres to a high of acres. The norm is about 400 acres. It is essential that the land have a slope not greater than 3% near the shoreline. The facility requires 300 feet of clear shoreline for each platform under construction. The shore must have good load-bearing characteristics and stable geologic conditions.

* Construction of Concrete OCS Platforms

Oceanographic and Navigational Characteristics. Concrete platform construction requires clear access to sheltered water 150 feet deep for completion of the superstructure of the largest platforms, 80 feet deep for average size platforms. Water depths close to shore should be 30 to 80 feet. Currents cannot exceed 1.5 to 2.0 knots.

Hydrology/Water Resources. Fresh water is needed for concrete mixing. Twenty-five to forty thousand gallons per day are required for each platform under construction. The water can come from a drilled well, utility connection, or barge.

Land Suitability. Concrete platform construction requires about 50 acres of land for each platform under construction, or between 50 to 150 acres per site. Because the land is used mostly for storage of materials, the land requirements are not as stringent for concrete platform yards as for steel platform yards. The soil must have good load-bearing characteristics. Bedrock geology must be stable, but bedrock geology is probably not a limiting factor in Maine.

D. IDENTIFICATION OF MOST CONSTRAINING INDUSTRIES

The previous sections of this part of the report have 1) determined the heavy industries most likely to seek to locate on the Maine coast in the next 25 years (Section A), 2) presented a comprehensive list of siting factors to be considered before locating any heavy industry in coastal Maine (Section B), and 3) described the primary siting factors for each of the potential industries (Section C).

This section of the analysis identifies the industries which have the most restrictive primary siting requirements and are therefore the most constrained in terms of where they can physically locate. Restrictive siting requirements are those which are 1) inflexible based on current technology (such as the 2.5 mile maximum length of a cryogenic pipeline), 2) inflexible because of extremely high costs for altering existing conditions (such as major alterations to a navigation channel), or 3) inflexible because of severe danger or disruption to the physical or human environment (such as relocating hundreds of families to meet public safety standards).

In the judgement of the project team, two of the potential heavy industries have primary siting requirements which are distinctly more restrictive: LNG facilities and oil terminals. LNG facilities require a combination of low population density, good navigational characteristics, 300-1,000 acres of suitable land with 600 feet of ocean frontage, and a distance of no more than 2.5 miles from the terminal to the regasification facility. Oil terminals require good oceanographic and navigational characteristics, including a 75 foot deep channel, which combine to minimize both the risk of tanker passage and of potential damage from chronic spills or major accident; at least 150 acres of suitable land with 600 feet of shore frontage; and compatibility with existing land uses.

Although the other industries discussed in Section A also have major siting requirements which must be met, none have the combination of needs or dictates as constraining as oil terminals or LNG. The project team initially believed that nuclear power plants would be among the most constraining industries. The major requirements of nuclear power plants are low population, good flushing rates, and a stable, earthquake-free, bedrock surface with no observed movement along any faults during the past 35,000 years. However, preliminary information indicated that, although these requirements are currently inflexible, nuclear power plants have more potentially suitable coastal sites than either oil terminals or LNG facilities, and are not severely constrained in where they may locate on the Maine coast. Therefore, LNG facilities and oil terminals are identified as the two most constraining industries considered in this analysis. The next section presents the results of a screening of the coast for areas which can meet the primary siting requirements of LNG facilities and oil terminals.

E. DETERMINATION OF COASTAL AREAS WHICH SATISFY PRIMARY SITING FACTORS FOR MOST CONSTRAINING INDUSTRIES

The preceding section identified LNG facilities and oil terminals as the two potential coastal industries which have the most stringent primary siting requirements. The next step is initial examination of the Maine coast to see what areas, if any, satisfy these requirements. This is a screening process conducted to (1) eliminate the broad sections of the coast which can not offer the required critical factors and (2) focus subsequent analysis on those areas which do meet the basic requirements and which may therefore contain suitable sites for LNG facilities or oil terminals. For LNG facilities, the materials and conclusions in this section were derived almost completely from the data and judgements of the Resource Planning Associates report, Alternative Site Study, Northeast Coast Liquefied Natural Gas Conversion Facility. For oil terminals, the materials were taken primarily from the New England River Basins Commission's report, Analysis of Potential Deepwater Oil Terminals in Maine. The recommendations in this section coincide with the recommendations in that report, given the state policy that oil terminals should be sited where environmental risks are minimized, while economic benefits are maximized.

The next section of this report further examines the selected areas in terms of the other siting considerations listed in Section B, Siting Factors for Heavy Industry on the Maine Coast.

For this report, the "coast" means all the municipalities south of Calais through which U. S. Route 1 passes or which lie totally to the southeast of U. S. Route 1. For this section, the coast is divided into 13 geographic sections: Calais to Quoddy Narrows, Quoddy Narrows to Cape Wash, Machias Bay, Machiasport to Schoodic, Frenchman's Bay, Blue Hill Bay, East Penobscot Bay, Upper Penobscot

Bay, West Penobscot Bay, Muscongus Bay, Pemaquid to Harpswell, Casco Bay, and Southern Coast.

LNG Area Screening

The most critical factors in siting an LNG facility are adequate public safety, oceanographic and navigational characteristics, and land suitability. The measure of public safety is the proximity of people to the terminal, regasification facility, and tanker route. Oceanographic and navigational characteristics include channel characteristics, navigation hazards, currents, tides, weather conditions, and exposure to storms. Land suitability refers to the compatibility of existing uses with an LNG facility and the general availability of a site suitable for a regasification facility in proximity to a terminal. For a more complete discussion of these major requirements and of other siting considerations, see Section C, Primary Siting Factors for Potential Heavy Industries and Appendix G, respectively.

* Calais to Quoddy Narrows

Public Safety. Although populations in this area are low, the majority of the people live near both the route LNG tankers would take and potential sites for the terminal and regasification facilities.

Oceanographic and Navigational Characteristics. Navigation is a problem because, although the channel is adequate to meet minimum standards, the tides, currents, and fog combine to create hazardous conditions. There is no storm protection except at Eastport and Robbinston. The approach to Eastport requires a 280° turn at Head Harbor Passage, and tug assistance. Ice is a problem above Robbinston. There are strong currents and 18 foot tides throughout the area. Fog occurs an average of 4 days a month except for June, July, and August, which average 8, 12, and 10, respectively.

Land Suitability. Land use is not a significant problem expect that a conditional

permit has been granted for an oil refinery at Eastport, a land use incompatible with LNG facilities. Campobello International Park is located near Quoddy Narrows and has an air quality classification of Class I.

Conclusion. No LNG sites are recommended in this area because of navigation difficulties, and potential site incompatibility.

* Quoddy Narrows to Cape Wash

Public Safety. Population in this area is low and widely dispersed.

Oceanographic and Navigational Characteristics. Navigation conditions for an LNG tanker are good because there is direct access from open ocean. There is no information available on currents. Fog averages 560 to 750 hours between June and August. Tides are about 13 feet. Water depth is 50 to 200 feet. However, the area is exposed to southeasterly and northeasterly storms and there is no protected harbor large enough to accommodate an LNG tanker.

Land Suitability. Suitable sites may exist. There is a land use conflict with Quoddy Head State Park and a possible conflict with the Naval station at Cutler.

Conclusion. No sites are recommended in this area because of lack of a protected harbor.

* Machias Bay

Public Safety. Public safety is generally adequate because of the area's low population and low vessel traffic.

Oceanographic and Navigational Characteristics. Navigation is not a problem.

The bay is 1 to 3 miles wide and the entrance is straight and unobstructed. The bay is open to the south but protected. Currents are about 1 knot at the east end of Moosabec Reach and average less than 2.5 knots in the bay. Fog averages 560 to 630 hours from June to August. Tides are about 12 feet. The bay ranges in depth from 50 to 150 feet, while depths close to shore are between 45 to 90 feet.

Land Suitability. There is a small community at Starboard. A VLF radio station at Cutler may present a land use conflict.

Conclusion. Within the Machias Bay area, Machiasport and Cutler have locations which meet the primary site requirements for LNG.

* Machiasport to Schoodic

Public Safety. Population levels and densities are low. Vessel traffic is generally confined to small craft.

Oceanographic and Navigational Characteristics. The area is generally exposed to the southeast. Currents are about 1 knot at the west end of Moosabec Reach. Fog occurs 505 to 630 hours between June to August. Tides are 11 to 12 feet. Water depths close to shore range from 30 to 70 feet. However, navigational problems are serious. The area is heavily broken up by islands, shoals, and shallows. In addition, there is no adequately protected harbor.

Land Suitability. Land use is generally residential and second home recreational. There is a state park at Roque Bluffs. Schoodic Peninsula is a part of Acadia National Park.

Conclusion. No sites are recommended in this area because of navigation conditions.

* Frenchman's Bay

Public Safety. Public safety is the major issue in use of Frenchman's Bay for LNG vessel traffic. Present marine traffic is mostly limited to recreation vessels, with an occasional Naval vessel visiting the area. Transient population in proximity to the vessel route approaches three million people per year.

Oceanographic and Navigational Characteristics. Navigational conditions in this area are good. There is excellent protection, a harbor sheltered from northeast and southeast storms, currents varying from .2 to .7 knots, deep water close to shore, and an excellent turning basin. Tides are about 10 feet. Fog occurs approximately 290 to 340 hours from June to August. However, two turns, of 45 and 75 degrees, are required during the approach to Frenchman's Bay.

Land Suitability. Land use is characterized by high intensity development in limited areas, recreation and second home development in other areas, and a popular national park which includes some of the offshore islands. There is a state park at Lamoine. An LNG terminal would be incompatible with these uses.

Conclusion. Although Frenchman's Bay has good navigational characteristics, the numbers of people in proximity to the tanker route or terminal constitute an excessive public risk. No sites are recommended in this area.

* Blue Hill Bay

Public Safety. Public safety issues are again of great importance for locations in Blue Hill Bay. There is a high summer population on the west side of Mount Desert Island and Blue Hill. There is heavy recreational use of the bay.

Oceanographic and Navigational Characteristics. The bay has a sheltered harbor. Current at the entrance to the bay is 2.5 knots. Fog occurs 310 to 340 hours

during June, July, and August. Tides are about 10 feet. Water depths close to shore are 50 to 100 feet. The channels in Blue Hill Bay are somewhat restrictive for LNG tanker traffic. One 45° turn is required during the approach to the bay. Some shoal areas at the mouth of the bay would have to be removed. The entire bay is interspersed with islands.

Land Suitability. Land use is heavily oriented to recreation. Most of the islands in the bay have been nominated for inclusion in national park protection and conservation districts and some easements already exist.

Conclusion. No sites are recommended in this area because of public safety concerns and marginal navigational conditions.

* East Penobscot Bay

Public Safety. Although there is a large recreation population, the permanent population of the area is low. Recreation vessel use is heavy and there is some commercial vessel traffic.

Oceanographic and Navigational Characteristics. There is a deep channel, but its northern part is extremely broken up by islands. The area is exposed for a long reach to the southwest. Currents at Isle au Haut average 1.5 knots. Fog occurs 325 hours from June to August. Tides are 9 to 10 feet. Water depths close to shore range from 15 to 100 feet. Eggemoggin Reach contains many offshore ledges and reefs.

Land Suitability. The area is used mainly for recreation and commercial fishing. There is national park land on Isle au Haut. Many of the islands, including Vinalhaven and North Haven, have been nominated for inclusion in national park protection and conservation zones.

Conclusion. The combination of a safe, suitable land area and protected deep water for a terminal facility apparently do not exist in this area without substantial investment. No sites in this area are recommended.

* Upper Penobscot Bay

Public Safety. Although permanent population centers exist at Belfast, Searsport, and Castine, recreational use of the area is concentrated at Belfast and Castine. There is a large transient summer population on the west side of the bay. There is recreational and commercial vessel traffic bound for Belfast, Searsport, and up the Penobscot River. As there is considerable recreational vessel traffic near Castine and the south side of Cape Rosier, LNG vessel traffic may cause some disruption.

Oceanographic and Navigational Characteristics. The channel into upper Penobscot Bay is long but straight. The channel is deep and wide without major obstructions. Currents are generally not strong, although information in this area is lacking. Tides average 9.5 feet. Fog averages about 238 hours from June to August. Water depths close to shore range from 50 to 70 feet. Ice may be a problem at Searsport Harbor during very severe winters.

Land Suitability. Land use in the area is heavily tourist oriented with second home development concentrated on the west of the bay. Substantial areas of open land exist with some land already designated for industrial development.

Conclusion. Within this area, Searsport, Stockton Springs, Penobscot, Castine, and Brooksville have locations which meet the primary site requirements for LNG.

* West Penobscot Bay

Public Safety. There are serious public safety problems in the West Penobscot Bay area. Although permanent population levels are high only in the Rockland to Camden area, the recreation and second home use of the entire area is heavy. Transient use of the state park at Camden is heavy during the summer months. There is heavy recreation vessel traffic in the Camden - Rockland - Owl's Head area.

Oceanographic and Navigational Characteristics. Navigation is not a problem in any part of the west side of Penobscot Bay. The channel is deep and wide without major obstruction. There is no storm protection from the northeast or southeast. Currents are .2 to .6 knots of Monroe Island. Fog averages 310 to 405 hours from June to August. Tides are about 9 feet. Water depth close to shore is about 75 feet.

Land Suitability. Land use varies from urban and second home development along the shore to undeveloped areas inland. The general area is highly developed. There are state parks at Camden and Warren Island.

Conclusion. Although the minimum physical requirements could be met at some locations in the area, the proximity of these locations to a large transient and year round population presents an excessive threat to public safety. No sites in this area are recommended.

* Muscongus Bay

Public Safety. Permanent population centers are located at Bristol, South Bristol and Pemaquid, and second home development exists throughout the area. There is heavy recreation use of the west side of the Pemaquid peninsula at Pemaquid Beach State Park. Using the standards applied by Resource Planning

Associates in the Alternative Site Study, the low population zone around potential sites would extend almost to Pemaquid Beach State Park. The road access for this high use area passes close to the potential terminal site. Because there is a high transient population just beyond the 4 mile radius, public safety hazards are considered unacceptable.

Oceanographic and Navigational Characteristics. There is direct access from open ocean, but no protection from the south. Currents are weak, variable, and unpredictable. Fog averages 210 to 250 hours between June and September. Tides are 8 to 9 feet. Water depths close to shore are about 60 feet. Navigational characteristics are good on the west of the bay, but not acceptable elsewhere.

Land Suitability. Land use is heavily oriented to second home and residential development with some state park land and a few small urban areas.

Conclusion. No sites in this area are recommended because of public safety concerns.

* Pemaquid to Harpswell

Public Safety. There are heavy transient populations throughout the area. Both Reid and Popham Beach State Parks have substantial recreation use - up to 56,000 visitors per month. Private recreation use of Boothbay Harbor is heavy.

Oceanographic and Navigational Characteristics. Protection is good at some locations, but open to the south. There is direct access to open ocean. Currents vary, but are strongest at the mouths of tidal rivers. Fog averages 250 to 369 hours from June to August. Tides range from 7 to 9 feet. Water depths close to shore range from 40 to 80 feet. Approach areas contain offshore ledges and reefs, and some channels are quite narrow.

Land Suitability. Large numbers of permanent residences exist in the area. Urban areas exist at Boothbay and Bath. Predominant land use is recreation and residential.

Conclusion. It is physically possible to locate an onshore LNG terminal in this area and, in fact, navigational conditions are quite good. However, public safety concerns are paramount. If the Resource Planning Associates low population standard is strictly applied, some sites may be acceptable. However, because large transient or permanent populations exist just beyond the 4 mile limit, the threat to public safety is unacceptable. No sites in this area are recommended.

* Casco Bay

Public Safety. Public safety is a major concern and the limiting factor in location of an LNG terminal in the Portland Harbor area. This section of coast contains the state's highest density population and experiences the heaviest levels of vessel traffic along the coast.

Oceanographic and Navigational Characteristics. Navigation is not a severe problem for the area. Lukse Sound and Hussey Sound have fair to good protection. The channel to the outer islands is good. Currents average 1.0 to 1.2 knots. Fog occurs an average of 225 to 280 hours from June to August. Tides are about 9 feet. Water depths close to shore range from 40 to 80 feet.

Land Suitability. Land use along Casco Bay is heavily residential. Some parts of this coastal area are densely populated. This area contains the state's largest urban area, Portland. Offshore islands, with the exception of Peaks Island, have low population levels.

Conclusion. Some potential on-shore sites appear capable of meeting the Resource Planning Associates 4 mile standard for a low population zone. However, application

of California's 6 mile standard would probably exclude these potential sites and all but the outermost islands of Casco Bay. There are acceptable navigation conditions for location of an LNG terminal on some of the outer islands. However, the LNG tankers would utilize a portion of the same approach channel already used by oil tankers and other commercial vessels heading for South Portland. This poses an unacceptable public risk. Therefore, no sites are recommended in this area.

* Southern Coast

Public Safety. Public safety concerns are critical in the southern coast areas. There are large transient recreation populations throughout the area and the coast from Portland to Kittery has a substantial year round population. Recreation vessel use is usually high and some commercial fishing exists.

Oceanographic and Navigational Characteristics. Currents are between .3 and .4 knots and tides average about 9 feet. Fog occurs for an average of 214 to 265 hours between June and August. Depth of water close to shore ranges from 15 to 70 feet. Navigation is generally not unacceptable in this area, although several shoals exist throughout the area. The greatest problem is that there is no harbor large enough to accommodate an LNG tanker.

Land Suitability. Land use is devoted to high density recreation development and residential and second home development.

Conclusion. No sites are recommended in this area because of public safety concerns, navigation problems, and lack of a suitable harbor.

Oil Terminal Area Screening

The most critical factors in siting an oil terminal are acceptable oceanographic and navigational characteristics and land suitability. Oceanographic and navigational characteristics include channel characteristics, navigation hazards, currents, tides, weather conditions, and exposure to open ocean. Land suitability refers to the compatibility of an oil terminal with existing uses and the general availability of a site suitable for such a facility. For a more complete discussion of these major requirements and of other siting considerations, see Section C, Primary Siting Factors for Potential Heavy Industries and Appendix G, respectively.

* Calais to Quoddy Narrows

Oceanographic and Navigational Characteristics. Navigation conditions in Head Harbor Passage are not difficult. The approach through the passage is 6 miles long, but straight, protected, and relatively wide. The channel is 75 to 150 feet deep or more, and 2,000 feet wide or wider. However, when these conditions are combined with oceanographic conditions, navigation becomes hazardous. Tides are about 18 feet and currents in Friar Roads are about 3 knots. The combination of tide, navigation, and current in Head Harbor Passage makes oil spill control and cleanup difficult.

The Pittston Company of New York has presented plans to construct an oil refinery and marine terminal in Eastport. The project faces two difficult hurdles. First, although the Maine Board of Environmental Protection has given conditional approval to the project, some severe restrictions have been placed on the approval. In consideration of navigational difficulties and other problems, these restrictions include 9 general conditions, 12

pre-operational conditions specific to the site, 15 pre-operational conditions specific to oil transport and the marine environment, 17 navigation and vessel design conditions, and 10 continuous conditions. Examples of these conditions are:

1. A real time simulation of tanker passage in Head Harbor must be made.
2. All vessels must have segregated ballast.
3. All vessels must have double bottoms.
4. Tanker size is limited to 150,000 DWT.
5. An oil clean-up test must demonstrate the capability of cleaning up oil under the most critical conditions.
6. Vessels must pass through Head Harbor Passage only in daytime. They must only enter on the ebb and leave on the flood tide and berth only at slack tide, with but one vessel in the channel at any time and no oil vessel anchored in Friar Roads.

The conditions requiring segregated ballast and double bottoms are not now capable of being met from the existing world tanker fleet. Several informed sources in Maine do not know of any vessels with both segregated ballast and double bottoms. Legislation is pending in Congress, as a result of recent tankers accidents, to require both double bottoms and segregated ballast.

In the words of the New England River Basins Commission's report, Analysis of Potential Deepwater Oil Terminals in Maine, "It remains to be seen as to whether the project will be built because of the difficulty in complying with some of the conditions."

The second major obstacle to the Pittston project is the continuing firm opposition of Canada to the use of Head Harbor Passage for oil transport. As a result of three Canadian studies, the Canadian government has recently reaffirmed its position with regard to the Pittston project. The first study, An Environmental Risk Index for the Siting of Deep Water Oil Ports, was prepared by the Department of Fisheries and the Environment and released in December 1976. The report analyzes the navigational risk and environmental vulnerability of 22 Canadian oil port sites and approaches. The "Passamaquoddy area in which the Passage is sited emerged as by far the least acceptable area for tanker operations, both 'because the value of fisheries and aquatic bird resources in the region is so high' and due to 'the high level of navigational risk associated with the passage'."

The second study, entitled Eastport Ship Terminal System: Accessibility and Ship Safety, Preliminary Analysis and Assessment, was prepared by the Department of Transportation and released in November 1976. This study concludes that "The degree of navigational risk associated with the continuous year-round supply of crude oil and product distribution from the refinery poses a serious threat to the ecology of the region...While highly sophisticated aids to navigation can certainly increase the navigator's awareness of track and heading deviations, it should be emphasized that even with massive dredging the approaches to Eastport would remain 'winding', the currents 'extremely difficult to judge' and weather conditions cannot as yet be controlled. In consequence, the risk of pollution remains high and is environmentally unacceptable."

The third study, Physical, Biological, Socioeconomic and Other Factors Relevant to an Oil Spill in the Passamaquoddy Region of the Bay of Fundy was re-released by the Fisheries Research Board.

There are no indications that the Canadian government will modify its well established position in opposition to the use of Head Harbor Passage by oil tankers. Following the methodological intent of this study to recommend only affirmatively suitable sites for coastal heavy industry, the project team feels that the difficulties inherent in this site are unacceptable.

Land Suitability. Land characteristics of the area are particularly suitable, with large areas of undeveloped land. The area is generally low density residential with some recreation use. Campobello International Park is located near Quoddy Narrows.

Conclusion. No sites are recommended in this area because of marginal navigational and oceanographic conditions.

* Quoddy Narrows to Cape Wash

Oceanographic and Navigational Characteristics. Approaches are good, with direct access from open ocean. However, there is no protected harbor large enough to accommodate oil tanker traffic and a marine terminal. Protection is poor with exposure to the northeast, southeast, south, and southwest. Channel depth is good, with depths of 75 feet close to shore. Tides range about 13 feet. No information is available on currents in this area.

Land Suitability. Land use in this area is very low density residential. Most land is undeveloped. There is a state park at Quoddy Head.

Conclusion. No sites in this area are recommended because of lack of a protected harbor.

* Machias Bay

Oceanographic and Navigational Characteristics. The approach has straight access from open ocean through a 2 mile wide passage. The channel leads to a fairly protected harbor with water depths of 60 to 90 feet close to shore. The turning basin is approximately one mile across. Use by other vessels is low. Tides are about 12 feet. Information on currents is lacking although currents at the east end of Moosabec Reach are recorded at 1 knot.

Land Suitability. Land use in this area is low density residential with some second home development. Large areas are undeveloped. The Cutler Navy station occupies most of the peninsula on the east side of the bay.

Conclusion. Within the Machias Bay area, Machiasport may have locations which meet the primary requirements for oil terminals. A definitive determination is contingent upon information about currents. Such information does not exist at this time.

* Machiasport to Schoodic

Oceanographic and Navigational Characteristics. Navigation along this part of the coast is very hazardous for any vessel the size of a VLCC oil tanker. Prospect Harbor is the only harbor deep enough for a tanker, but its channel and turning basin are too restricted. Protection is poor. Tides range 11 to 12 feet. Information on currents is lacking but currents of 1.0 to 1.2 knots are recorded at the west end of Moosabec Reach.

Land Suitability. Land use is low density residential development with small communities at South Addison, Jonesport, and Beals. Large amounts of open land exist.

Conclusion. No sites are recommended in this area because of hazardous navigational conditions and lack of a protected harbor.

* Frenchman's Bay

Oceanographic and Navigational Characteristics. The approach channel is deep, straight, short, and over 2,000 feet wide. The turning basin is 1 mile in diameter. Protection is generally good to excellent. Depths close to shore are 75 to 125 feet. Hazards from other vessels are limited to recreation vessels, ferry service to Nova Scotia, and occasional Naval vessels. Tides range 10 to 10.5 feet. Currents are reported at 0.7 knots.

Land Suitability. Land use in this area is predominantly residential, second home, and recreational. Concentrations of settlement exist at Bar Harbor, Winter Harbor, and Hancock Point. Most of the islands in the bay have been nominated for inclusion in national park conservation and preservation zones. There is heavy recreational use of Acadia National Park and Lamoine State Park.

Conclusion. Although Frenchman's Bay has good navigational characteristics, an oil terminal and oil tanker traffic are incompatible with the existing uses. Therefore, no sites in this area are recommended.

* Blue Hill Bay

Oceanographic and Navigational Characteristics. The channel is long and narrow for oil tankers. Although water depth is adequate, some dredging would probably be required to reduce risks. There is at least one turning basin of 2,500 foot radius. The tide averages 10 feet and currents are about .7 knots.

Land Suitability. Land use is heavily oriented to recreation and second home use. There are concentrations of settlement at Blue Hill, Trenton, and Tremont. Most of the islands in the bay have been nominated for inclusion in national park protection and conservation zones and there is heavy recreational use of the bay.

Conclusion. No sites are recommended in this area because of incompatibility with existing uses.

* East Penobscot Bay

Oceanographic and Navigational Characteristics. The channel is long, deep, and up to 4,000 feet wide. A turning basin up to 1/2 mile across is possible. Protection is poor with exposure to the south and southwest. The northern part of the channel is interspersed with islands and shoals. Tides range from 9 to 10 feet. Currents vary but have been recorded at 1.5 knots at Isle au Haut. Water depths close to shore range from 15 to 100 feet.

Land Suitability. Land use in this area is oriented towards small communities, residential uses, and second home development. All of the islands, including most of North Haven and Vinalhaven, have been nominated for inclusion in national park protection and conservation zones. There is national park land on Isle au Haut.

Conclusion. This area does not have an unobstructed approach to any protected, deep water terminal site which is compatible with existing uses. Therefore, no sites are recommended in this area.

* Upper Penobscot Bay

Oceanographic and Navigational Characteristics. The channel into upper Penobscot Bay is long but straight and up to 3,000 feet wide. The upper part of the bay is 27 miles from open ocean. The tide ranges about 9.5 feet. Although information on currents is lacking, it is suspected that the strongest currents are found at the mouth of the Penobscot River. The major limitation of this area is that the channel lacks sufficient depth for oil tankers. Although the southern part of the channel is deep enough, the 75 foot depth contour does not extend into the end of the bay.

Land Suitability. On the west side of the bay, land use is heavily oriented to transient recreation. There are concentrations of settlement at Belfast and Searsport. On the east side of the bay, permanent and transient populations are lower. There are state parks or recreational areas at Moose Point, Fort Point, and Cape Rosier.

Conclusion. No sites are recommended in this area because of inadequate navigational conditions.

* West Penobscot Bay

Oceanographic and Navigational Characteristics. The approach to west Penobscot Bay is 24 miles long, but there is straight access from open ocean. The channel is wide up to Islesboro with depths varying to over 100 feet. There are some shoal areas. Use of the channel by other vessels includes recreation and commercial traffic, especially near Rockland and Camden. Tides range about 9 feet and currents are generally weak. Protection is poor to fair throughout the area.

Land Suitability. Land use is heavily oriented to recreation and second homes. There are large transient populations in the area during summer. There are several urban areas in the region. There are state parks at Camden Hills and Warren Island.

Conclusion. No sites are recommended in this area because of incompatibility with existing uses.

* Muscongus Bay

Oceanographic and Navigational Characteristics. The approach channel is 6 to 8 miles long and sufficiently wide up to Bristol. Channel depth is 90 to 100 feet. Protection is fair to good with exposure to the east and south. Much of the bay is dotted with islands and hazardous shoals, some of which would have to be removed for the passage of a VLCC. The tide fluctuates about 9 feet. Currents are apparently weak but information is lacking.

Land Suitability. Land use is primarily residential and second home development with some state park land and a few small urban areas. There is heavy recreational use of this area, particularly on the west side of the bay at Pemaquid peninsula.

Conclusion. No sites are recommended in this area because of the combination of fair protection, hazardous shoals, and incompatibility with existing uses.

* Pemaquid to Harpswell

Oceanographic and Navigational Characteristics. Navigation on this part of the coast is generally difficult. However, in two areas there is direct access through a fairly open channel about 6 miles long. These channels are wide, have little interference from shoals, and have adequate

turning basins. Protection is fair to good with exposure to the south and southeast. Tides range from 7 to 9 feet. Information on currents is lacking but current at Covis Point on the Damariscotta River has been recorded at .6 to 1.0 knots.

Land Suitability. This section of the coast contains many permanent residences and second homes. There are communities at Bath and Boothbay. In addition to a large year round population, there is a substantial seasonal population throughout the area. The state parks at Reid and Popham are heavily used. As many as 56,000 people visit these parks during a summer month.

Conclusion. No sites are recommended in this area because of incompatibility with existing uses.

* Casco Bay

Oceanographic and Navigational Characteristics. The approach is 9 miles long and generally fair. Channel depths average 85 feet, although some dredging may be necessary close to shore. Protection is fair to good with exposure to the south and southeast. Currents are recorded at 1.1 to 1.2 knots southwest of Overset Island, 0.9 to 1.2 knots southeast of Pumpkin Island, and 0.8 to 0.9 knots east of Crow Island. Tides are about 9 feet. Traffic from other vessels is heavier than in other parts of the coast, but still not excessive.

Land Suitability. Land use along Casco Bay is heavily residential. This area contains the state's largest urban center. An industrially zoned oil tank farm currently exists in the area.

Conclusion. Within this area, Portland Harbor contains locations which meet the primary requirements for oil terminals.

* Southern Coast

Oceanographic and Navigational Characteristics. This area of the coast has no protected harbor even remotely capable of accommodating a VLCC oil tanker. The approach is direct from open ocean and there is no protection. The water shoals gradually toward shore but water depths are generally adequate. Tides average less than 9 feet. Currents range from .3 to .4 knots throughout the area.

Land Suitability. Land use is heavily oriented to transient recreation use, second homes, and year round residences.

Conclusion. No sites are recommended in this area because of lack of a suitable harbor and incompatibility with existing uses.

Summary

Municipalities which satisfy the primary siting factors for LNG are Cutler, Machiasport, Penobscot, Stockton Springs, and Searsport. Municipalities which satisfy the primary siting factors for oil terminals are Machiasport and Portland-South Portland.

F. DETAILED SITING INFORMATION REGARDING COASTAL AREAS WHICH SATISFY PRIMARY SITING FACTORS

The preceding section identified nine municipalities which satisfy the primary siting factors for the two industries which are more demanding in terms of site requirements than other heavy industries which may locate on the Maine coast. The municipalities group into three general areas: Machias Bay, Upper Penobscot Bay, and Portland Harbor. This section examines other non-primary siting factors as they relate to the location of heavy industry within the three areas. How the siting factors used in this report were derived and what they comprehend are explained in Section B, Siting Factors for Heavy Industry on the Maine Coast and Appendix F, respectively.

The project team relied mainly on governmental and outside agencies to describe and to assess the importance of the non-primary siting factors for sites within the designated areas. The responses from these agencies are presented in Appendix H.

Two siting considerations, local zoning requirements and socioeconomic impacts, were not clearly within the jurisdiction of any responding agency. The project team undertook data gathering and analysis for these two factors. The results of the examination of local zoning are presented in Part IV in the section titled Should a State Policy to Cluster Heavy Industry Overrule Local Zoning Ordinances? The results of the examination of socioeconomic factors are also contained in Part IV in the section titled Fiscal Considerations. We had planned to use a computer simulation model, recently purchased by the state, to analyze local economic impacts in a hypothetical case of heavy industry location in one or more of the designated areas. The model turned out to be unusable at the time it

was needed for this report. We were limited, therefore, to a very general analysis of socioeconomic impacts. However, as Fiscal Considerations points out, because these impacts vary widely depending on the particular type and nature of heavy industry involved, specific analysis of socioeconomic impacts can be better performed ad hoc than on a hypothetical basis. Another set of siting factors dealing with air quality is based on legal requirements which are both sufficiently complicated and sufficiently important to merit discussion in a separate section in Part IV titled Air Quality Considerations.

There is one category of siting factors that could not be examined at all. These are the factors for which data has not been collected or information is largely incomplete. Some of these factors, such as archeological sites or critical coastal deer wintering areas, relate more to an evaluation of specific industrial sites than to an examination of general areas. The lack of site specific information, important as it may be to a particular siting decision, is not critical for this report. Lack of information about siting factors which relate to general areas, however, creates a gap in this report, which we note here and in other sections where needed siting factor information is lacking or incomplete. The area-related siting factors for which information is missing are: currents along the coast, especially in potential deepwater ports; geologic faults; flushing rates for waters that could be used in power plant cooling; and coastal areas used by cetaceans (whales).

The constraints of available time and resources made it impossible for this report to examine siting factors for the general areas in anywhere near the detail found in a federal environmental impact statement, for example. For the same reasons, this report does not identify or judge

the trade-offs among positive and negative impacts which might be involved in the use of each designated area by different heavy industries or by heavy industry in general. It is a very difficult exercise to compare such items as potential gains in industrial job income against possible losses in fishing income, or measure seals against improved harbor facilities. Furthermore, agency comments are weighted to the con side of heavy industry on the coast because there are, quite naturally and logically, many more agencies concerned with the benefits accruing from the resources presently existing on the Maine coast than there are agencies looking out for benefits which possible heavy industry may bring. In any event, an analysis of the trade-offs among such often unquantifiable and usually dissimilar items as the siting factors will depend on far many more policy assumptions regarding whether, how many, and which heavy industries should locate on the Maine coast than this report was asked to make.

In place of a detailed impact statement or benefit/cost analysis, the project team attempted to identify designated areas or portions of areas where impacts from heavy industry location will be clearly unacceptable or where local, state, or federal law prohibits location of heavy industry.

At the end of this section is a summary for each of the three areas of those siting factors which outside agencies or the project team found to be unfavorable to the location of heavy industry. Most of the unfavorable factors cannot be clearly categorized as adverse impacts because it is possible that these factors can be prevented or mitigated by available technology. On the other hand, it would be equally foolish to assert that heavy industry will have no adverse impact in relation to the siting factors. In the judgement of the project team none of the designated areas will sustain clearly unacceptable impacts from the presence of heavy

industry. One designated area, however, appears to stand in particular and unnecessary jeopardy from one particular industry. The area is Machias Bay. The industry is an oil terminal. In the judgement of the project team, oil should be restricted to the Portland Harbor area. A discussion of the reasoning behind this judgement is found in Part IV in the section titled How Many Oil Ports?

One particular siting factor listed as unfavorable to the location of heavy industry in Upper Penobscot Bay is a local, state, or federal law which prohibits location of heavy industry. Local zoning ordinances in both Brooksville and Castine contain such prohibitions. For this reason, the project team eliminated the towns of Brooksville and Castine from further consideration as part of a heavy industrial area. For a discussion of the role of local zoning within a heavy industry clustering policy, see the section in Part IV of this report titled Should a State Policy to Cluster Heavy Industry Overrule Local Zoning Ordinances?

Siting Factors Unfavorable to the Location of Heavy Industry in Machias Bay (Machiasport-Cutler)

Shellfish are the most valuable marine resource in the Machias Bay area with an estimated annual sustainable yield of clams valued at $1,216,080. Randall Point flat in Machias Bay is one of the richest clam producing areas in the state. The area is also a major herring nursery ground. The bay lies within the migratory route of Atlantic salmon entering the Machias and East Machias Rivers. These populations represent over 40 percent of the naturally produced Atlantic salmon in the United States.

The waters of Machias Bay are Class SA.

The Machias Bay area contains 8.6 percent of the state's seabird nesting islands. One of only two razor-billed auk colonies in Maine is in this area. The largest puffin colony in the state lies offshore. Wintering bald eagles use the Machias Bay area throughout much of the season. This area has the highest harbor seal density of any portion of the Maine coast with 23 known seal haulout sites supporting a minimum of 920 harbor seals. Whales and porpoises are commonly sighted along the entire coast of eastern Maine, including the endangered right whale. The area off Machiasport is heavily used by large marine mammals. The abundance of unique wildlife in this part of Maine is due largely to isolation from human disturbance.

Clustering industrial development in the area may be limited by Moosehorn National Wildlife Refuge and Roosevelt International Park on Campobello Island, which both have been designated mandatory Class I regions by the Federal Clean Air Act Amendments of 1977. This classification sets forth very stringent standards to prevent any significant deterioration of air quality.

The towns of Machiasport and Cutler do not have support services that can adequately meet the needs of heavy industry.

Siting Factors Unfavorable to the Location of Heavy Industry in Upper Penobscot Bay (Searsport - Stockton Springs - Penobscot - Castine - Brooksville)

Upper Penboscot Bay represents an important fisheries production area. In 1975 the Bagaduce River and the shore of eastern Penobscot Bay produced approximately two million dollar's worth of scallops. While the clam flats in Searsport and Stockton Springs have been closed because of domestic pollutants, they may be reopened when new waste treatment facilities come on line. The towns of Searsport, Stockton Springs, Penobscot, Castine, and Brooksville together have an estimated annual sustainable yield of clams valued at $730,890. Smelts and alewives spawn in the streams and tributaries of upper Penobscot Bay. Alewife landings increased fivefold from 1970 through 1974 in this area. Upper Penobscot Bay lies within the migratory pathway of Atlantic salmon entering the Penobscot River. Salmon restoration in the Penobscot watershed has become a multi-million dollar program.

The entire Penobscot Bay area contains approximately 14 percent of Maine's wintering waterfowl population. Over 26 percent of the state's seabird nesting islands are in Penobscot Bay. Upper Penobscot Bay is of critical importance to the wintering bald eagle population. Five seal haulout sites have been identified with a minimum of 132 harbor seals. The mouth of Penobscot Bay is heavily used by whales and porpoises.

Penobscot Bay like Casco Bay is one of the most important recreation areas on the coast. Within a ten mile radius of Sears Island are six properties administered by the Bureau of Parks and Recreation.

Clustering industrial development in this area may be limited by nearby Acadia National Park, which is designated a mandatory Class I region by the Federal Clean Air Act Amendments of 1977. This classification sets forth very stringent

standards to prevent any significant deterioration of air quality. Also both the Bangor-Brewer and Rockland-Thomaston areas are non-attainment areas for total suspended particulates (see Part IV, Air Quality Considerations). Major development in the upper Penobscot Bay area might impact the two areas.

Although the towns of Searsport and Stockton Springs already have some of the support services necessary for heavy industry, the towns of Penobscot, Castine, and Brooksville lack nearly all the necessary infrastructure, including railroads, port services, and adequate municipal services.

Zoning ordinances in Brooksville explicitly prohibit all forms of heavy industry. Castine's zoning ordinances, although weaker than Brooksville's, are similarly intended to prohibit heavy industry.

Siting Factors Unfavorable to the Location of Heavy Industry in Portland Harbor (Portland-South Portland)

The entire Casco Bay area is an important fishing production area, with 651 lobster licenses and 46 commerical fishing licenses. The Department of Marine Resources has estimated the annual sustainable yield of clams at a value of $670,374. The Portland area is a major fishing port, handling a large portion of the ground fish landing for the state.

The waters of outer Casco Bay, including those around some of the islands under consideration, are class SA, which is the highest classification. The Department of Inland Fisheries and Wildlife considers Casco Bay to be of high importance because it contains over 25 percent of the salt marshes and 20 percent of the tidal flats within the State. Approximately 26 percent of Maine's wintering waterfowl use the area. The seabird nesting islands in Casco Bay constitute 24 percent of the State total. Between Cape Elizabeth and Cape Small, which includes the Portland Area, 28 seal haul-out sites have been identified with a minimum of 423 harbor seals.

Casco Bay is one of the most important recreation areas on the coast.

Several archaeological sites are suspected on the islands of Casco Bay.

Portland has had a history of violations of the sulfur dioxide ambient air quality standard. The violations were caused by the cumulative impact of many small emission sources in the immediate vicinity of the city. Any new industries, emitting sulfur dioxide, that might locate in the area could violate the present air quality standards.

Summary

Municipalities which satisfy primary siting factors for oil or LNG, and which are not eliminated by a consideration of detailed siting information are: Cutler, Machiasport, Penobscot, Stockton Springs, Searsport, Portland, South Portland.

G. REMAINING COASTAL AREAS WHICH SATISFY PRIMARY SITING FACTORS FOR LESS CONSTRAINING INDUSTRIES

Three areas of the coast have been determined suitable for one or both of the most constraining industries: Portland-South Portland, Searsport-Stockton Springs-Penobscot, and Machiasport-Cutler. This section of the report examines these areas for their ability to satisfy the primary siting factors of the remaining industries. These primary siting factors are described in Section C. The remaining industries are oil refining, nuclear power plants, coal-fired electric generation, coal storage and handling, steel OCS platform construction, and concrete OCS platform construction.

Oil Refinery

An oil refinery requires at least 250 acres of land with slopes less than 8%. The facility requires pipeline access from a marine terminal. Rail access is desirable.

As mentioned in the preceding section and discussed in the section of Part IV titled How Many Oil Ports?, this report recommends that oil terminals be restricted to the Portland Harbor area. The project team made the assumption that, although an oil refinery need not be located at the site of an oil terminal, any refinery in Maine would be most likely to be located relatively close to a marine terminal. Therefore, this report does not evaluate the suitability of the Searsport-Stockton Springs-Penobscot area or the Machias-port-Cutler area for oil refineries.

* Portland-South Portland

The Portland-South Portland area already has several marine oil receiving facilities. However, the Portland-South Portland area does not have enough undeveloped industrially zoned land available for an oil refinery. Current zoning excludes oil refining of any type.

Conclusion. The Portland-South Portland area does not have locations which meet the primary siting factors for oil refineries.

Because this report recommends that oil terminals be restricted to the Portland-South Portland area, the project team concluded that no oil refineries will seek to locate in the Upper Penobscot Bay area or the Machias Bay area. This section also concludes that there are no locations in the Portland-South Portland

area which meet the primary siting factors for oil refineries. The effect of these two conclusions is to exclude oil refineries from the entire coastal area. It should be noted that this is an effect of the process used in this report rather than a recommendation. An oil refinery does not require location immediately proximate to an oil terminal. However, the refinery must be close enough to the terminal to insure economic transportation of the crude oil through a pipeline. It is very highly probable that there are suitable refinery sites in inland municipalities which are close enough to the Portland-South Portland area to make pipeline transportation from a marine terminal economical.

Nuclear Power Plant

The primary siting factors for a nuclear power facility are 300,000 to 450,000 gallons per minute of water for cooling, 1,000 gallons per minute of fresh water, low population density in proximity to the plant, and a very stable, earthquake-free site of 200 or more acres. In addition, the site must be free from the threat of major fire or explosion.

The tasks of finding an area with a stable bedrock surface and evaluating its potential for possible future seismic shocks are complicated and time consuming. The geologic region in which the Maine coast is located is characterized by a very great number of fractures and faults. These breaks in the crust originated hundreds of millions of years ago. Evidence presently available indicates that there has not been any significant movement during the last 50,000 years. However, the Nuclear Regulatory Commission, in co-operation with the Maine Geological Survey, is presently conducting geological and seismological studies in coastal Maine to gather sufficient data for the construction of a seismic risk map of the state. This study will be completed in 1979-80 and will provide the state with an accurate picture of the seismic risk patterns from which a final decision on nuclear plant location can be made. For the present, there is a consensus among knowledgeable structural geologists and seismologists that coastal Maine is extremely stable, has historically had only infrequent and low-level earthquakes, and presents little evidence of recent seismic events. Based on that consensus, the stable bedrock requirement is satisfied for all three of the proposed areas.

* Portland-South Portland

The Casco Bay area is underlain by various metamorphic rocks and few volcanics. Portland Harbor is characterized by a moderate number of old faults and fractures.

Land availability is limited. Fresh water supplies are probably adequate but the flushing capability of the inner harbor is suspect.

The population density in the Portland-South Portland area exceeds the standards established for proximity to a nuclear plant.

Conclusion. Because of the density of population, no locations in the Portland-South Portland area satisfy the primary siting factors for nuclear power plants.

* Searsport-Stockton Springs-Penobscot

The upper Penobscot Bay area is underlain by a complex series of metasedimentary and metavolcanic rocks. The Lucerne and Mt. Waldo granites ring the north end of the bay. Several major faults are present but no recent movement has been observed. A break in old glacial till is noted on Sears Island. Evidence regarding whether or not it was caused by a crustal earthquake is inconclusive. It may have been caused by another, non-seismic phenomenon.

Substantial amounts of open land are available and population density does not exceed the limits set forth in NRC guidelines.

Adequate cooling water is available. There is an open embayment up to 100 feet deep and the mean low water flow of the Penobscot River is 3,000 cubic feet per second. Availability of fresh water supplies may be limited.

Conclusion. Contingent upon the availability of fresh water, the Searsport-Stockton Springs-Penobscot area contains locations which satisfy the primary siting factors for nuclear power plants.

* Machiasport-Cutler

The Machias Bay area is underlain by a complex of metavolcanic rocks, well fractured and faulted. However, there is no history of high level seismic

activity in this area.

There is a large amount of undeveloped land. The low population levels and densities in the area are within the guidelines established by the NRC.

The supply of cooling water is adequate, but fresh water availability is restricted.

Conclusion. Contingent upon the availability of fresh water, the Machiasport-Cutler area contains locations which satisfy the primary siting factors for nuclear power plants.

Coal-Fired Electric Generation

The facility requires about 400 acres of cleared, well drained, level ground. Approximately 300,000 gallons per minute of cooling water are necessary. Up to 2,000 gallons per minute of fresh water is also required. The transport of coal requires access to either a railroad or a docking facility; the presence of both is preferable.

*Portland-South Portland

Portland Harbor has limited amounts of land available along the shore and limited amounts of industrially zoned land inland. Soil characteristics may be a limitation for disposal of solid waste.

Port facilities are adequate and there is good highway and rail access.

The inner harbor area has a low flushing rate for salt water cooling. There is no fresh water source of cooling water.

Conclusion. Because of the restricted availability of land and cooling water, the Portland-South Portland area has a very limited ability to satisfy the primary siting factors for a coal-fired electric generation facility.

*Searsport-Stockton Springs-Penobscot

There is considerable open land available. A coal-fired electric generation plant is already proposed for Sears Island. Soils on mainland sites may have limitations for solid waste disposal.

Water depth is adequate and there is an existing coal handling facility at Searsport. There is rail access to Searsport and Stockton Springs. Rail access and port facilities in Penobscot are lacking.

Availability of cooling water is adequate. There is an open embayment with a depth ranging from 30 to 100 feet close to shore and the mean low water flow of the Penobscot River is 3,000 cubic feet per second. Availability of fresh water may be limited.

Conclusion. Contingent upon the availability of fresh water, Searsport and Stockton Springs have sites which satisfy the primary factors for a coal-fired electric generation plant. Also contingent upon fresh water supplies, Penobscot has areas which meet the physical requirements but lack rail access and port facilities.

*Machiasport-Cutler

Large amounts of open land are available in Machiasport and Cutler. Areas suitable for solid waste disposal may be limited.

Water depths close to shore are adequate. There are no existing dock facilities which handle coal.

Existing rail access in Machias is 8 miles from Machiasport and 12 miles from Cutler.

Cooling water availability is adequate. The lower bay is an open embayment with depths ranging from 30 to 70 feet close to shore. Supplies of fresh water are limited.

Conclusion. Machiasport and Cutler have locations which satisfy the physical requirements for a coal-fired electric generation plant. However, rail access and docking facilities are lacking.

Coal Storage and Handling

A coastal location for coal handling facilities requires water access for barges and ships as well as rail and road access. Land area requirements are flexible, but the site must have little or no slope.

* Portland-South Portland

Waterfront property sites ranging in size from 5 to 15 acres are available. The Portland Harbor channel is adequate for 70,000 DWT vessels up to South Portland.

Existing rail and road access is excellent.

Conclusion. The Portland-South Portland area has locations which satisfy the primary siting factors for coal storage and handling.

* Searsport-Stockton Springs-Penobscot

There are substantial amounts of land available at the Searsport docking facility and in Stockton Springs.

The channel is adequate to handle nearly any size collier with depths of 30 to 70 feet close to shore.

There are existing coal offloading facilities at Searsport which are conservatively estimated to be able to handle 25,000 tons of coal in 48 hours. The facility is underutilized.

Although Penobscot has undeveloped land and adequate channel characteristics, there are no existing dock or rail facilities.

Conclusion. Searsport and Stockton Springs have locations which satisfy the primary site requirements for coal storage and handling. Penobscot has sites which meet the physical requirements for coal storage and handling. However, this municipality currently does not satisfy all the primary siting factors because of the lack of docking facilities and rail access.

* Machiasport-Cutler

Substantial amounts of land are available in both communities.

Water depth close to shore and in the channel is adequate for almost any size collier.

The nearest railway to Machiasport is at least 8 miles away in Machias. Cutler is much further from the Machias rail facilities. There are no existing port facilities. Road access is poor.

Conclusion. Machiasport and Cutler have locations which meet the physical requirements for coal storage and handling. However, the Machiasport-Cutler area currently does not satisfy the primary siting factors for coal handling because of the lack of rail access, docking facilities, and good road access.

Construction of Steel OCS Platforms

Steel platform construction requires between 50 and 500 acres of flat land with at least 300 feet of shoreline. Water depth close to shore must be at least 30 feet with access to a channel at least 300 feet wide. The channel must have vertical clearance of 300 feet. At least 100,000 gallons per day of fresh water are required.

*Portland-South Portland

The amount of available land with shore frontage is very limited. Slope is not a problem on the land that is available.

Water depth close to shore and channel characteristics are adequate.

Conclusion. Within the Portland-South Portland area, there may be sites for a small OCS platform construction yard. Land availability severely restricts the size of any site.

*Searsport-Stockton Springs-Penobscot

There are substantial areas of undeveloped land. Although slope may range up to 15%, there are shore areas where slope is not a problem.

Water depth varies from 40 to 100 feet close to shore. Channel depth varies from 35 to 250 feet and width is a minimum of 3,000 feet.

Conclusion. Stockton Springs and Penobscot have sites which meet the primary requirements for steel OCS platform construction.

*Machiasport-Cutler

There are substantial amounts of undeveloped land in the area. Slope generally varies up to 15%, but there are one or two areas where slope may not be a problem.

Water depth close to shore is 30 feet. Channel depth is 30 to 80 feet with a minimum width of 2,500 feet.

Conclusion. Contingent upon the availability of land with suitable slope, Machiasport and Cutler may have sites which meet the primary requirements for steel OCS platform construction.

Construction of Concrete OCS Platforms

A construction yard for concrete OCS platforms requires about 50 acres of land for each platform under construction. However, land requirements are flexible because much of the site is used only for storing materials and mixing concrete.

Concrete platforms are initially constructed behind a cofferdam, then floated out of the cofferdam and completed while moored in calm water. There must be access to shore where water depths are 30 to 80 feet and access to a channel where depths are 80 to 150 feet.

The greatest problem of concrete platform construction is the tow of the completed platform to the the drilling area. Currents can not exceed 1.5 to 2.0 knots.

Twenty-five to forty thousand gallons per day of fresh water are required for each platform under construction.

* Portland-South Portland

Although only limited amounts of land are available for industrial development in the Portland-South Portland area, there may be sufficient land available for a small construction yard.

Recorded currents in Portland Harbor are a maximum of 0.9 to 1.1 knots. Water depths are adequate for towing platforms of moderate size.

Sufficient fresh water supplies are available in the Portland area.

Conclusion. Contingent upon the availability of land, both Portland and South Portland have sites which meet the primary requirements of concrete OCS platform construction yards.

* Searsport-Stockton Springs-Penobscot

Upper Penobscot Bay may have no area suitable for construction of the necessary cofferdam or sufficiently sheltered for the construction required after the platform base is towed out of the cofferdam.

Information on currents at the upper end of Penobscot Bay is lacking, although information from the lower bay does not indicate strong currents.

Water depths are considered adequate. There is sheltered 100 foot deep water.

Supplies of fresh water are limited.

Conclusion. Because of the lack of information on currents, it is not known whether the Searsport-Stockton Springs-Penobscot area has locations which meet the primary requirements for concrete OCS platform construction.

* Machiasport-Cutler

The Machias Bay area has undeveloped land which may be suitable for construction of platforms. Protected anchorage may be available at specific sites. Water depths are adequate.

Information on currents is lacking for this area. The nearest recorded current is off the east end of Moosabec Reach where currents registered 1.0 knots.

There are no municipal water systems. Supplies of fresh water are very limited in Machias, Machiasport, and Cutler.

Conclusion. Because of the lack of information on currents and the limited fresh water supply, it is not known whether the Machiasport-Cutler area has locations which meet the primary requirements for concrete platform construction.

SUMMARY

Each of the three designated heavy industrial areas is suitable for three or more of the heavy industries identified in this report. All of the heavy industries considered in this report, with the exception of oil refineries, may be located in one or more of the designated areas. We recommend that the following groups of municipalities be designated as heavy industrial development areas: 1) Machiasport-Cutler; 2) Searsport-Stockton Springs-Penobscot; and 3) Portland-South Portland.

IV. ELEMENTS OF A CLUSTERING POLICY: PROBLEMS AND ALTERNATIVES

HOW MANY OIL PORTS?

Portland Harbor and Machias Bay both satisfy the primary siting factors for location of an oil terminal. Although the project team did not make a judgement that impacts from an oil terminal in Machias Bay will be clearly unacceptable, we received comments from several agencies indicating that the potential for environmental harm in Machias Bay is of particular concern. (See Section III F, Detailed Siting Information Regarding Coastal Areas Which Satisfy Primary Siting Factors and Appendix H). This potential for considerable harm raises the question of whether designation of Machias Bay as an oil port is warranted.

The project team sees two possible advantages to designating Machias Bay as an oil port: (1) because the area satisfies the primary siting factors, opportunities for safe, economical, and efficient operation of an oil terminal are greater than elsewhere along the coast and (2) the Washington County region may receive significant net economic benefits if a terminal and accompanying refinery are built (See discussion in Fiscal Considerations).

The disadvantages of designating Machias Bay as an oil port are created by a combination of three facts: (1) Machias Bay supports natural resources which knowledgeable sources deem to be of considerable importance, (2) even without a major oil spill, use of the area as an oil port will harm these resources to some degree, and (3) Portland Harbor can handle all the oil that is expected to come to Maine in the next 25 years.

Chronic, low level oil spills occur in the operation of any oil terminal. Even small concentrations of oil will alter interactions between ecological communities and populations (Environmental Protection Agency 1976). Chronic,

low level spills may impose greater environmental damage in estuaries and marshes because of mixing with pollution from other sources. Additional stresses brought about by small unavoidable spills are likely to degrade water quality and have long term toxic and subtoxic effects on the marine environment (U. S. Department of Interior 1973).

From the perspective of state or New England region energy needs, it is not necessary for Machias Bay or any other Maine port not now receiving oil to suffer the adverse impacts an oil terminal may bring. Portland Harbor appears capable of accepting the transportation of an additional 200 million barrels of oil per year, according to the Coast Guard's Marine Safety Division and the Portland Pilots Association. (Haynes Personal Communication 1977 Smith Personal Communication 1977). This level can be achieved by the use of one 250,000 DWT VLCC in the harbor every three days, and is sufficient to supply 2.2 oil refineries with a 250,000 barrel per day capacity. No more than two such refineries are expected to seek to locate in Maine within the next 25 years.

The State of Maine consumed 38 million barrels of petroluem products in 1976. The figures above indicate that 5.2 times the state's total petroleum consumption can be added without significant problems to the 160 million barrels per year currently entering Portland Harbor.

After examining the advantages and disadvantages, the project team judges that Machias Bay should not be designated as an oil port. We recommend that any heavy industry involving bulk storage, handling or transfer facilities for crude oil be located in the Portland Harbor heavy industrial development area.

SHOULD A STATE POLICY TO CLUSTER COASTAL HEAVY INDUSTRY AREAS OVERRULE LOCAL ZONING ORDINANCES?

The project team which produced this report studied carefully the local zoning ordinances in each of the municipalities which satisfied the primary siting factors for oil terminals or LNG facilities. We also invited local officials in each municipality to discuss with us local planning and zoning considerations which might disfavor or favor heavy industrial development. The provisions of the zoning ordinances and the sentiments of local officials are summarized at the end of this section.

Each municipality has some form of zoning ordinance. Ordinance provisions range from outright prohibition of heavy industry (Brooksville, Castine) to allowance of heavy industry almost anywhere in town (Stockton Springs, Penobscot, Machiasport) to allowance of certain heavy industries in certain zones (Portland, South Portland).

Reactions of municipal officials to the possibility of their municipality being designated as a heavy industrial development area demonstrated a similar range, but had one common element: a strong desire to retain local control over the location of heavy industry. No official called for a local referendum on each industrial proposal; all officials indicated that their concern is that local zoning not be pre-empted.

Zoning ordinances are produced in a far more reasoned and balanced manner than are case-by-case votes on industrial proposals. The provisions of zoning ordinances are known in advance and tend to demonstrate continuity and integrity over time.

Providing that a state heavy industry siting policy not pre-empt local zoning, however, presents a problem. Are there enough suitable sites for heavy industry remaining in the designated heavy industrial development areas after local zoning restrictions are applied?

The answer to this question depends on the definition of the word "enough." Discussion in the Siting Considerations section indicates why there may not be "enough" sites regardless of local zoning, and recommends a way out of that dilemma.

The question then becomes: Will local zoning restrictions make a difference in the availability of suitable sites for location of heavy industry within the designated areas? The answer is "probably not." With the exception of Brooksville and Castine, local zoning provisions rule out very few possible heavy industrial sites and prohibit very few industries which this report found capable of locating in the municipalities with the prohibitions.

We recommend that a state policy to cluster heavy industry in designated areas of the coast not prevent any municipality from adopting or administering more restrictive zoning ordinances.

Zoning in Municipalities Which Satisfy Primary Siting Factors for Most Constraining Heavy Industries

Portland. The city has three zoning classifications (I1, I2, I3) permitting industry. The I3 classification is the least restrictive. It permits most forms of heavy industry, except smelters, refineries, and liquefied natural gas plants, which are prohibited throughout the city. The land adjacent to Portland Harbor and part of Long Island are zoned I3. A very limited amount of open land is available to heavy industry along the waterfront. With the exception of Long Island none of Portland's islands have land zoned industrial. Planning Board approval is required for construction of new industry.

South Portland. South Portland has set aside several districts zoned industrial. Within these areas the following heavy industry is specifically prohibited: smelters, refineries, and liquefied natural gas plants. These industries are prohibited in all of South Portland. Land at the mouth of the Fore River and some inland areas are zoned industrial.

Searsport. Searsport has zoned several areas for industry. These include shoreland property. Within these districts heavy and light industry are permitted. There are no specific prohibitions against heavy industry. Planning Board approval is required for construction of new industry.

Stockton Springs. The town has five districts which permit industry with Planning Board approval. These districts are residential; commercial; industrial; rural, agriculture, forest; and general development. There are no specific prohibitions against heavy industry. Since all of the aforementioned districts permit heavy industry, many areas are potentially available, including shoreland property.

Penobscot. The town has one district, general development, which permits industrial development. No other districts allow heavy industry. No shoreland is zoned general development. Commercial and industrial structures are prohibited within 250 feet of all the town's shoreland. There are no specific prohibitions against heavy industry. Planning Board approval is required for construction of new industry.

Castine. Although heavy industry is not specifically prohibited in the town, existing zoning regulations allow "industrial activity" only in a very small area adjacent to Castine Harbor. Planning Board approval is required for construction of new industry. Town officials have indicated that the town will amend the zoning ordinance to prohibit all forms of heavy industry.

Brooksville. The zoning regulations of Brooksville are very explicit in regards to heavy industry. The following are prohibited within the town: storage of petroleum products other than for retail sale to the consumer and for home use, oil refineries, smelting operations, and other heavy industries injurious to the environment and natural beauty of the town.

Machiasport. The town has one shoreland district, general development, which permits industrial development. There are no specific prohibitions against heavy industry. Planning Board approval is required for construction of new industry. Zoning in Machiasport applies only to shoreland areas.

Cutler. The town has two districts, management and general, which do not prohibit heavy industry. There are no specific prohibitions against heavy industry, although town officials have very strongly indicated that

they do not want oil or LNG in the town. Planning Board approval is required for construction of new industry.

Zoning Summary Table

Municipality	Land Already Zoned Industrial	Other Zoning Categories Permitting Industry	All Heavy Industry Prohibited	Specific Prohibitions	Shoreland Available to Industry through Zoning
Portland	Yes[a]	None	No	Smelters, Refining Operations LNG Plants	Yes
South Portland	Yes	None	No	Refining Operations, Smelters LNG Plants	Yes
Searsport	Yes[a]	None	No	None	Yes
Stockton Springs	Yes[a]	Residential District[a] Commercial District[a] Rural/Agriculture/Forest District[a] General Development District[a] Industrial District[a]	No	None	Yes
Penobscot	None	General Development District[a]	No	None	None
Castine	None	General Development District[a]	No	None	Yes[b]
Brooksville	None	None	Yes	All Heavy Industries	None
Machiasport	None	General Development District[a]	No	None	Yes
Cutler	None	Management District[a] General District[a]	No	None	Yes

[a]Planning Board Approval Required [b]Castine Harbor [c]Shoreland zoned industrial or available in other zones if approved by local planning board.

HOW SHOULD A CLUSTERING POLICY DEAL WITH HEAVY INDUSTRIES WHICH EXIST OR WHICH HAVE BEEN GRANTED PERMITS FOR LOCATION OUTSIDE DESIGNATED HEAVY INDUSTRIAL DEVELOPMENT AREAS?

The problem of what to do about existing or licensed uses which are not in compliance with new regulations is generic to regulatory proposals such as the one this report recommends.

There are three general options for dealing with existing or licensed* heavy industries located outside designated heavy industrial development areas:

1. Designate the areas in which the non-conforming industries are located as additional heavy industrial development areas.

2. Grandfather the non-conforming industries and require that they cannot be converted to other heavy industrial uses.

3. Grandfather the non-conforming industries and allow conversion to certain other heavy industrial uses.

With the exception of the proposed oil terminal at Eastport, no non-conforming heavy industry is located where there is water of sufficient depth to accommodate the ship traffic necessary for many of the heavy industries which may seek to locate on the Maine coast in the next 25 years.

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*This section treats heavy industries which have secured the necessary state permits for construction (e.g. Pittston Company) in the same manner as existing heavy industries.

If a clustering policy is to be implemented, option #1 is inadvisable for these industries.

In the case of Eastport, the amount of land which will be available if the Pittston Company's plans are carried out may not be sufficient to allow location of any other heavy industry in the municipality. Location of heavy industry elsewhere around Cobscook Bay will create difficulties in scheduling ship traffic so as to comply with conditions which the Board of Environmental Protection has attached to Pittston's application. On the other hand, the enhancement of infrastructure which construction of an oil terminal and refinery at Eastport will certainly bring about provides a strong economic incentive to overcome traffic scheduling difficulties.

Although option #2 is the most common approach used in dealing with non-conforming entities, it seems unnecessarily harsh for the state to deprive a community of an established tax base and source of employment because a facility converts from one industrial use to another. Allowing conversion to any heavy industrial use, however, may controvert a clustering policy because new heavy industries might seek to locate where old heavy industries had shut down rather than in a more suitable designated heavy industrial development area.

The project team finds option #3 to be the most satisfactory. In evaluating what sorts of conversion should be allowed, we considered the change in employment opportunities which a conversion represents to be a significant factor. We recommend that existing heavy industry outside a designated heavy industrial development area be allowed to convert to another heavy industrial use if the new use is a suitable one for the site and if it is likely to maintain employment opportunities in the community.

Another problem arising from the existence of non-conforming industries is how to deal with expansions of these industries. Most regulations addressing similar problems require a permit for any expansion of a non-conforming use. The project team feels, however, that reasonable leeway should be allowed. We recommend that expansions of fifteen percent or more in non-conforming heavy industries be subject to approval by the Board of Environmental Protection under the Site Location of Development Law. The Site Law does not cover incremental expansions of less than a certain size (38 MRSA 482). Without the recommended provision, a non-conforming industry could enlarge greatly, in impact as well as size, without satisfying the requirements of the Site Law, so long as the enlargement were made in relatively small steps.

SITING CONSIDERATIONS

There are three problems inherent in a siting policy that goes only as far as mandating that heavy industries cluster development within designated areas. One is that incompatible industries may locate next to one another. A second is that an industry may locate at a particular site for which it is not well suited. A third is that the designated area may not be capable of accommodating enough heavy industries.

In the case of the first problem the two potential coastal industries which are of concern are nuclear power plants and LNG facilities. At present, location of nuclear plants in proximity to any potential source of fire or explosion is prohibited by Nuclear Regulatory Commission guideline 4.7 (Nuclear Regulatory Commission 1975). The Federal Power Commission will most probably promulgate similar regulations regarding LNG at such time as a new facility is sited in the United States. The State of Maine, however, may wish to consider enacting a similar requirement as a result of LNG public safety hearings, which this report recommends in the discussion of LNG primary siting factors.

Mechanisms available to deal with the second problem of locating heavy industry at suitable particular sites include not only federal regulation, such as air quality standards, and local regulation, such as zoning ordinances, but also Maine's Site Location of Development Law.

It has been alleged that the siting factors mentioned in the Site Law are too general in nature to assure that industrial development will be suitably sited. Many who work with the law, however, including its administrators, feel that this generality affords a flexibility in dealing with specific and sometimes unique cases that often better accomplishes the purposes of the law

than would rigid standards. Some additional policy problems with specific standards are mentioned in Part I of this report.

Aside from any problems with generality in the Site Law, there may be a problem with the law's comprehensiveness in evaluating suitable sites for heavy industry. As the project team examined various heavy industry siting factors in the course of this study, we wondered whether some of the factors were within the jurisdiction of the Site Law. We asked the Department of Environmental Protection to list any heavy industry siting factors which may not be covered by the Site Law. Several were mentioned: visual aesthetics and noise control which could both be promoted by buffering industrial facilities from adjoining properties, shorelines, and public roads; cultural resources; critical areas; effects of water use on availability of water for existing uses; and transportation of hazardous materials. In addition, the DEP also suggested that a capacity to consider alternative sites could improve the capability of the Site Law to insure that heavy industry is suitably sited.

We recommend that the Site Law be augmented to include, with respect to heavy industry, each of the siting factors mentioned above as well as the ability to consider alternate sites.

Another siting consideration absent from the Site Law is one that the Committee on Coastal Development and Conservation has ranked first among its policy goals for coastal resource use: compatability with traditional activities. If the Committee wishes to provide for the achievement of this goal in heavy industrial siting, we recommend that the Site Law be augmented, with respect to heavy industry, to include assessment of compatibility with traditional uses.

The third problem related to clustering heavy industry is whether or not the clusters offer suitable sites for enough heavy industries. A definition of "enough" depends on future public policies regarding whether, how many, and which heavy industries should be sited in Maine or on the Maine coast. Consideration of such policies is, as we noted in the Statement of the Issue, beyond the scope of this report. We can, however, address the problem of whether or not the designated areas can accommodate over time all those heavy industries which public policies determine should be located on the Maine coast.

There are within the designated areas a finite number of suitable sites and a limited resource carrying capacity for supporting heavy industrial development. If those heavy industries which public policy determines should locate on the coast have siting needs in excess of the siting capacity of the designated areas, other coastal sites, outside the designated areas, will have to be used.

We recommend that a heavy industry which requires a coastal location and which cannot be accommodated within any designated area be allowed to locate at a site outside a designated area if the site meets the requirements of the Site Location of Development Law and if public policy favors location of the industry on the Maine coast.

FISCAL CONSIDERATIONS

Heavy industrial development, regardless of where it is located, will result in a major increase in the local property tax base. At the same time, heavy industrial development creates new demands on local fiscal resources. Any state policy affecting the location of heavy industry should give serious consideration to the fiscal impacts of such a policy.

The objective of this section is to (1) review the fiscal implications of heavy industrial development, (2) identify any disruptions created by the heavy industry clustering policy recommended in this report, and (3) recommend policies to mitigate fiscal disruptions or imbalances created by the heavy industry clustering policy.

In assessing the need for a fiscal adjustment mechanism, four distinct fiscal impacts were reviewed. They are (1) major fiscal imbalances, (2) lost tax base opportunity, (3) regional socio-economic impacts, and (4) adverse impacts on individuals.

Major Fiscal Imbalances

In Maine and across the country, smaller commercial and industrial facilities are being phased out. Modern plants have taken full advantage of economies of scale and have consolidated in larger more centralized facilities. We have seen this phenomenon in Maine with the construction of the Maine Yankee Nuclear Power Plant, recent proposals for oil refineries at various locations along the coast, and recent expansions in Maine's pulp and paper industry.

This concentration of industry, under an unmodified local property tax system, has and will continue to result in fiscal imbalances. The property tax base of the state is becoming more geographically concentrated in communities that

happen to be the chosen location for heavy industrial development.

Municipalities in which these heavy industrial developments are located have enjoyed lower property tax rates than other Maine communities. Communities such as Baileyville, the home of the Georgia Pacific Paper mill, and Wiscasset, the home of the Maine Yankee Nuclear Power Plant, have significantly lower tax rates than the state average. In fiscal year (FY) 1977 the full value mill rate for Wiscasset was 17.8; for Baileyville it was 24.0; the state average was 27.0. These disparities existed even with the now repealed Uniform Property Tax, which was designed in part to equalize local property tax burdens. In the absence of the Uniform Property Tax, the FY 1977 mill rates in Wiscasset and Baileyville would have been 8.3 and 22.4 mills respectively.

Not all communities in Maine with heavy industrial tax bases, however, have exceptionally low mill rates. In the final analysis the mill rate is not determined exclusively by the local tax base. It is strongly influenced by the accuracy of property valuation, which is a universally acknowledged problem, and by the level of local services delivered in the community. If heavy industry is undervalued then the full fiscal advantage of having that industry in a community is not reflected in the local mill rate.

In general, there is agreement that communities where heavy industrial property is valued at 100% of market value have tax burdens on real property that are significantly lower than they would be in the absence of heavy industry.

Many feel that the lessening of the tax burden which heavy industry brings to one community creates an inequity among communities. In many cases the employees of heavy industry do not live in the community where the industry is located so that the service requirements of those employees are not funded by the industry's property taxes. Furthermore, taxpayers throughout the state have invested

in the infrastructure, such as highways, necessary to support heavy industry.

Daniel Webster, Deputy Commissioner of the Maine Department of Transportation, has given the project team some specific examples of how funds collected throughout the state are used to support industrial development in those communities where the development is located:

> Highway improvements required to serve industry are dependent upon need, administrative highway system and available funds. In the case of state highways, the state has basic responsibility for the condition and operation of these systems. The Department of Transportation generally attempts to respond to increasing traffic needs and has made necessary improvements in cooperation with industry and local communities in the past, and it would be our hope that we could continue this practice.
>
> Recent examples of improvements made by the state in response to industry include improvements to U. S. 201 in the vicinity of the new Scott mill in Hinckley and more recently at the shopping centers being developed off the Hogan Road in Bangor and off Center Street in Auburn. In the past we have worked cooperatively with International Paper in developing improved access across the Androscoggin River in Jay and in efforts to provide improved access to the Maine Mall Shopping Center (Webster Personal Communication, 1977).

Numerous mechanisms have been designed to adjust unequal tax burdens among communities. In Maine, one such mechanism was the Uniform Property Tax (UPT) which was designed to insure that tax bases in Baileyville and Wiscasset were shared with other communities in the State. Although the UPT was repealed, there is a general consensus that some alternative should be developed to adjust for the fiscal discrepancies created by heavy industry, specifically Maine Yankee in Wiscasset.

Among the other mechanisms that have been developed in other areas of the country to adjust for this problem are tax base sharing which has been implemented in the Minneapolis-St. Paul area. This alternative calls for a regional sharing of

all new tax base increments. A certain percentage of all new valuation is considered to be part of the regional property tax base and is not taxable at the local level.

However, a policy which prohibits heavy industrial development in a number of communities along the coast does not create the need for such a mechanism. The clustering policy recommended in this report highlights the fiscal disparities that could be created by heavy industrial development. The need to compensate for these disparities exists independently of the proposals in this report and should be addressed as an overall tax policy issue.

Lost Tax Base Opportunities

The state policy recommeded in this report prohibits large industrial development in a designated set of communities. One important implication of this policy is that it denies those communities the opportunity of enjoying the potential tax base associated with heavy industrial development, For example, if Wiscasset had been prohibited from having heavy industrial development, that community would now be foregoing the approximately $3,000,000 it receives annually in property taxes from Maine Yankee.

In theory, the measure of the fiscal losses to these communities because heavy industrial development is restricted is the expected net benefit that they would receive if, in fact, they were destined to have heavy industrial development in the future. This net fiscal benefit from possible heavy industrial development is the opportunity cost for the restricted communities.

In practice, however, an exact measure of the potential tax loss is impossible to calculate. Nevertheless, the prohibition of heavy industrial development in some areas creates an inequity that can be alleviated by compensating those communities in which development is prohibited.

The opportunity cost concept can be used to identify those communities eligible for compensation, while the concept of fiscal need and fiscal capacity is used to set the relative level of compensation to each community. One method of calculating fiscal need is in terms of population, tax effort, and valuation. Under the principles of this approach, a community's fiscal need can be determined by the level of population and the amount of property taxes raised in that community. A community's fiscal capacity on the other hand, is measured by the valuation in the community. A community's share of the funds distributed on a fiscal need/fiscal capacity basis should be positively related to tax effort and population (need) and inversely related to the valuation of taxable property (capacity).

There are, of course, several alternative combinations of these factors which give different weights to each. The present state revenue sharing formula, which distributes state funds to municipalities, utilizes one of these alternatives. The percentage distribution to each municipality under state/local revenue sharing is determined by the following formula:

$$\frac{\frac{P_i T_i}{V_i}}{\frac{PT}{V}}$$

where P_i = Population in municipality i

T_i = Property tax in municipality i

V_i = State valuation of municipality i

P = State population

T = Total property tax collected in Maine

V = State valuation

This formula not only accomplishes the objective of allocating funds based

upon fiscal need, it is also based on a formula currently in use. We recommend that this fiscal need capacity formula be used to distribute funds to the participating communities (i.e. coastal municipalities in which heavy industry is prohibited from locating).

The procedure for adopting the state formula to the participating areas is to replace the state variables in the numerator with variables measuring the sums of each of the three variables for the participating communities. This formula calculates the percentage for each participating municipality and insures that exactly 100% of all the funds are distributed.

Because this mechanism is designed only to compensate communities for tax base lost because of a state clustering policy for coastal heavy industry, the total level of compensation in the program should not be large. It is not a tax sharing program designed to correct major fiscal disparities resulting from heavy industrial development.

As heavy industry expands in Maine, the tax collections under this mechanism will grow. It is recommended that funds distributed never exceed twice the annual state/local revenue sharing funds distributed to the participating communities.

There are two alternative funding sources for such compensation. They are:

1. General Fund

People throughout the state will enjoy the environmental and aesthetic benefits of protecting areas of the coast from the serious environmental impacts of heavy industrial development in undeveloped areas. It might therefore be equitable for the compensation program to be funded through the state's General Fund. There is precedent for this in the Maine Tree Growth Tax Law. Municipalities are compensated from the state's General Fund for the difference

between the "productivity tax" collections on forest land and the 1972 ad valorem tax collections on that land. The concept underlying this compensation is that all the people in Maine benefit from the objectives of the Maine Tree Growth Tax Law.

2. Heavy Industry Excise Tax With Property Tax Credit

A more equitable way to fund such a program would be through a tax on the type of industry that will be prohibited from locating in coastal communities outside designated heavy industrial development areas. This could take many forms. The simplest form, administratively, is an excise tax on the gross receipts of new heavy industries. The administrative problems associated with such an excise tax will be minimal and the equity advantages substantial. It seems equitable that all communities throughout the state that are not prohibited from having heavy industrial development share responsibility for such compensation and that the tax not result in an automatic tax increase for industry. We recommend that any Maine community in which heavy industry is prohibited be compensated through an excise tax of .5% on the gross receipts of all new heavy industrial development and expansion throughout the state. We further recommend that industries subject to the excise tax be allowed credit for the tax against local property taxes.

In the case of Maine Yankee, a .5% tax in 1975 would have yielded $308,000; this is nearly 10% of Maine Yankee's 1976 property taxes which were $3,417,000. The $308,000 is equal to approximately three quarters of the amount of state revenue sharing distributed to all the participating communities in 1975.

Regional Socio-Economic Impact

This sub-section addresses the question of whether a fiscal adjustment mechanism should be introduced to alleviate any negative socio-economic impacts created

by a heavy industry clustering policy for the Maine coast.

A heavy industrial development in any one community in Maine most probably will have a significant socio-economic impact on the host community and on neighboring communities. Such a development will affect employment, income, population growth, and municipal finances of communities throughout the region. The intensity of this impact will be less severe in larger communities and will become less important as distance from the development increases.

Consider the range of impacts that could result from an OCS concrete platform construction plant on the coast of Maine. It would first of all create new jobs, and increase the income of its employees and owners. The industry would also stimulate its supplying industries thereby resulting in further job creation and income growth. Incomes generated both directly and indirectly would further increase spending and investment. With increased economic activity people would move into the area and demand housing and municipal services including public safety, social services, transportation services, and sewage systems.

The Maine State Planning Office is in the process of developing a computer simulation capability which is designed to measure, among other things, the net fiscal impact on municipalities of large scale industrial development. A review of the model description suggested that the utilization of this model would be an efficient means of studying the socio-economic impact of a heavy industrial development.

The simulation model, however, could not be made operational in time for this report. Therefore, it was not possible for this report to utilize the model to assess the net impact of a hypothetical heavy industrial development on the coast.

Even if the model were available at the present time, the application of the model could measure only a hypothetical situation. Because regional socio-economic impact will vary considerably among facilities and among locations, the study of a hypothetical situation is not appropriate analysis upon which to base a specific policy. The variation in impacts among sites and among facilities is important both for the construction phase of a heavy industry development project and for the operational phase.

Nevertheless, a number of observations can be made without the use of a formal model that shed considerable light on the policy issue of fiscal adjustment for socio-economic impacts.

During the construction period the important question to be answered is whether or not the construction workers will commute to the site or whether they will set up temporary residence at the site. In general, one can expect different patterns depending upon the proximity of the site to the supply of labor, the size of the project, and the skills required for construction. The magnitude of the impact of the construction of a heavy industry on both the local community in which the facility is located and on the neighboring communities will vary greatly depending upon the factors listed above.

The same variation in impact will exist during the operational phase of the project. Again, this impact can only be measured on a case-by-case basis. One example is the difference in economic impact of an oil refinery built in the Portland area and an oil refinery built in the Machiasport area. In 1972, the Governor's Task Force on Energy, Heavy Industry and the Maine Coast undertook an analysis of the varying impacts. The overall implications of that analysis still hold and are worth quoting:

1. Effect on Employment and Income

For the purposes of discussion, it will be assumed that petroleum refineries producing either 100,000 or 300,000 barrels per day will be established in either South Portland or Machiasport. The direct and indirect economic effects of the refinery will be measured within the respective economic areas of the two communities. The Portland Economic Area (Portland-South Portland Standard Metropolitan Statistical area) includes the municipalities of Portland, South Portland, Westbrook, Falmouth, Cape Elizabeth, Cumberland, Gorham, Scarborough, and Yarmouth. The Machias Economic Area (population 5,777) encompasses the towns of Cutler, East Machias, Machias, and Whitneyville.

Direct Impact. The current work force in the Portland Economic Area totals 74,000, of which 3,400 (4.6%) are unemployed, 13,200 are employed in manufacturing (principally paper, foods, electrical machinery, fabricated metals, and leather products), and the remaining 57,400 are employed in the various service industries (wholesale and retail trade, business and professional services, government, finance, transportation, and construction).

The addition of an average workforce of about 770 conconstruction workers for 18 months to build a new 100,000 barrel per day refinery in South Portland, or 1,400 workers on a 300,000 barrel plant for 21 months, would have a major impact on the present employment (3,600) in the construction industry of that area. Although most of the land preparation, foundation, carpentry, and basic steel erection for the refinery presumably could be undertaken by construction workers already in the area or elsewhere in the state, it is likely that much of the electrical, pipe-fitting, and welding on the extremely complex machinery would be carried out primarily by skilled employees brought in from elsewhere, due to the insufficient supply of such workers in Maine. The addition of an average of 260 "imported" workers on the smaller refinery and 700 on the larger one would increase existing construction employment for 1 to 2 years by 7-20% and the total labor force of the area by about 0.5-1%. Practically all of the specialized equipment installed in the refinery would be purchased outside of Maine, since it is obtainable in only a few areas of the world (mainly Texas and Japan).

After completion of the refinery, the operating work force would consist of from 124 to 175 persons, who would be employed directly in the refinery and at the marine terminal and other ancillary facilities. It is likely that about two-thirds of the personnel hired by the smaller refinery and half by the larger one initially would be present local residents who would be trained by the oil company. In addition, from 75 to 150 outsiders would be

> brought in under contract for periodic maintenance on the refinery. The "imported" workers therefore would raise the area's current manufacturing employment by 1-2% and the total labor force of the area by less than 1%. It should be noted that ultimately many Maine residents probably would undertake the intensive training necessary to operate the complex machinery of a refinery, so that its economic impact on the community would rise over a period of years.
>
> Within the Machias area, on the other hand, the economic impact of a new refinery would, of course, be considerably greater. The current work force consists of only 2,400 persons, of whom about 200 are unemployed, 215 work in manufacturing (principally foods and textiles) and the remaining 2,000 persons are employed in agriculture, fisheries, trade, and the various other services. Although many of the present labor force (employed or unemployed) presumably could be hired as construction workers by the refinery, it is likely that about 260 out-of-state workers would be hired to build the smaller refinery and 700 the larger one, thereby raising the total labor force of the area by 11-29% for several years. After construction of the refinery, the addition of 41 to 87 highly skilled outsiders to operate the machinery would raise present manufacturing employment by 19-40% and would increase the total labor force by 2-4%. It is presumed that most of the employees of the marine terminal and auxiliary facilities would be obtained from the area. (Report of the Governor's Task Force 1972)

The conclusion is that the less developed an area is the more significant the socio-economic impact of a heavy industrial development is likely to be. In this regard, the clustering of heavy industries in heavy industrial development areas should result in less of a socioeconomic impact from heavy industrial development than would more dispersed development. Clustering of such development has the following advantages: First, if heavy industrial development is clustered in a limited number of areas, the initial impact of development will be limited. Additional development in a community that has already experienced heavy industrial development will not cause the same degree of disruption as it would in a community experiencing heavy industrial development for the first time. Communities that have experienced development have already gone through the initial adjustment period. They are more

prepared in terms of labor force, infrastructure, local services, and overall experience to handle development. Clustering will limit the initial shock to a few areas and thereby limit the degree of disruption.

A second advantage of clustering, which was mentioned in the first part of this report, is that infrastructure development can be concentrated in a limited number of areas. This infrastructure, such as transportation systems, can then service a number of industries in one location. Such development will result in more efficient utilization of infrastructure and less costly development.

A third socio-economic advantage of clustering is based upon the idea that communities become more self-sufficient as they become larger. Once a community reaches some threshold of population and income, it develops its own local services. Retailing, health services, financial services, insurance, and other local industries develop only after a community reaches a certain threshold size. Only then can a community truly develop as a somewhat independent economic entity. Clustering will insure that population and income will be more geographically concentrated and that local economies will fully develop to take advantages of the heavy industrial economic base. It will also increase the potential for self-sustaining diversified growth in the areas experiencing heavy industrial development.

Having generally reviewed the idea of regional socio-economic impact, we can now address the question of whether or not a fiscal adjustment mechanism for regional socio-economic impacts ought to be recommended as a component of a state clustering policy for heavy industrial development on the coast. An adjustment mechanism is not warranted for two reasons: (1) The issue of negative regional impact and a fiscal compensation policy is a general fiscal issue and does not arise because of the clustering policy. (2) The clustering

Neighbors of proposed sites for heavy industry, because their losses relative to their benefits are so great, are often prepared to fight the development in the courts if necessary. In many cases they can stop a development that would be in the interest of the region or nation as a whole. The argument proposes that people of the larger region benefiting from the development should compensate the neighbors of such development in order to get them to accept the development.

Although the arguments are reasonable, such a policy is not recommended in this report because it addresses a problem generic to heavy industrial siting and not a problem created by the clustering policy recommended in this document. In fact, clustering of heavy industry would alleviate this problem because the area in which adverse environmental affects could be incurred would be limited. Furthermore, it should be noted that a policy to compensate neighbors of heavy industrial development has never been implemented in the United States, although such a policy is being studied by the U. S. Energy Research and Development Administration through the Laboratory of Architecture and Planning at M.I.T.

AIR QUALITY CONSIDERATIONS

Clustering of certain heavy industries along the Maine coast may result in the violation of ambient air quality standards and may violate air classifications established by the Federal Clean Air Act Amendment of 1977. This section discusses both the standards and classifications, and explains which industries may be affected in each designated heavy industrial development area.

Ambient air quality standards dictate the maximum allowable level of air pollutants from all sources within an air quality control region. The Board of Environmental Protection has established air quality regions within the state for the purposes of conducting air quality studies, and establishing reasonable ambient air quality standards and emission standards within a region.

The Department of Environmental Protection has designated those areas of Maine which do not meet ambient air quality standards as "non-attainment" areas. Federal law prohibits new air pollution sources which will add to air quality violations in non-attainment areas. The Department is required by federal law to develop a plan for meeting national standards in non-attainment areas by 1983.

Air classifications established by the Federal Clean Air Act Amendments of 1977 are as follows:

> Class I - In these areas, the maximum allowable increase of any air pollutant subject to a national standard must not exceed 2 percent (10 percent for particulates) of maximums set by the standard.

Class II - In these areas, the maximum allowable increase of any air pollutant subject to a national standard must not exceed 25 percent of maximums set by the standard.

Class III - In these areas, the maximum allowable increase of any air pollutant subject to a national standard must not exceed 50% of the maximums set by the standard.

The entire state has been classified Class II except for Acadia National Park, Roosevelt International Park, and Moosehorn National Wildlife Refuge, which have been classified Class I. Although the state is free to reclassify Class II areas, Class I areas can not be reclassified.

Moderate industrial growth will not violate Class II standards. If a heavy industrial development area experiences substantial industrial growth, it may be necessary to downgrade the area to Class III if new heavy industries are to be permitted. However, because the state has no power to redesignate Class I areas, construction of heavy industry which cannot meet Class I standards will be prohibited in or near any of these areas. Similarly, new industry will be prohibited in or near non-attainment areas if its construction or operation will further violate ambient air quality standards.

The national park owns land in the vicinity of Mount Desert Island and has also taken conservation easements on many islands in Penobscot Bay. The refuge holds several properties on or near the coast, including Petit Manan. The National Park Service has no clear policy on the application of Class I standards to areas of the coast where they only hold conservation easements (Watts Personal Communication 1977). If the standards do apply to conservation easements, then park and refuge properties combine to form a band of Class I

zones from Penobscot Bay to Campobello Island. Location of any heavy industry in this entire region, which includes both the Machias Bay and the Upper Penobscot Bay designated heavy industrial development areas, will require meeting the very stringent standards for Class I areas mentioned above.

If this is the case, liquefied natural gas facilities, platform construction yards, and nuclear power plants will easily be able to meet emission requirements within the two areas. The operation of a coal-fired power plant might be possible with modern pollution control technology. There is also a limited possibility that a coal-fired plant in Upper Penobscot Bay might impact the non-attainment areas of Bangor-Brewer and Rockland-Thomaston.

In the Portland Harbor designated heavy industrial development area, potential heavy industries are oil terminals, coal storage and handling facilities, and concrete OCS platform construction yards. Of these, only an oil terminal is likely to violate ambient air quality standards. Proper siting of a terminal will greatly reduce the possibility of violation.

OFFSHORE FACILITY CONSIDERATIONS

During the last 30 years, applications of offshore oil drilling technology have been used to develop ocean-sited cargo handling facilities and industrial plants. Offshore cargo handling facilities, both platform and mono-buoy, are operational in many parts of the world where economic and environmental requirements are favorable. The Nuclear Regulatory Commission has given serious consideration to the installation of a nuclear power generation plant on sea bottom or in a semi-submersible platform.

Offshore facilities present an alternative to location of heavy industry within specific shoreside areas. The several advantages and disadvantages to their use are briefly discussed in the following paragraphs. These comments, however, are very general. Consideration of offshore facilities was not within the mandate of this report, and acquisition of the necessary technical information was not possible within the time and resources available. Nonetheless, the project team recognizes offshore location as a potential siting alternative, and therefore includes these comments.

Offshore Loading Facilities and Mono-buoys. Offshore loading facilities and mono-buoys are installed in coastal areas where there is insufficient water depth at the shoreline, or where navigational hazards are so extreme that the risk of making a shoreside landing becomes prohibitive. Such facilities are also employed where economic or resource considerations require their use. An example is the mono-buoy crude oil facility at St. John, N. B. where use of a mono-buoy was the only means by which oil could be brought to an existing refinery site.

Offshore loading facilities are large, self-sustaining platforms with complete

cargo handling, maintenance and living quarters on board. They are of two types: floating semi-submersible and fixed sea-bottom-mounted. The choice is dependent upon the physical characteristics of the site and type of cargo being transferred. These facilities are used primarily for bulk and slurry cargos, but occasionally have served to transfer oil.

A mono-buoy is used primarily as an oil offloading facility. It consists of a small floating platform containing one end of a wide, high pressure flexible pipeline. The platform is anchored to the sea bottom. An oil spill boom and curtain completely enclose the buoy platform and off-loading tanker. Tugs and fire fighting support vessels are nearby during the off-loading periods.

The advantages to the use of either an offshore loading facility or a mono-buoy are, first, that it can be located at a site directly adjacent to the consuming facility (e.g., LNG converter, cement plant,or refinery) without concern about depth of water or navigational difficulties. Second, in busy harbors, such as New York City, congestion is not increased and turn-around time is reduced. Third, in the case of hazardous cargos, the offshore facility can be removed from both population and the potential for a series of explosions or fires in a congested harbor.

The disadvantages in the use of these facilities are two-fold: first, installation, maintenance and servicing are often expensive and complicated; second, such facilities are frequently more susceptible to naturally caused disasters and more difficult to protect than shoreside facilities.

Ocean Siting of Industrial Plants. Excluding sea bed mining, the most serious application of plant siting in the ocean is in nuclear power generation. As with the other facilities, ocean siting presents the advantage of location

anywhere along the coast, in any reasonable depth of water. Additionally, isolation is complete, and the dispersion of heated cooling water is immediate and relatively harmless because of rapid thermal dilution. The entire plant is ocean enclosed, self-sustaining, and separate from population and shoreside environmental concerns.

The problems of maintenance and protection from internal or external disaster are severe; little is known concerning the level of technology available to solve these problems.

V. SUMMARY OF RECOMMENDATIONS AND PROPOSED LEGISLATION

SUMMARY OF RECOMMENDATIONS

This report makes the following recommendations:

1) That the state designate particular areas of the coast for the location of heavy industry, and prohibit the location of new heavy industry along the remainder of the coast (page 11).

2) That, prior to approval of any specific site for location of a liquefied natural gas facility, the state conduct public hearings and establish public safety standards for such facilities (page 38).

3) That the following groups of municipalities be designated as heavy industrial development areas: a) Machiasport-Cutler; b) Searsport-Stockton Springs-Penobscot; and c) Portland-South Portland (page 97).

4) That any heavy industry involving bulk storage, or handling or transfer facilities for crude oil be located in the Portland-South Portland heavy industrial development area (page 99).

5) That a state policy to cluster heavy industry in designated areas of the coast not prevent any municipality from adopting or administering more restrictive zoning ordinances (page 101).

6) That existing heavy industry outside a designated heavy industrial development area be allowed to convert to another heavy industrial use if the new use is a suitable one for the site and if it is likely to maintain employment opportunities in the community (page 106).

7) That any expansion of fifteen percent or more in an existing heavy industry outside a designated heavy industrial development area be subject to approval by the Board of Environmental Protection under the Site Location of Development Law (page 107).

8) That the Site Location of Development Law be augmented to include, with respect to heavy industry, the ability to consider alternate sites and each of the following siting factors: visual aesthetics, noise control, cultural resources, critical areas, effects of water use on availability of water for existing uses, and transportation of hazardous materials (page 109).

9) That the Site Law be augmented, with respect to heavy industry, to include assessment of compatibility with traditional uses of the coast (page 109).

10) That a heavy industry which requires a coastal location and which cannot be accommodated within any designated heavy industrial development area be allowed to locate at a site outside a designated area if the site meets the requirements of the Site Law and if public policy favors location of the industry on the Maine coast (page 110).

11) That any Maine municipality in which heavy industry is prohibited by a state clustering policy be compensated under a formula based on the current state revenue sharing formula (page 116).

12) That distributed funds never exceed twice the total annual state/local revenue sharing funds distributed to the participating municipalities (page 116).

13) That this compensation program be funded through an excise tax of .5% on new heavy industrial development and expansion throughout the state, and that industries subject to the excise tax be allowed to credit the tax against local property taxes (page 117).

PROPOSED LEGISLATION
DESIGNATING HEAVY INDUSTRIAL AREAS

An ACT Creating Coastal Heavy Industrial Development Areas

Be it enacted by the People of the State of Maine, as follows:

38 M.R.S.A. c.6 is enacted to read:

§ 951. Short Title

This chapter shall be known and may be cited as the "Maine Coastal Industrial Development Act".

§ 952. Findings and Purpose

The Legislature finds and declares that any new heavy industrial development on the seacoast of the State will have a substantial impact on the economic well-being of the people of the State, the use of the seacoast for private and public recreational purposes, the continuation of traditional economic uses such as fishing, lobstering and other traditional commercial uses, and on the general physical, cultural and economic environment of one of the State's greatest resources.

The Governor's Advisory Committee on Coastal Development and Conservation has presented to the Legislature a study of potential heavy industry on the Maine coast, heavy industrial siting requirements and a survey of coastal resources which may be significantly affected by heavy industrial development.

The purposes of this Chapter are to provide for economic expansion in an orderly fashion compatible with traditional activities; to provide for the clustering of heavy industrial development so that the character of coastal communities will be maintained; to maximize the efficiency of public investment decision making such as the location, acquisition and development of roads, parks, schools and other public facilities; to ensure that certain industrial development creating potential hazards to public safety is located in areas where such hazards are minimized; to maintain the environmental quality of the coast of Maine, including the maintenance of open space and agricultural and forest land; and to provide generally for the public health, safety and welfare.

§ 953. Definitions

As used in this chapter the following items shall have the following definitions:

1. Coastal Area. Coastal Area means all municipalities south of the northernmost boundary of the Town of Calais through which U.S. Route 1 passes and all municipalities south of the northernmost boundary of the Town of Calais which lie totally to the southeast of U.S. Route 1, meaning and intending to include all the area within the boundaries of such municipalities whether land, water or subaqueous land.

2. Critical Area. Critical Area means any area classified as a critical area pursuant to the Act for a State Register of Critical Areas, Title 15 M.R.S.A. Sections 3310 et seq.

3. Feasible. Feasible means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors.

4. Hazardous Material. Hazardous Material means any material which presents a serious danger of death or injury because of its toxicity, flammability, radioactivity or pathogenic nature. Examples of hazardous materials are refined petroleum products; natural gas, whether liquid or gaseous; acids and other industrial chemicals; pesticides and herbicides.

5. Heavy Industry. Heavy Industry means a development characteristically employing equipment such as, but not limited to, smoke stacks, tanks, distillation or reaction columns, chemical processing equipment, scrubbing towers, pickling equipment and waste treatment lagoons; which industry, although conceivably operable without polluting or otherwise causing a significant adverse environmental impact on the coastal area (by, but not limited to, the liklihood of generation of glare, heat, noise, vibration, radiation, electromagnetic interference and obnoxious odors) has the potential to pollute or otherwise cause a significant adverse environmental impact. Examples of heavy industrial development are oil refineries; basic steel manufacturing plants; automobile assembly plants; basic celluosic pulp or paper mills; chemical plants such as petro-chemical complexes; liquified natural gas handling or conversion facilities; oil or coal-fired electric power generation facilities with a base load or intermediate capacity of two hundred megawatts or greater; nuclear power generating facilities; bulk storage, handling or transfer facilities for crude oil; bulk storage, handling or transfer facilities for coal with an average throughput of 1,000 tons or more per day; steel or concrete drilling platform construction. Examples of development which is not heavy industry are textile mills; shoe factories; leathergoods manufacturing establishments; fish processing plants; and garment factories. For the purposes of this chapter the proposed Passamaquoddy tidal power project is not a heavy industry.

6. Heavy Industrial Development Area. Heavy Industrial Development Area means any area designated in this chapter for heavy industrial development.

7. Important Cultural Resource. Important Cultural Resource means any historic or archeological resource having the following characteristics:

A. Historic resources are districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association, and:

(1) are associated with events that have made a significant contribution to the broad patterns of our history; or

(2) are associated with the lives of persons significant in our past; or

(3) embody the distinctive characteristics of of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or

(4) have yielded, or may be likely to yield information important in history.

B. Archeological resources are all remaining physical evidence of former occupation or use by prehistoric and early historic cultural groups -- including settlement and industrial remains, cemetaries, artifacts, inscriptions and monuments.

8. Value. Value means fair market value.

§ 954. Designation of Heavy Industrial Development Areas

For the purposes of this chapter the following areas are designated Heavy Industrial Development Areas:

Area 1: The municipalities of Portland and South Portland;

Area 2: The municipalities of Searsport, Stockton Springs and Penobscot;

Area 3: The municipalities of Machiasport and Cutler.

§ 955. Map to be Kept

The Department of Environmental Protection shall prepare and maintain a map of the coastal area of the State of Maine delineating the heavy industrial development areas as designated by this chapter. Copies of this map shall be filed with the following agencies: the Department of Environmental Protection, the Department of Conservation, the State Planning Office, the State Development Office, the Registries of Deeds for York, Cumberland, Sagadahoc, Lincoln, Knox, Waldo, Hancock and Washington Counties, the Public Utilities Commission, the United States Federal Energy Regulatory Commission, the United States Environmental Protection Agency and the United States Army Corps of Engineers.

§ 956. Heavy Industry Restricted to Development Areas

1. Except as otherwise permitted by this chapter no heavy industry shall be constructed, developed, operated or maintained in the coastal area unless such industry is located within a heavy industrial development area as designated by this chapter.

2. No permit or approval for the construction, development, operation, maintenance or expansion of any heavy industry within the coastal area shall be granted by the Board of Environmental Protection except in conformity with the provisions of this chapter.

3. In addition to any other restrictions found in this chapter no heavy industry involving the storage, transfer or regasification of liquid natural gas, or the use, handling, storage or disposal of radioactive fuels shall be constructed, developed, operated or maintained in Heavy Industrial Development Area 1 as designated in Section 954 of this chapter. No heavy industry involving bulk storage, handling or transfer facilities for crude oil shall be located in Heavy Industrial Development Areas 2 or 3 as designated in Section 954 of this chapter.

§ 957. Existing Heavy Industrial Uses

1. Any existing heavy industry in the coastal area and any heavy industry for which a permit or approval has been granted under Section 484 of this Title for development in the coastal area prior to January 1, 1978 may continue to be constructed, developed, operated and maintained regardless of its location outside of an appropriate designated heavy industrial development area.

2. Any heavy industry permitted under this section to be constructed, developed, operated or maintained outside of an appropriate designated heavy industrial development area may be enlarged, expanded or extended without regard to the other provisions of this chapter provided such enlargement, expansion

or extension does not involve one or more of the following: (a) an increase in total value of the development of fifteen percent or more; (b) an increase in the land area occupied by the development of fifteen percent or more; (c) any development requiring approval or permit by the Board of Environmental Protection pursuant to Section 484 of this title or the terms and conditions of an existing permit.

3. Any heavy industry permitted under this section to be constructed, developed, operated or maintained outside of an appropriate designated heavy industrial development area may be enlarged, expanded or extended other than as permitted by subsection 2 of this section only with approval or by permit from the Board of Environmental Protection pursuant to Section 484 of this title, which approval or permit shall be granted only after consideration of the factors enumerated in Section 958 of this chapter. For the purposes of Section 482 of this title, development described in this subsection is deemed to be development which may substantially affect the environment.

4. Any heavy industry permitted under this section to be constructed, developed, operated, maintained, enlarged, expanded or extended outside of an appropriate designated heavy industrial development area may be converted to another heavy industrial use other than bulk storage, handling or transfer facility for crude oil, oil refinery, electric power generating plant, bulk storage, handling and transfer facility for coal, or facility for the storage, transfer or regasification of liquid natural gas if such conversion is accomplished within ten years from the cessation of the original heavy industrial use. Provided, however, that nothing herein shall be interpreted to prohibit the conversion of an oil burning electric power plant to an electric power plant fueled by other non-nuclear fuel.

5. Any heavy industrial use permitted by this section to exist outside of an appropriate designated heavy industrial development area, which use is discontinued for any reason for a period of time greater than ten years, is deemed abandoned and may not be resumed or converted to another heavy industrial use.

§ 958. Site Location Review

When reviewing any proposed development or expansion of an existing development in the State of Maine for a heavy industry as defined by this chapter, the Board of Environmental Protection in determining pursuant to the Site Location of Development Law whether the developer has made adequate provision for fitting the development harmoniously into the existing natural environment and that the development will not adversely affect existing uses, scenic character or natural resources, shall, in addition to its

other considerations, consider and make findings with respect to each of the following factors:

1. Whether or not the proposed development is compatible with traditional activities in communities potentially affected by the development.

2. Whether or not the development as proposed provides adequate buffering by use of fences, natural or planted vegetation, open space or otherwise to minimize the noise levels, dust, odors, air and water discharges and visual impact on the lands and waters in the vicinity of the proposed development.

3. The availability of feasible alternative locations in the designated industrial development areas or outside of the coastal area, the development of which would fit more harmoniously into the existing natural environment and involve less adverse impact on existing uses, scenic character or natural resources.

4. The probable effect of the water use projected for the proposed development on the source of water supply and the availability and maintenance of ground and surface water levels for existing uses.

5. Whether or not the transportation of hazardous materials to and from the site of the proposed development creates any danger to the public safety and the extent to which the proposed development includes provisions to avoid or minimize such danger.

6. The probable effect of the proposed development on important cultural resources and critical areas.

§ 959. Designation of Additional Heavy Industrial Development Areas

1. The Board of Environmental Protection may, by regulation, designate additional heavy industrial development areas solely for the purpose of locating a single specific proposed heavy industry if, after public hearing, it finds the following facts:

A. There is a heavy industrial development proposed to be located in the coastal area which cannot be located in an existing heavy industrial development area;

B. The proposed heavy industry is required by the public convenience and necessity, and the lack of the proposed heavy industry would cause severe hardship for the people of the State of Maine;

C. The proposed heavy industry cannot be located outside of the coastal area;